SOCIAL ENVIRONMENTAL INFLUENCES ON PHYSICAL ACTIVITY OF CHILDREN WITH AUTISM SPECTRUM DISORDERS

by

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Abstract

Background: Children with Autism Spectrum Disorders (ASD) may be at greater risk for not meeting physical activity guidelines than neurotypical children (NT). Influences on physical activity (PA) of children with ASD are unclear and marked characteristics of the disorder pose challenges for developing interventions to promote PA. . The purpose of this study was to explore setting (free play versus structured) and group composition influences on ASD and NT young children's physical activity (LMVPA, MVPA) during a summer camp.

Methods: Data were collected on 12 boys (5-6 years) attending an inclusive summer camp. During free play and structured activity sessions, research assistants observed the camp's social environment and children's PA using a modified version of the Observational System for Recording Physical Activity of Children – Preschool.

Results: In a free play setting, children with ASD spent significantly less time in MVPA while with a peer (1.0% of session time), compared to being with a group of peers (12%) or when alone (13%). In free play, NT peers spent significantly more time in LMVPA when solitary (67%) compared to with a peer (38%) or with an adult (40%). In a structured setting, NT peers had greater LMVPA solitary (72%) social environments compared to being in a group with adult (34%).

Conclusion: Preliminary evidence suggests that features of the social environment may influence PA levels of children with and without ASD. Depending on the setting, certain social group contexts may be more PA promoting than others.

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Dedication

For the Flint Hills Summer Fun Camp and families of children diagnosed with an Autism Spectrum Disorder.

Preface

This thesis report is submitted for the degree of Master of Public Health at the Kansas State University. In partial fulfillment of the degree, a field experience related to public health must be completed. The following report serves a dual-purpose of presenting a master's thesis study and reporting on a public health field experience. The work conducted is, to the best of my knowledge, original except where references are provided, and is presented in three chapters.

The first chapter is a literature review which aims to provide background information on Autism Spectrum Disorders (ASD) and physical activity. This chapter will identify unique characteristics of individuals with ASD and environmental influences which may inhibit participation in physical activity. Specifically, social environmental influences will be addressed, and teaching strategies to enhance physical activity among this population will be explored.

The second chapter is a research study examining the social and environmental influences on physical activity of children with ASD. Conducted in the summer of 2012, this study assesses physical activity behaviors and the social environment of young children with and without ASD. A description of the study including participants, methods, analyses, and results is provided in this chapter. Additionally, implications for future research are discussed.

Finally, the third chapter explores preschoolers' weight status and the physical activity environment at Head Start sites in Kansas. This brief study was conducted during my field experience with Kansas Head Start Association in Lawrence, KS. Contextual information is provided with descriptions of the methods, analyses, and results to follow. Recommendations for promoting physical activity at Kansas Head Start sites are described, and potential directions for future research are explored.

Chapter 1 - Review of the Literature

Overview

Childhood obesity rates in the United States have been increasing rapidly over the past few decades, posing a major public health concern for the nation. Currently, 16.9% of children are obese and 31.8% of children are classified as overweight or obese (Ogden, 2012). The United States Department of Health and Human Services (USDHHS) reports that obesity in children has been linked to several chronic health problems including Type II diabetes, asthma, and hypertension, (USDHHS, 2008) and one study has shown that overweight and obesity tracks through adulthood (Whitaker et al., 1997). Many professionals are undertaking the daunting challenge of combating childhood obesity through research, interventions, and policy reform. Though the literature targets the general population, less focus is given to special populations such as individuals with Autism Spectrum Disorders. By understanding the current issue with overweight ($\geq 85^{th}$ percentile) as well as influences on physical activity, professionals can better refine physical activity interventions to fit the unique needs of this special population.

Background on Autism and Obesity

Autism Spectrum Disorders

Autism Spectrum Disorder (ASD) is an umbrella term which encompasses three diagnoses: Autistic Disorder (also called "classic autism"), Asperger Disorder (or Asperger's Syndrome), and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). From this point on, "ASD" will refer to all disorders under the autism spectrum, "AD" will be used when identifying Autistic Disorder (classic autism), specifically, and "AS" will denote Asperger Syndrome. As a spectrum disorder, symptoms range from mild to severe and there are individual variations (MMWR, 2012). ASDs are pervasive developmental disorders that are characterized

by severe impairments in three primary areas of development: 1) social skills, 2) communication, and 3) presence of stereotyped behavior, interests, and activities (American Psychological Association, 2000).

Children with ASD often struggle with social imagination and do not engage in pretend play or understand that other people have independent minds (Wing, 1988). Reciprocal social and emotional interactions may not exist, and are manifested in the failure to form developmentally appropriate relationships, with these children preferring solitary activities, and having the inability to share enjoyment or interests with others (APA, 2000).

Marked differences in communication are additionally evident among this population. Some may be non-verbal and display a total lack of language, while others may demonstrate language delays or repetitive, idiosyncratic language (APA, 2000). Additionally, reciprocal conversation may not occur for those individuals who verbally communicate (Wing, 1988).

The third domain encompasses stereotyped behaviors of individuals with ASD, and these repetitive behaviors and interests are characteristic of the population (Matson et al., 2011; APA, 2000) as are repetitive sensorimotor behaviors (RSM) (Richler et al., 2006). Often, individuals fixate on narrow interests, perseverate on patterns or behaviors, engage in repetitive use of objects, or demonstrate unusual sensory interests (APA, 2000; Richler et al., 2006). Other sensorimotor behaviors common to individuals with ASDs include rocking, aimless pacing, and finger flicking (Wing, 1988).

Overweight and Obesity Trends

Children with ASD are two to three times more likely to be obese than their typically developing counterparts (Rimmer et al., 2010). It has been reported that 19% of children with ASD are obese with 35.7% overweight (Curtin et al., 2005), which is higher than the national

average. High rates of overweight and obesity among individuals with ASD is a common finding (Curtin et al., 2005; Curtin et al., 2010; Rimmer et al., 2010; Winter et al., 2012) and similar to typically developing individuals, rates of obesity tend to increase from childhood to adolescence among those with intellectual disabilities (Maïano, 2010). Rimmer et al. (2010) found that youth with an intellectual or developmental disability have higher numbers of secondary conditions and there is a significantly higher prevalence of high blood cholesterol, diabetes, preoccupation with weight, and early maturation. High levels of blood lipids (hyperlipidemia) have also been reported in this population (Tyler et al., 2011).

Many children with ASD have particular food aversions and feeding behaviors (Schreck et al., 2004) and spend a considerable amount of time engaging in sedentary activities. Orsmond & Kuo (2011) examined daily activities of adolescents with ASD and found that a large portion of their day is spent engaged in discretionary activity, and 86% of that discretionary time watching television. Additionally, children with ASD display impaired motor functions (Baranek, 2002), low motivation for physical activity (Koegel, Koegel, & McNerney, 2001; Pan, Tsai, Chu, & Hsieh, 2011), and a lack of enjoyment for physical activity (Pan, Tsai, Chu, & Hsieh, 2011) and team sports (Pan & Frey, 2006). Of particular interest are the factors influencing physical activity behaviors and barriers to physical activity as perceived by the ASD population.

Physical Activity and Autism

Physical Activity Participation

Current national physical activity guidelines suggest children should engage in daily physical activity in order to attain health benefits (USDHHS, 2008). Current United States public health recommendations indicate that children ages 6-17 years should engage in at least 60

minutes of moderate-to-vigorous physical activity (MVPA) daily including at least three days per week of muscle- and bone-strengthening exercises (USDHHS, 2008). Preschoolers (3-5 years) should engage in light, moderate, and vigorous physical activity for 15 minutes per waking hour for 12 waking hours which corresponds to 3 hours of activity per day (Pate & O'Neill, 2012). Due to the sporadic nature of preschoolers' physical activity behaviors, it is important to consider all non-sedentary intensities of physical activity (Ward, Vaughn, & Story, 2013).

Despite these recommendations, studies have demonstrated that children both with (Pan & Frey, 2006; Pan et al., 2011) and without ASD (Troiano et al., 2008) do not achieve sufficient time in physical activity. Furthermore, physical activity levels of children with ASD have been reported to decline with age (MacDonald et al., 2011; Memari et al., 2012), similar to NT peers (Trost et al., 2002). The research however is inconsistent. Some studies have shown that children with ASD engage in similar levels of physical activity as NT peers while others found that children with ASD are less active.

Recently, Bandini and colleagues (2012) examined physical activity levels of children aged 3-11 years with ASD compared to NT of the same age and found that both groups demonstrated similar levels of weekly physical activity. Rosser-Sandt and Frey (2005) also found that among elementary aged children with and without ASD, daily, recess, physical education, and after-school physical activity levels were similar. Additionally, both groups in this study acquired the majority of their activity during recess. Another study found that youth with ASD met minimum activity recommendations, but were less active than NT peers (Pan & Frey, 2006). All elementary aged youth in the Pan and Frey (2006) study engaged in more MVPA than middle or high school youth during school, yet were more active overall after school. Furthermore, physical activity was higher among those in elementary school, as opposed

to middle and high school. Pan (2008) measured physical activity levels of children with and without ASD in an inclusive recess setting using accelerometry, and found that those with ASD were less active than NT peers during recess and two morning recess sessions.

In a recent cross-sectional study, physical activity of 80 Iranian children and adolescents aged 7-14 years (mean = 9.7 years, SD= 2.0) with ASD were assessed in a school-based setting. Children wore an accelerometer for seven consecutive days and start and end wear times were recorded in a log provided to parents and teachers. Significant differences in physical activity between age groups were shown, with physical activity declining with increasing age. Overall, boys were significantly more active than girls, and all children were less active in school than during after-school (Memari et al., 2012).

Additional recent studies suggest that middle school children with ASD are less physically active than peers during inclusive physical education (Pan, Tsai, & Hsieh, 2011; Pan, Tsai, Chu, & Hsieh, 2010) and that motivational processes differ between groups (Pan et al., 2010). In both studies, accelerometers were used to monitor physical activity levels and one study (Pan et al., 2011) further examined the relationship between physical activity and social engagement. Participants' physical activity was found to be positively related to social interaction with peers suggesting that NT peers may serve as models of appropriate behavior in the inclusive physical education setting and may offer more motivation to their ASD peers. Motivation differences between NT peers and children with ASD have been observed in one study which found that children with ASD had lower levels of motivation for physical activity than NT peers (Pan et al., 2010).

Benefits of Physical Activity

It is known that regular physical activity is essential for good health (USDHHS, 2008). Several studies have linked physical activity to decreased risk of obesity, declines in cardiovascular risk factors, less body fat, enhanced aerobic fitness, improved motor functioning, and less engagement in sedentary activity (USDHHS, 2008; Strong et al., 2005). Individuals with ASD experience the same health benefits and physical activity is linked to additional psychosocial and behavioral benefits such as appropriate academic responding and a reduction in stereotypic repetitive behaviors (Watters & Watters, 1980; Kern et al., 1982; Baranek, 2002).

A review conducted by Baranek (2002) explored the use of physical activity to treat stereotypic, maladaptive behaviors demonstrated by individuals with ASD. Such behaviors interfere with learning, and the reviewed studies indicated that more intense aerobic activities yielded greater effects. Examining the effects of exercise intensity and duration on stereotypic behaviors, Levinson and Reid (1993) found a 17.5% mean reduction of stereotypic behaviors. Consistent with another study (Kern et al., 1984), vigorous exercise produced a greater reduction in these behaviors compared to mild exercise.

Many early studies measured the effects of jogging sessions on such behaviors and discovered that significantly lower levels of self-stimulatory behaviors followed brief jogging sessions (Watters & Watters, 1980; Celiberti et al., 1997; Rosenthal-Malek & Mitchel, 1997). Furthermore, jogging sessions had the potential of improving other appropriate behaviors of children with ASD. Kern et al. (1982) selected seven children with ASD to participate in a study, based on the children's demonstration of high self-stimulatory behaviors. Children participated in a jogging intervention during which they jogged alongside a therapist for a period of time prior to being randomly placed in three different settings: academic setting, outside play area, and a quiet room devoid of other activities. Results indicated that the brief jogging session

produced decreases in self-stimulatory behaviors and increased appropriate play and academic responding.

Similar findings were reported in a study conducted by Elliot et al. (1994). Six adults with ASD participated in an aerobic activity for 20 minutes prior to completing a vocational task. When aerobic activity occurred prior to the task, stereotypic behavior was significantly reduced and there was an increase in on-task behavior. In a recent study, Oriel and colleagues (2011) examined the effects of aerobic exercise on academic engagement using a fifteen-minute jogging intervention. They discovered that the brief jogging session significantly improved correct responses of 3-6 year olds with ASD in a classroom setting, however they did not find any significant differences for on-task or stereotypic behavior. Rosenthal-Malek and Mitchell (1997) found that, preceding an academic condition, aerobic exercise not only decreased self-stimulatory behavior, but it also increased on-task performance and correct responding. Such cognitive effects have also been observed among individuals with ASD when exercising through exergaming. According to Anderson-Hanley, Tureck and Schneiderman (2011), exergaming links physical activity movements to video game controls combining both physical and mental exercise.

Videogames are attractive to individuals with ASD (Durkin, 2010) and exergaming has been shown to increase energy expenditure among this population (Getchell et al., 2012). In a study conducted by Anderson-Hanley and colleagues (2011), participants underwent a control session during which they completed tests of executive function and their behaviors were observed. Participants then began one of two exergaming sessions. Twelve individuals with ASD aged between 10-18 years participated in a Dance Dance Revolution (DDR) exergaming intervention while 10 individuals (aged 8-21 years) participated in a cybercycling intervention.

Following the exergaming session, executive function and behaviors were measured. Repetitive behaviors and one measure of executive function were improved for both the DDR and cybercycling groups, compared with the control condition. These findings again support the use of exercise to decrease stereotypic behavior and improve cognition through a new, technological approach that may be embraced by individuals with ASD as a form of physical activity different from, as opposed organized sports or other activities involving high levels of peer interaction.

Barriers to Physical Activity

Physical activity benefits are evident for the ASD population just as they are for typically developing individuals. As previously discussed, there are no clear physical activity patterns among children with ASD; however they do tend to be less active than NT counterparts. As with any population, various barriers to physical activity exist on several levels. A recent review by Shields, Synnot, and Barr (2011) reported that intrapersonal barriers of physical activity for children with various disabilities included a lack of physical and social skills, preference for other activities, fear of exercise, and a lack of knowledge about exercise. Interpersonal barriers consisted of parental actions, the fear that peers would view children with disability as being helpless, and a shortage of friends with whom they could engage in physical activity. Frequently expressed environmental barriers consisted of inadequate facilities or means of transport while a lack of opportunities for programs, lack of staff capacity, cost, and negative staff attitudes were commonly cited policy or program barriers.

Very little is known about the specific barriers to physical activity of children with ASD. Obrusnikova & Cavalier (2011) assessed 12 boys with ASD (aged 8-14 years) on their perceived barriers to afterschool physical activity using the Social Ecological Model, a multi-level model which considers the interaction of individual, interpersonal, organizational, societal, and policy

factors on behaviors. Results suggested that intrapersonal barriers are the most frequently occurring and 94% of children reported preference for videogames, computer use and watching television because they believe them to be more exciting than physical activity. The lack of a friend to be active with and parent responsibilities were the most frequently reported interpersonal barriers, while weather was the most commonly cited physical barrier. Regarding barriers within the community, children only reported lack of transport to activities and a lack of opportunities for physical activity programs.

Following up the study on children's perceived barriers, Obrusnikova and Miccinello (2012) further explored what barriers to physical activity parents perceived their children with ASD to be experiencing. Again using the Social Ecological Model, the authors reported that the most common interpersonal barriers included parental lack of time or energy, and that their child did not have an exercise partner. Furthermore, if the weather was poor, their children were less inclined to be active after school, and within the community there was a lack of community physical activity programs and competent staff who understood the unique needs of children with ASD. Once again, the most frequently cited barriers fell under the intrapersonal category, and parents listed lack of motivation or interest in physical activity and preference for sedentary activities among the top barriers. Parents additionally cited their children's impaired social and motor skills as barriers to activity.

Motor Development Deficits

An individual characteristic that is a cited barrier for physical activity participation of children with ASD is impaired motor skills. Motor development delays are more prevalent among individuals with ASD than within the typically developing population (Matson et al., 2011; Provost, Lopez, & Heimerl, 2006). Staples and Reid (2010) compared a group of children

aged 9-12 years with varying ASD diagnoses to three typically developing groups: chronological age (CA), developmental age (DEV), and mental age (MA). Children with ASD performed similarly to DEV, a group comprising typically developing children half their age, on tests of gross motor and object control, though this finding was not significant. However, children with ASD performed significantly worse than CA and MA. Results suggest that children with ASD experience significant motor development delays.

In one study, out of 101 children with ASD 79% had definite movement impairments; however such impairments may have differed according to the specific autism diagnosis and IQ scores (Green et al., 2009). Individuals diagnosed with childhood autism were more impaired than those with other ASDs. Additionally, 34 out of 35 children (97.1%) with an IQ below 70 demonstrated movement difficulties, compared to 46 of 66 children (69.7%) with an IQ greater than 70 (Green et al., 2009). While the prevalence of various motor deficits may vary depending on the diagnosis, there are several common types of motor development impairments among this population. A retrospective cohort study conducted by Ming and colleagues (2007) revealed that hypotonia, reduced resistance during passive movement in the limbs, was the most prevalent impairment, with 51% of 2-18 year-olds affected. Motor apraxia, impairment of the ability to execute skilled movements and gestures, as well as toe-walking were observed across 34% and 19% of children, respectively. Additionally, approximately 9% of the children demonstrated gross motor delays and were significantly more likely to receive physical therapy services than children with ASD who do not demonstrate motor delays.

Clumsiness is frequently observed in individuals with ASD, especially those with AS (APA, 2000; Ghaziudden & Butler, 1998; Wing, 1988). Sahlander et al. (2008) used the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) to assess motor function of adults with

AS compared to a typically developing group and found that those with AS performed significantly worse on tests of motor proficiency. Aside from potential gross motor deficits among adults with ASD, a high prevalence of clumsiness has been noted among children with AS (Green et al., 2002); however, in a review of sensory and motor interventions for children with ASD, Baranek (2002) speculates that deficits in motor planning, or the ability to carry out a sequence of movements, may be falsely identified as clumsiness.

Motor imitation deficits are also noted in young children with ASD. Attempting to replicate previous studies, Stone and colleagues (1997) compared three groups of 3½-year-old children to determine group differences in motor imitation of body movements and actions involving objects. Significant differences between groups of children were discovered suggesting that children with ASD exhibit greater deficits in motor imitation tasks than non-ASD developmentally disabled children and typically developing children. Body movement imitation tasks also proved to be more challenging than tasks involving moving objects.

Impairments in Social Interactions

In addition to motor development difficulties, individuals with ASD experience impairments of social interactions. In an early article, Wing (1988) describes that interacting with others is a marked characteristic of those with ASD and can be manifested in three specific domains: social recognition, social communication, and social imagination and understanding. Social recognition is "the ability to recognize that human beings are the most interesting and potentially rewarding features of the environment" (Wing, 1988, p. 92) Often, individuals with ASD will be indifferent to other people, ignoring social or physical contact to varying degrees. Unless redirected by peers or adults, they may withdraw and wander from groups. Additionally, they may refrain from socially approaching others (Wing, 1988).

Interacting with unfamiliar individuals leads to a significant increase in stress among some children with ASD (Lopata et al., 2008) suggesting that a reason for social withdrawal is the anxiety produced from such social interactions. Stress responsivity during play has been examined by Corbett et al. (2010) in an effort to understand the impairing effects of social interactions experienced by children with ASD. Consistent with other studies (Hauck et al., 1995; Sally & Hill, 2006), children with ASD exhibited fewer initiations with peers and often rejected initiations from others in free play and cooperative play. Many children exhibited heightened cortisol levels when interacting with peers, and such levels increased by age. Given that the older children avoided social interaction less than younger children, the authors speculated that cortisol levels could be a result of preparing for social interaction while the younger children, who were more avoidant, found play to be more threatening.

The second domain of social interaction is impairments in social communication. Such an impairment "affects the giving and receiving of nonverbal, preverbal, and verbal social signs, the pleasure in conversation, and, at a more sophisticated level, the ability and desire to talk about feelings and exchange ideas" (Wing, 1988, p. 93). Examples include a lack of desire to communicate with others other than to express needs, lack of reciprocity in conversations, tendency to make comments irrelevant to social context, and tendency to ask repetitive questions and express boredom with interactions. Children may have difficulties expressing feelings through gestures such as offering a hug as consolation to an injured playmate, or offering words of comfort. Such impairments in communication may contribute to difficulties establishing friendships and lead to feelings of social isolation (Müller, Schuler, & Yates, 2008).

Many children with ASD may fail to develop appropriate developmental relationships with their peers and instead gravitate towards friendships with adults (APA, 2000). In an early

study, Hauck, Fein, Waterhouse, and Feinstein (1995) explored social interaction of children with ASD aged 7-12 compared to a group of intellectually disabled peers in free play and lunchtime settings. Those with ASD engaged in significantly more positive interactions (reciprocal interaction, giving attention, and initiating play) with adults rather than peers. Initiations with peers occurred more frequently in the free play setting, and children with ASD demonstrated less initiation than peers with intellectual disabilities. Younger children tended to be more cautious than older children when initiating interactions with peers (Sally & Hill, 2006).

Out of 235 adolescents and adults with ASD (aged 10-47 years), 8.1% were found to have mutually responsive friendship (Orsmond, Krauss, & Seltzer 2004). Furthermore, individuals' impairments in social interactions predicted the likelihood of having a peer relationship. Calder, Hill, and Pellicano (2012) examined the experiences and importance of friendships to adolescents with ASD. Compared to NT peers, participants with ASD expressed significantly fewer feelings of closeness within their friendship. Many expressed that friendships were confusing and that they preferred to be alone. Overall, children with ASD reported their friendships were of poorer quality than NT peers, emphasizing that a friend was solely someone to play with, rather than to bond with. During interviews, parents reported taking significant roles in their child's development of friendships through instruction of appropriate social behavior and providing opportunities to interact with peers by inviting children to their home.

The third social interaction domain presented by Wing (1988) is that of social imagination and understanding which may "affect the ability to copy other people's actions with the genuine understanding of their meaning and purpose" (Wing, 1988, p. 94). Pretend play and mimicking actions or behaviors may be absent, or, if present, children with ASD may not understand the meaning or purpose of such behaviors. Those with ASD often demonstrate a lack

of theory of mind (ToM), or the knowledge that others have independent minds. Some struggle to understand the feelings of others, and therefore may not understand how to express feelings such as empathy or anger appropriately. Implications of a lack of ToM will be explored following a brief description of how ToM is assessed.

The concept of ToM was defined by Premack and Woodruff (1978) as "the ability to impute mental states to oneself and to others" (p. 515) and refers to the ability to assume what others believe to be the case, and what they might do from there (Baron-Cohen, Leslie, & Frith, 1985). One must be aware that other people have wants, intentions, and beliefs apart from one's own. Baron-Cohen, Leslie, and Frith (1985) first proposed the idea that children with ASD lacked a ToM and conducted a study during which 20 children with ASD, 14 children with Down's syndrome, and 27 NT children were placed in an experimental condition involving two dolls. After introducing the two dolls, the investigators manipulated the first doll (Sally) to place a marble in a basket and then leave the scene. Next, the second doll (Anne) was manipulated to remove the marble from Sally's basket and place it in her own box. When Sally returned, the children were asked where Sally would look for her marble (belief question). If the child pointed to the original location of the marble, it would demonstrate their understanding that Sally would first look in that location (false belief) and they proceeded to answer two additional control questions to ensure memory and knowledge of the actual location of the marble. Significant group differences were found among the three groups and children with Down's syndrome and NT passed the trials at rates of 85% and 86%, respectively. Only 20% of children with ASD passed the trials, and the 80% who failed all pointed to where the marble was actually located, rather than where Sally last left it.

The results of Baron-Cohen, Leslie, and Frith's study (1985) suggested that children with ASD lacked a ToM because the children failed to answer the Belief Question based on the doll's belief rather than their own knowledge. More recently, Colle, Baron-Cohen, and Hill (2007) conducted false belief tests with children with ASD who had low language levels to determine if they lacked ToM. Results indicated that even lower-functioning children with ASD (language and verbal comprehension equivalent to that of a two year old) demonstrated ToM impairments more than the control groups (NT children, and non-ASD with speech-language impairments). The ToM hypothesis has been widely criticized however, as limited research has investigated its link to core characteristics of ASD and in some early studies, reported significant correlations no longer existed after controlling for age and language level (Tager-Flusberg, 2007). If children with ASD do in fact experience ToM impairments, the impairments may contribute to a lack of desire or ability engage in pretend play. Additionally, it may influence their general understandings of the behaviors and motives of others, thus contributing to difficulties with social understanding and posing challenges when engaging with peers in physical activity settings.

Enhancing Physical Activity

Given the unique challenges individuals with ASD face, designing physical activity interventions which take into consideration their needs and sensitivities are most appropriate. For example, using videogames to increase energy expenditure (Durkin, 2010; Anderson-Hanley, Tureck & Schneiderman, 2011; Getchell et al., 2012) allows children to engage in physical activity without having to cope with potential stressful social settings. A downfall, however, is that such videogames tend to be solitary activities which could negatively impact the learning of appropriate social interactions and further isolate the child from peers. Other interventions target

psychological concepts such as self-efficacy and self-monitoring while concurrently attempting to increase physical activity levels (Todd & Reid, 2006; Todd, Reid, & Butler-Kisber, 2010).

In a study by Todd and colleagues, a 16-week cycling intervention was found to increase sustained physical activity by encouraging self-determined behaviors (2010). Three adolescents severely affected by ASD participated in the program three days a week in addition to regular physical education classes. The program consisted of self-regulating, self-monitoring, and self-efficacy components. Participants set goals before each session using pictograms to illustrate intensity and duration and when the goal was achieved they placed a happy face marker on a chart with their name (self-monitoring). For the first 12 sessions, food reinforcements were given to the students by the research team or teachers. Participants self-reinforced for the remaining sessions of the program (self-regulation). Pictograms were also used to ask questions of self-efficacy to identify student's confidence in their ability to achieve the goals each session. Results of the intervention indicated that teaching self-regulation in physical activity interventions can sustain participation among this population.

Interventions such as the cycling program (Todd et al., 2010) have shown positive results, however they fail to reach a large amount of individuals. Other settings, such as inclusive physical education (PE), have the potential to impact many children with and without disabilities. If children have positive attitudes and a greater intent to be physically active, then they are more likely to follow through with that behavior in inclusive PE (Kodish et al., 2006). There are, however, unique challenges pertaining to having children with ASD integrated in a general PE setting.

The unique characteristics of ASD, such as motor skill deficits, impairments in social interaction, and difficulties regulating emotion, as well as the immense variation in behaviors

and abilities ensure that PE instruction is nothing short of a difficult task. Obrusnikova and Dillon (2011) recently conducted a study examining the specific challenges of teaching PE to children with ASD by surveying 43 certified general PE or adapted PE instructors nationwide. Overall, the teachers reported the most challenging aspects of teaching PE to children with ASD were due primarily to their inattentiveness or hyperactivity, social impairments, and social isolation by peers, and their need for additional support. When examined across learning situations (cooperative, competitive, and individualistic), these challenges were most frequent? in the cooperative setting where two or more students must work together to achieve a goal. In the competitive learning setting (success was measured by being faster or better than others), more managerial challenges were evident, specifically when trying to manage hyperactive behaviors and handle children who lacked the ability to regulate emotions. Finally, in the individualistic setting (where students worked independently to achieve a goal), teachers felt that the most challenging aspects of teaching children with ASD were their extra instructional needs, social impairments, lack of understanding, and failure to perform tasks.

Teaching Strategies

In order to overcome the challenges associated with teaching PE to children with ASD, many recommendations have been made to improve the learning environment. The North Carolina Treatment and Education of Autistic and Related Communications-Handicapped Children (TEACCH) program advises the use of physical boundaries that define the play space (Schultheis, Boswell, & Decker, 2000). This creates visual barriers and reduces the potential over-stimulating atmosphere of a large space and in turn decreases the likelihood of repetitive, stereotypic behaviors (Houston-Wilson & Lieberman, 2003; Schultheis, Boswell, & Decker, 2000). Visual cues may be placed throughout the play environment, serving as prompts

reminding children with ASD of the skills or activities they should be performing (Groft-Jones & Block, 2006). Additionally, it is recommended to create a quiet zone for those children that do become over-stimulated.

Various strategies for teaching children with ASD in PE emphasize the importance of establishing a routine. Children with ASD possess a desire for sameness and establishing a routine will help prepare them for what is to come, reducing anxiety about the unknown (Groft-Jones & Block, 2006). Visual schedules are a common tool utilized with children on the spectrum because they provide a simple visual showing children what activities will be occurring and what activities have already been completed (Schultheis, Boswell, & Decker, 2000; Groft-Jones & Block, 2006; Ganz, 2007). The Picture Exchange Communication System (PECS) allows non-verbal individuals with ASD to communicate by using small picture cards to represent items of desire (Tissot & Evans, 2003) and the cards may also be utilized to visually represent choices in physical activities (Crollick, Mancil, & Stopka, 2006; Zhang & Griffin, 2007).

Several studies have found that children with ASD do not enjoy physical activities and would prefer more sedentary activities such as videogame or computer use (Obrusnikova & Cavalier, 2011; Obrusnikova & Miccinello, 2012). Because most PE classes follow a specific curriculum, teachers are encouraged to offer choices of physical activities to children with ASD as much as possible (Crollick, Mancil, & Stopka, 2006) to enhance participation. Additionally, it would be beneficial for instructors to individualize instruction for those with ASD and (Zhang & Griffin, 2007) should ensure children are paying attention when giving clear, straight-forward instruction, and provide additional demonstration as needed (Groft-Jones & Block, 2006). This strategy which individualizes instruction for children with ASD may however be a burden for PE

instructors who manage large classrooms and have limited resources and may not be a feasible approach for some PE classrooms.

As described by Obrusnikova and Dillon (2011), children with ASD demonstrate challenging behaviors that can make managing an inclusive PE classroom difficult. Instructors should seek appropriate, specialized trainings to understand how to prevent aggressive outbursts and meltdowns (Zhang & Griffin, 2007). Often, meltdowns and aggression are the result of sensitivity to stimuli which may be triggered by sounds, sights, or touch (Groft-Jones & Block, 2006). Furthermore, teachers should seek training in appropriate reinforcement techniques and learn to employ consistent, positive reinforcement (providing stickers, high fives, food rewards) while identifying activities that are reinforcing to the children (repetitive bouncing of a ball, shooting baskets, spinning with a hula hoop) (Groft-Jones & Block, 2006). While many negative behaviors may occur, instructors should learn to embrace the more harmless behaviors, such as spinning, and adapt them into new physical activities so as to connect PE to the children's interests (Zhang & Griffin, 2007).

Some suggest that motor development should be the focus of PE for children with ASD because by enhancing coordination and motor control, children will be more encouraged to participate in play with their peers (Crollick, Mancil, & Stopka, 2006; Schultheis, Boswell, & Decker, 2000). Motor skill instruction requires a more individualistic approach, and when learning new motor tasks, children often fare better when provided with a high degree of initial prompting (complete physical manipulation, skill demonstration, cues, initiation) from the instructor and with a gradual decrease over time (Collier and Reid, 1987). Zhang and Griffin (2007) recommend that PE instructors survey the children with ASD to determine if they are achieving age-appropriate milestones; however, this may not be feasible in all PE classrooms.

Physical activity settings including PE and recess have additionally been a target setting for teaching appropriate social skills to children with ASD. Communication is often difficult for most individuals with ASD and by engaging with peers in an inclusive PE or recess setting, children are presented with various opportunities to develop social interaction skills. Unlike NT peers, children with ASD struggle to understand implied rules, such as turn-taking, and must be explicitly taught such interactions (Zhang & Griffin, 2007). Developed by Carol Gray, Social Stories™ are "brief, individualized stories written to teach a social skill or behavior, or about a concept or event" (Bohlander, Orlich, & Varley, 2012, p. 170). They have been used with the ASD population in the classroom settings to correct stereotypic, repetitive behavior, teach appropriate place, and encourage initiation and responses towards peers (Kokina & Kern, 2010; Ozdemir, 2008; Crozier & Tincani, 2007).

Crozier and Tincani (2007) employed an intervention using Social Stories™ to increase appropriate behavior of preschoolers with ASD. Three preschoolers were recruited to participate in the study and were assessed on cognitive ability and communication. Specific target behaviors of the intervention consisted of sitting appropriately during circle time, increasing conversations with peers during snack time, and playing appropriately with peers in the block center. Across all three participants, a reduction in inappropriate behaviors and an increase in appropriate responding occurred. Another intervention targeted the promotion of activity choices and appropriate play with toys and peers among two individuals with severe ASD (Barry & Berlew, 2004). Social Stories™ were utilized in conjunction with verbal prompts in the beginning of the intervention and as the intervention progressed, little to no prompting was required and students were capable of independently choosing activities.

Social Stories™ are useful tools which, created and implemented properly, are effective in decreasing disruptive behaviors (Ozdemir, 2008) and increasing social behaviors among children with ASD (Crozier & Tincani, 2007; Barry & Berlew, 2004). In Crozier and Tincani's intervention (2007), the story was bound as a book and read to children prior to the settings where the target behavior was to occur, yet Social Stories™ may also take on other forms such as a picture book or song (Bohlander, Orlich, & Varley, 2012). They have been deemed socially valid (Hutchins & Prelock, 2012) and are presumed to be effective in physical education settings (Sandt, 2008) although only one study, to our knowledge, has examined this idea.

Zimbelman and colleagues (2006) recruited 17 trained PE teachers; all had experience working with children with developmental disabilities. Participants completed a pre-intervention assessment and 24% indicated they had little to no training in how to teach children with disabilities. Following the assessment, teachers went through an intervention which trained and exposed them to two specific teaching strategies: visual schedules and Social Stories™. Participants were encouraged to apply these teaching techniques to their PE setting and 7 months later, they completed a post-intervention assessment. Seventy-five percent of teachers implemented the use of visual schedules with their students and 65% found them to be effective. Only 6% of teachers utilized Social Stories™ as a PE teaching strategy for children with developmental disabilities and 100% of teachers reported them to be effective. Results suggested that both the visual schedule and Social Stories™ teaching strategy are effective tools for the PE setting; however Kokina and Kern (2010) warned that few studies on Social Stories™ have reported data on generalizability and maintenance and effectiveness of published studies vary considerably.

In addition to Social Stories™, evidence supports the use of peer models to demonstrate appropriate play and social behaviors in classroom and physical activity settings alike (Bohlander, Orlich, & Varley, 2012; Kasari et al., 2011; Harper, Symon, & Frea, 2008; Zhang & Griffin, 2007; Ward & Ayvazo, 2006). Kasari et al. (2011) compared a peer-mediated intervention (PEER) and a child-assisted intervention (CHILD); each intervention was used in a general classroom setting. Within the CHILD intervention, children with ASD met with researchers and were instructed on how to socially engage with their peers more frequently. The PEER intervention trained NT peers on strategies for engaging peers with social challenges (instruction, modeling, prompting, and initiating). Children with ASD who were involved with the PEER group made significant improvements socially, identified more friendships, and were reported to be doing better socially in the classroom. Similar results were not found following the CHILD intervention.

Peer tutoring models has been shown to improve accurate motor tasks of children with ASD (Ward & Ayvazo, 2006) among other important social skills. Harper, Symon, and Frea (2008) employed peer modeling at recess to encourage appropriate play skills. Third grade NT peers were trained on specific teaching strategies (narrating play, reinforcement, turn-taking) across seven sessions, were trained on dealing with aggressive behaviors, and were provided with materials such as cue cards (for activity choices). Results indicated that participants with ASD improved social initiation from baseline to intervention and learned appropriate ways to refuse interactions from NT peers. It should be noted that partnerships should be encouraged, rather than forced as not all NT peers may feel comfortable mentoring peers with ASD (Zhang & Griffin, 2007).

Summary

ASD is a spectrum disorder ranging from high-functioning to severely affected, which makes identifying influences of physical activity very difficult. Many past studies exploring physical activity among this population have focused on the use of interventions to decrease restricted, repetitive behaviors however more recently attention is being drawn to physical activity behaviors and influences. As just discussed, some studies suggest that children with ASD engage in less physical activity than NT peers, while others have found physical activity to be comparable. Children with ASD are unique from NT peers as they demonstrate many marked characteristics and behaviors including, but not limited to, communication delays, social interaction impairments, motor skill deficits, repetitive behaviors, various sensitivities, and an insistence on sameness. Furthermore, this population often experiences various environmental barriers to physical activity including inaccessibility, lack of resources, lack of developmental programs, and inadequate staff training.

It may be that individual characteristics or environmental influences independently influence physical activity behaviors of children with ASD, or the two may interact and together influence physical activity. Addressing social impairments of children with ASD may be beneficial when developing interventions to increase physical activity. Fortunately several teaching strategies such as visual schedules, peer modeling, and social narratives are already established methods in the classroom used to teach appropriate social behaviors. Such strategies may be adapted to fit various physical activity settings such as recess and physical education to enhance engagement of children with ASD in physical activity and should be explored in future research.

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Chapter 2 - Research Study

Introduction

In order to attain health benefits such as decreased body fat, enhanced cardiorespiratory and muscular fitness, lower risk for coronary heart disease, lower risk for developing type 2 diabetes, and lower risk of stroke, the United States Department of Health and Human Services (USDHHS) reports that regular physical activity is essential (USDHHS, 2008). Current United States public health recommendations indicate that children aged 6-17 years should engage in at least 60 minutes of moderate-to-vigorous physical activity (MVPA) daily, including at least three days per week of muscle- and bone-strengthening exercises (USDHHS, 2008). Preschoolers (3-5 years) should engage in light, moderate, and vigorous physical activity (LMVPA) for 15 minutes per waking hour for 12 waking hours, which corresponds to 3 hours of activity per day (Pate & O'Neill, 2012). Due to the sporadic nature of preschoolers' physical activity behaviors, it is important to consider all non-sedentary intensities of physical activity (Ward, Vaughn, & Story, 2013).

In recent national prevalence data, only 42% of children ages 6-11 years were meeting guidelines (Troiano et al., 2008) and physical activity levels are also known to decline over the childhood years (Trost et al., 2002). According to the Youth Risk Behavior Surveillance System (YRBSS) in 2011, 28.7% of students grades 9-12 attained 60 minutes of physical activity daily and 55.6% of students participated in three or more days of muscle strengthening activities (MMWR, 2012). One population that may be at greater risk than typically developing individuals for not meeting physical activity guidelines is children with Autism Spectrum Disorder (ASD) (Pan et al., 2011; Pan & Frey, 2006). By engaging in regular physical activity, individuals with ASD may not only reduce their risk of obesity and attain other health benefits,

but may additionally decrease the frequency of maladaptive behaviors and increase appropriate academic responding (Pitetti et al., 2007; Levinson & Reid, 1993; Watters & Watters, 1980; Kern et al., 1982; Baranek, 2002).

Autism Spectrum Disorder (ASD) is a pervasive developmental disorder, and the Centers for Disease Control and Prevention (CDC) estimates that in the United States, one in 88 children is diagnosed with ASD (CDC, 2012). The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) describes that ASD is characterized by marked deficits in communication, social interactions, and restricted, repetitive behaviors and interests, individuals with ASD display unique and challenging social and behavioral impairments (American Psychological Association (APA), 2000). Implied social cues such as making eye contact, turn-taking, and reciprocating conversations are often difficult (APA, 2000; Wing, 1988) and, while not specifically considered a diagnostic criterion for ASD, individuals often display gross and fine motor skill impairments (Matson et al., 2011; Green et al., 2009; Staples & Reid, 2010). Moreover, individuals with ASD frequently demonstrate lower levels of social, academic, and other forms of engagement and have difficulty establishing developmentally appropriate relationships (Wing, 1988; Hauck et al., 1995; APA, 2000).

The majority of early research on physical activity and ASD focused on the effects of exercise on frequency of repetitive behaviors (Celiberti et al., 1997; Elliot et al., 1994; Levinson & Reid, 1993; Watters & Watters, 1980) and appropriate responding (Kern et al., 1982). More recently, physical activity behaviors, across various settings and age groups, and determinants, such as age, motivation, and social engagement, are being studied. Age-related declines in physical activity have been observed to occur among children with ASD and are similar neurotypical peers (NT) (MacDonald et al., 2012; Memari et al., 2011) however differences in

physical activity behaviors between these populations are unclear. Some recent studies have suggested that levels of physical activity of children with ASD and NT are similar (Bandini et al., 2012; Rosser-Sandt & Frey, 2005) while others have noted that children with ASD are less physically active overall than a previous report on NT peers (Pan & Frey, 2006; Trost et al., 2002).

The lack of consistent findings in physical activity levels may be due to environmental influences, individual ASD characteristics influencing physical activity independently, and/or environmental influences interacting with ASD characteristics to determine physical activity. For example, environmental influences may include a lack of developmentally appropriate programs, a lack of resources, poor accessibility, and inadequate staff training (Obrusnikova & Cavalier, 2011; Obrusnikova & Miccinello, 2012). Characteristics of ASD that may directly influence physical activity include a desire for sameness, a focus on narrow interests and routines, a lack of motivation, and a preference for sedentary activities such as television, videogames, and computer use (Obrusnikova & Miccinello, 2012; Obrusnikova & Dillon, 2011; Obrusnikova & Cavalier, 2011; APA, 2000; Wing, 1988). However, environmental influences may interact with ASD characteristics, such that children with ASD have been found to demonstrate less physical activity in settings such as recess than NT peers (Pan, 2008; Pan, Tsai, & Hsieh, 2011), but are more active overall in afterschool settings than are NT peers (Memari et al., 2012; Pan & Frey, 2006). It may be that there are social and physical environmental variables unique to settings that interact with ASD characteristics to determine physical activity.

One key characteristic of ASD is social impairment (APA, 2000; Wing, 1988). The social impairments associated with ASD affect children's ability to understand the perspectives of others, leading to inhibition of play and increasing the likelihood of social isolation (Wing,

1988). Children with ASD infrequently initiate social interactions (Hauck et al., 1995; Sally & Hill, 2006; Corbett et al., 2010).With respect to peer interaction, children with ASD demonstrate less interest in their peers and often reject initiations from peers in free and cooperative play (Feldman, and Morrier, 1997; Corbett et al., 2010; Sigman & Ruskin, 1999; McGee, Feldman, & Morrier, 1997). When social interaction does occur, children with ASD are more likely to interact with adults than with peers (Hauck et al., 1995).

Frequency and types of social interaction experienced by children with ASD may relate to physical activity. Pan, Tsai, and Hsieh (2011) assessed physical activity behaviors of adolescents with ASD in an inclusive physical education setting and found a positive correlation between social initiations (requesting assistance, initiating an activity) and interaction (gestures, mutual play, talking) with peers and MVPA, suggesting that social engagement may promote physical activity. For adult interaction, frequent ASD child-adult engagements in an inclusive physical education setting resulted in an increase of vigorous physical activity (VPA), defined for children as activities which considerably increase breathing and heart rate (Pan, 2009; USDHHS, 2008). Children in this study were observed on engagement with adults and with peers during normal recess and physical education opportunities. Results showed that non-interactive engagement with adults (specifically receiving regular encouragement through verbal/non-verbal cueing) was positively correlated with VPA.

The association of social engagement on physical activity is illustrated in studies examining the effects of peer modeling. Peer modeling is a teaching strategy that has been employed in classroom (Bohlander, Orlich, & Varley, 2012; Kasari et al., 2011) and physical activity settings (Kasari et al., 2011; Harper, Symon & Frea, 2008; Zhang & Griffin, 2007; Ward & Ayvazo, 2006) to improve social behaviors among children with ASD. There is some evidence

that peer modeling in physical education settings improves performance on motor tasks among children with ASD (Ward & Ayvazo, 2006).

Physical activity levels of children with ASD may be determined by the interaction between environmental influence and specific ASD characteristics. Specifically, social impairments of children with ASD may decrease engagement in physical activity tasks in social group environments and increase physical activity in solitary environments. The purpose of this study was to explore setting (free play versus structured) and group composition influences on ASD and NT young children's physical activity (LMVPA, MVPA) during a summer camp. We hypothesized that: 1) Children with ASD would have lower LMVPA and MVPA than NT children across all settings, 2) All children will have greater LMVPA and MVPA in the free play setting, compared to the structured setting, and 3) Across both settings, children with ASD will have less LMVPA and MVPA in social contexts compared to a solitary environment, and NT children will have higher LMVPA and MVPA in social contexts compared to solitary social environment.

Method

Study Design

This exploratory study used a factorial cross-sectional design to examine social environmental influences had on physical activity of children and to examine whether effects were moderated by diagnosis (ASD, NT) and setting (free play, structured). This study was designed as an inductive exploratory study using observational methods and was not guided by a theoretical framework. Social environmental influences and physical activity were observed among a subsample of children during participation at a summer camp. The study was approved by the Kansas State University's Institutional Review Board (IRB).

Participants

To be included in the study, children had to either be NT or diagnosed with ASD, had to be enrolled in the selected summer camp during the first camp session (June 4, 2012-July 2, 2012), and had to be in elementary school (K-6th grade) A total of 61 children were at the camp and invited to participate in the study (NT = 36, ASD = 25). Parental consent was received for 59 children. Of these 59 children, one child with ASD displayed behavioral challenges and did not assent to participate, and was therefore excluded from the study yielding a total of 58 children eligible to participate in the study.

Overall mean age was 7.5 years (SD = 1.97), 64.4% were male, 77.1% were non-Hispanic Caucasian, and 72.4% were healthy weight. Across all participants, 26.3% were eligible for free or reduced lunch (NT = 20.6%, ASD = 34.8%), an indicator of lower socioeconomic status (SES). Demographic characteristics were similar across NT peers and children with ASD, as illustrated in Table 2.1. For the present study, we excluded children 7 years and older because we were unable to establish suitable matches among the older children. Furthermore, the 5 and 6 year old children in the present study are transitioning out of the preschool age group (aged 3-5) and our observational measures were developed for preschoolers. Consequently, we followed a 5-6 year old classroom with 18 children (ASD = 6, NT = 12). Six children with ASD were matched on age and male gender with NT children (n=6). The NT peer closest in age to the child with ASD was matched accordingly, and other six children were excluded.

After deletions, the present study consisted of twelve participants aged 5-6 years (mean age = 5.4, SD=0.52 years) (see Table 2.2). As an exploratory study, we were unable to determine if this study was adequately powered. Children were all male, 75.0% were non-Hispanic Caucasian, 83.3% were normal weight, and 33.3% qualified for free or reduced lunch (NT =

33.3%, ASD = 33.3%). Children with ASD were 66.7% non-Hispanic Caucasian and 66.7% were normal weight. NT peers were 83.3% non-Hispanic Caucasian and all were within a normal weight.

Setting

Children enrolled in an inclusion-based summer camp which featured academic enrichment and arts education, were invited to participate in the study. The summer camp served families in a Midwest college town and surrounding regions who had children in preschool or elementary school, and one-third of camp participants were diagnosed with ASD. Families had the opportunity to enroll their children in one or two sessions for up to eight weeks. Session 1 occurred during the month of June, and Session 2 occurred in July. Each camp day (approximately 7 hours a day) consisted of academic enrichment opportunities (math, language arts, science, social studies, and handwriting), arts education (art, music, and drama), physical activity, and a weekly field trip. Five classrooms (one preschool class and four elementary classes) were led by teachers and paraprofessionals who had experience working with children with special needs. Structured physical activity sessions were led by volunteer undergraduate Kinesiology students who had no previous physical activity training. There were approximately 18 students per class.

Measures

Parent Survey

Participant characteristics were identified through a parent survey. The survey utilized demographic questions from the Behavioral Risk Factor Surveillance System (BRFSS) (CDC, 2013) and the 2009-2011 National Survey of Children's Health with Special Health Care Needs (CDC, 2011). Parents were first asked to self-report the age and birth date of their child who was

enrolled in the summer camp. Next, parents were asked, "Has a doctor or other health care provider ever told you that your child (who is enrolled in the summer camp) has autism, Asperger Disorder, pervasive developmental disorder not otherwise specified, or other autism spectrum disorder?" If parents reported "yes," they were then asked to specify the ASD diagnosis and were directed to the following question, "How old was your child when he/she began receiving services?" Parents were then asked if the child was currently receiving services. Additional questions included sex, parent and child race/ethnicity, marital status, parent education, socioeconomic status (free or reduced lunch status), and self-report height and weight for the parent and children living at home (see Table 2.1 and Table 2.2).

Body Mass Index (BMI)

Research assistants assessed participants' BMI using a standardized protocol. Weight was measured to the nearest 0.1 kg using a high precision digital scale (Seca Corp, Model 770, Hamburg, Germany) and height was recorded to the nearest millimeter using a Seca Corp (Model 214, Hamburg, Germany) portable stadiometer with shoes removed. Height and weight were measured twice to ensure reliability. Raw BMI scores were determined for each child using the average values for height and weight. These scores were then converted to percentile ranks and z-scores utilizing the Center for Disease Control and Prevention's reference standards (Kuczmarski et al., 2000). Children were classified as underweight (less than 5th percentile), healthy weight (greater than 5th percentile and less than 85th percentile), overweight (greater than 85th percentile) and obese (greater than 95th percentile). BMI data for study participants is illustrated in Table 2.2.

Physical Activity and Social Environment

Observational System for Recording Physical Activity – Preschool Version

A modified version of the OSRAC-P was utilized to assess the influences of the social environment on children's physical activity behaviors. We assessed all OSRAC-P categories, but the focus in the present study was on setting (free play, structured), group composition (solitary, one-on-one with a peer, one-on-one with an adult, peer group, group with an adult), and initiator (adult-initiated, child-initiated, peer-initiated) while simultaneously coding physical activity levels for the children (Brown et al., 2006). Structured activity was defined as teacher-arranged and adult-led physical activity or organized games.

Similar to other direct observation tools, OSRAC-P is a momentary time sampling observation system. Sessions are measured at the individual level and consist of a 5-s observe and 25-s coding interval for each focal child. In the literature, duration of OSRAC-P observation sessions has been reported varyingly as 3 minutes (Gubbels et al., 2012), 15 minutes (Nicaise et al., 2011), 20 minutes (Pate et al., 2013), or 30 minutes (Brown et al., 2006; Brown et al., 2006b; Brown et al., 2009; Nicaise et al., 2011). Due to limited time in the free play setting, duration of all observation sessions in this study were 15 minutes. Physical activity codes were drawn from an observation tool developed by Puhl and colleagues (1990) to assess physical activity levels of 3-6 year old children. The Children's Activity Rating Scale (CARS) rates physical activity intensities on a scale of 1 to 5 based on the amount of bodily movement and intensity of the activity.

Consistent with the CARS protocol, stationary activity was coded as a 1, stationary activity with limb movement was coded as a 2, slow-easy movement was coded as a 3, moderate movement was coded as a 4, and vigorous activity was coded as a 5. Codes were then collapsed and ratings of 1 and 2 were considered sedentary activity, a code of 3 indicated light activity, codes of 4 and 5 represented MVPA, and codes 3, 4, and 5 were considered LMVPA. Pilot

testing of the OSRAC-P at three preschools revealed suitable interval-by-interval agreement (kappa and category-by-category agreement means = 0.79 – 0.80) across observers (Brown et al., 2006).

For this study, the OSRAC-P was modified to further explore the social environmental influences on physical activity. Brown et al. (2006) defines the child code as "the activity area or the activity in which the focal child is observed was selected by a child." For the purpose of this study, we felt that the definition of child initiated activity was too broad as it accounted for both focal child and peer initiated activity. We examined whether the focal child initiated the activity or if a peer initiated the activity by creating the "peer code" which was defined as the activity area or the activity in which the observed focal child participated in was selected by a peer. The "child code" was selected if the focal child independently selected the activity or activity area.

Research assistants were trained by the lead author on the OSRAC-P. Trainings consisted of defining OSRAC-P codes, presenting examples, and watching videos used for training observers on the System for Observing Fitness Instruction Time (SOFIT). These videos were utilized because our modified OSRAC-P tool included some variables from SOFIT, which are beyond the scope of the present study. Upon completion of the training, research assistants practiced observations at the summer camp a week before the study was to begin. When an agreement of 80% or more on all variables was reached during the in situ training sessions, observers were allowed to begin the study (Brown et al., 2006).

Observation sessions in the present study followed the OSRAC-P momentary-time sampling protocol (Brown et al., 2006) consisting of observing a focal child for 5-s followed by a 25-s coding period per interval, for a duration of 15 minutes per session. Research assistants

wore headphones and were prompted by audio recordings that were downloaded to individual audio devices.

Procedure

A brief, informational discussion regarding this study was presented to parents and guardians at a camp meeting. Parents were given the informed consent documents and parent survey at the end of the meeting and were asked to return documents to camp staff for later collection by the research team. Informed consent forms were gathered and processed before proceeding with the study, and children had to assent to height and weight measurements.

Four trained research assistants visited the classroom to assess height and weight of participants in order to determine their BMI. Each camp day contained opportunities for free play and structured physical activity, during which we conducted our observations. All twelve children were present during observation sessions and were observed for 15 minutes twice in each setting, yielding four observations and a total of 1,440 observation intervals. To control for any observer effects, each child was observed once by each research assistant in free play (two sessions) and structured physical activity (two sessions). Observations for each matched pair (ASD, NT) occurred at the same time for each of the four observations.

Analysis

During the observation period, eight field-based inter-observer agreement checks were conducted. Two observers independently coded the same children in the same physical activity session while listening to the audio recording prompts through split headphones. Inter-observer agreement (IOA) was calculated for each session and variable using the following equation: [#agreements/(#agreements + #disagreements)] x 100. Overall, IOA by session ranged from 94.6%-100% which were deemed to be acceptable levels of agreement (Brown et al., 2006).

Children were observed for 1440, 30-second observation intervals. The influence of diagnosis (ASD, NT) by session type (free play, structured) by group composition (solitary, one-on-one with adult, one-on-one peer, group with adult, group without adult) on frequency of LMVPA or MVPA was analyzed using generalized mixed models (Proc GLIMMIX, SAS 9.2) with observer (research assistant), session, matched pair, and child as random effects. Planned comparisons examined the proportion of time spent (percent of time) in LMVPA and MVPA. Given the intermittent physical activity behaviors of young children, we felt it appropriate to account for LMVPA behaviors in addition to MVPA behaviors (Ward, Vaughn, & Story, 2013; Pate & O'Neill, 2012).

Results

Results from IOA checks are presented in Table 2.3. Percent agreement is presented for each OSRAC-P variable, however physical activity level, activity initiator, group composition, and prompt variables were the only variables explored in this study. Agreements by variable averaged 95.4%, 99.6%, 94.6%, and 99.6%, respectively which are acceptable levels of agreement (Brown et al., 2006).

Overall

Children spent 40.2% of session time performing LMVPA and 13.2% in MVPA across both settings (Table 2.4). During these sessions, children were among a group of peers 59.9% of the time, with (12.2%) or without (47.7%) an adult present, in a one-on-one social setting 29.3% of the time with either a peer (11.0%) or an adult (18.3%), or solitary for 10.8% of the time. Most activity was initiated by the focal child or an adult with <1% of intervals initiated by peers.

There were no significant main effects for diagnosis (F (1, 5) = 0.0, p = 0.99), setting (F (1, 14) = 0.0, p = 0.99), or group composition (F (4, 117) = 0.41, p = 0.80). The two-way

interaction of Group Composition x Setting = F (4, 117) was also not significant. Although planned comparisons were conducted for the hypothesized diagnosis moderation effects, we found non-significant two- and three-way interaction effects: LMVPA (Setting x Diagnosis = F (1,14) = 0.0, p = 0.99; Group Composition x Diagnosis = F (4, 117) = 0.44, p = 0.78; p = 1.50, p = 0.21; Group Composition x Setting x Diagnosis = F (4, 117) = 0.53, p = 0.71) MVPA (Setting x Diagnosis = F (1,14) = 0.0, p = 0.99; Group Composition x Diagnosis = F (4, 117) = 0.13, p = 0.97; Group Composition x Setting = F (4, 117) = 2.12, p = 0.08; Group Composition x Setting x Diagnosis = F (4, 117) = 0.77, p = 0.55).

Physical Activity Intensity of Children with ASD by Setting and Group Composition

As illustrated in Figure 1, during free play, children were observed to spend significantly more time in LMPVA while in a solitary social context (68.2%) compared to one-on-one with an adult (25.8%, p = 0.00), one-on-one with a peer (34.8%, p = 0.01), or with a peer group (28.2%, p = 0.00). When in the free play setting, children with ASD exhibited significantly more time spent in MVPA while in a group of peers (11.5%) as opposed to one-on-one with a peer (1.2%, p = 0.05). Additionally, significantly more time in MVPA was observed when the child with ASD was solitary (13.2%) as compared to one-on-one with a peer (1.2%, p = 0.04) (see Figure 3). For children with ASD in the structured setting, physical activity intensities were not significantly different by group as shown in Table 2.6.

Physical Activity Intensity of NT Peers by Setting and Group Composition

During free play, NT children demonstrated significantly more time in LMVPA when solitary (66.7%) compared to one-on-one with an adult (40.0%, p = 0.03) or one-on-one with a peer (38.3%, p = 0.03). In a structured physical activity setting, significantly more time in LMVPA was observed while in a solitary social context (72.2%) compared to a group with an

adult present (33.9%, $p = 0.04$) (See Figure 2). As illustrated in Table 2.7, time spent in MVPA did not differ significantly by group composition when the NT peer was in a structured or free play setting.

Physical Activity Intensity of ASD and NT Peers by Setting and Initiator of Activity

Significant differences between free and structured play for all children were not observed when analyzing the effects of the initiator of activity, however they were observed when NT and ASD groups were examined separately. In the structured physical activity setting, children with ASD spent significantly more time in MVPA when the child initiated the activity (46.2%) rather than the adult (7.6%, $p = 0.04$). Additionally, children with ASD spent significantly more time in MVPA during child initiated activity (46.2%) in the structured physical activity setting compared to free play (8.0%, $p = 0.05$).

Discussion

The purpose of this study was to explore social environmental setting (free play, structured) and group composition influences on ASD and NT young children's physical activity (LMVPA, MVPA) during a summer camp. Contrary with the first hypothesis, there were no significant differences between ASD and NT children's LMVPA and MVPA across all settings and group compositions. Furthermore, the second hypothesis was not supported such that there was no difference in LMVPA and MVPA between free play and structure activity settings. There was evidence that ASD and NT children's physical activity differs depending on the social environment setting and group composition.

Data from the present study revealed that across all types of group composition, there was no difference between free play and structured physical activity settings. Thus, setting did not appear to be an independent influence on LMVPA and MVPA of children. Our finding that

time spent in LMVPA and MVPA while in free play and structured was not significantly different contradicts a study which assessed the influence of setting on physical activity of elementary aged children (Coleman et al., 2008). Using SOFIT as an observational rating tool, Coleman and colleagues (2008) found that third through sixth graders in after-school programs engaged in more MVPA and VPA in free play (69%) than structured sessions (51%). Notably, the study was conducted in after-school programs and children in the Coleman et al. (2008) study were older than those in the present study; however, we expected to see similar physical activity patterns across settings. After-school programs and summer camps are fairly similar in that they typically provide opportunities for both structured and free play and staff may have similar levels of training regarding physical activity. Our data suggests that the physical activity setting does not influence LMVPA or MVPA independently.

Children in the present study demonstrated surprisingly low levels of MVPA across both settings which were not expected in such a young population. However, these results were similar to a study another study which assessed influences of social and environmental factors on NT preschoolers' physical activity (Brown et al., 2009). Brown and colleagues (2009) directly observed 476 preschool children (aged 3-5 years) during a typical preschool day. Results suggested that when children were outdoors, they engaged in MVPA 17% of the time. Additionally, Gubbels et al. (2012) observed preschool children engaging in MVPA 21.3% of the time when outdoors.

Though not explicitly studied, low levels of activity may be attributed to teacher behaviors. When 6^{th} – 8^{th} grade physical education teachers spent time managing (McKenzie et al., 2000) and 7^{th} to 12^{th} grade physical education teachers spent time providing general instruction (Chow et al., 2009), student physical activity levels were negatively affected. Brown

et al. (2009) found that teachers rarely encouraged preschool children to be physical active but speculated that perhaps this population of young children would benefit from physical activity prompting. Therefore, the participants in the present study may individually prefer more sedentary activities, or they may require more frequent prompting from teachers to engage in physical activity. Another contributing factor to the low levels of physical activity among this population could be the weather. Though evidence regarding seasonal variations of physical activity among young children under the age of 6 years is unclear (Carson & Spence, 2010), Baranowski and colleagues (1993) assessed effects on physical activity of children in Texas aged 3-4 years. There was a significant interaction between gender, location, and month of the year and all children spent less time in MVPA outdoors in the summer, with July being the least active month. Nearly all observation sessions were conducted during humid, hot days with a temperature range of 78-89˚F (mean = 84.8˚F). During the free play sessions children were frequently observed sitting or lying under the shade of a solitary tree playing in the sand, suggesting that the temperature could have potentially contributed to less time in LMVPA and MVPA. Furthermore, the playground equipment was constructed of steel bars (not traditional plastic and metal equipment) which got hot throughout the day and seemed to be of little interest to the children.

The second hypothesis of this study was also not supported by the results of this study, which indicated that children with and without ASD demonstrate similar levels of physical activity. These findings parallel other studies (Bandini et al., 2012; Rosser-Sandt & Frey, 2005) and were not surprising given the inconsistencies in the literature. However, Pan (2008) compared physical activity levels between children with and without ASD (7-12 years) in an inclusive recess setting and found that those with ASD were significantly less active than NT

peers. The Pan (2008) study did not account for the social context during which activity occurred. In a free play setting children have the opportunity to choose activities and social settings, allowing for personal preferences such as more sedentary activities and not interacting with peers. Furthermore, compared with previous reports on NT children, one study suggests that youth with ASD are achieving less physical activity overall (Pan & Frey, 2006). A lack of motivation towards physical activity may contribute to lower levels of physical activity among individuals with ASD (Pan, Tsai, Chu, & Hsieh, 2011).

While results of the present study illustrated that physical activity setting or diagnosis of ASD did not appear to be independent influences on physical activity, A key finding of this study was that following subsequent analyses, time spent in physical activity (LMVPA and MVPA) was significantly different between group compositions by diagnosis and setting, providing support for our final hypothesis. Brown and colleagues (2009) found that the social context was a predictor of NT preschool children's physical activity in the outdoor play environment. In the present study, for all children in a structured physical activity setting, a significantly higher proportion of time spent in MVPA was associated with a one-on-one peer group composition, and more time spent in LMVPA was significantly associated with a solitary group composition compared to a group with an adult present. Significantly more time engaged in MVPA was observed in the free play setting when all children were solitary, as opposed to one-on-one with a peer or in a group with an adult.

Results were consistent with two studies on NT preschoolers which found that a solitary or alone with a peer social context was associated with more time spent in MVPA, compared to in a peer group (Brown et al., 2009; Nicaise, Kahan, & Sallis, 2011). In the Brown et al. (2009) study, MVPA was observed 28.5% of the time when children were solitary and 21.1% of the

time when alone with a peer, thus MVPA was 3.55 and 2.29 times more likely in these settings, respectively, compared to when engaged in activities with an adult present. Nicaise, Kahan, and Sallis (2011) determined that, compared to a peer group setting, children were 1.6 and 1.3 times more likely to engage in MVPA when solitary and alone with a peer, respectively.

Interestingly, while children with ASD were in a structured physical activity setting, they engaged in significantly more MVPA when one-on-one with a peer compared to the same social context in free play. Structured physical activity sessions were observed to consist of many skill-based activities and instructors frequently assigned partners prior to each activity, thus reducing the need for children with ASD to initiate activity with a peer. Furthermore, this structure affords both social and physical development opportunities while encouraging reciprocal interaction between individuals (Grenier, 2006). Structured physical activity typically involves instructional strategies to demonstrate activities using a combination of verbal and visual cues that may serve to reinforce appropriate behaviors of children with ASD while working with a peer in this setting (Crollick Mancil, & Stopka, 2006). Though individuals are likely to respond to instructional cues very differently, this strategy may be effective in increasing children's physical activity in the structured setting. Furthermore, children with ASD benefit from having established routines (APA, 2000; Groft-Jones & Block 2006) and unlike a free play setting, structured physical activity sessions present the opportunity for an established, well-defined routine that is consistent each time the child enters that setting. Perhaps the ability to anticipate upcoming activities and expectations contributes to the higher levels of MVPA while alone with a peer in structured activity compared to free play.

In a free play setting, children with ASD in the present study spent more time in MVPA while among a group of peers or when solitary rather than interacting alone with a peer. A

solitary social context was also associated with significantly more time in LMVPA among children with ASD compared to a one-on-one with an adult, one-on-one with a peer, and with peer group social context. Corbett and colleagues (2010) found that children with ASD spent less time interacting with other children during free play than their NT peers, perhaps as a result of stress. Social interactions with unfamiliar individuals have been shown to elevate stress for children with ASD (Lopata et al., 2008) although the children in the present study had already spent a week of summer camp together by the time data were collected. Marked social impairments associated with an ASD diagnosis may contribute to difficulties engaging with peers when activities are not structured. Children with ASD are less likely to receive social interactions from NT peers (McGee, Feldman, & Morrier, 1997) and frequently reject solicited play from other children (Corbett et al., 2009; Sigman & Ruskin, 1999; McGee, Feldman, & Morrier, 1997), further isolating them from social contexts involving peers.

This study has several limitations. First, our sample was highly selected as participants represented merely a small number of children enrolled in the summer camp. Additionally, participants in the present study consisted of only males, aged 5-6 years, reducing the potential to generalize results to older children and females. Next, another factor that may influence physical activity levels is the environment in which the physical activity setting takes place. All free play settings were conducted outdoors at the same playground facility, whereas structured physical activity time was provided both indoors and outdoors. During the study, average temperature across observation days was 84.8˚ F and humid, which could hinder desire to be physically active. Furthermore, instructors of structured physical activity were volunteers and had little to no prior experience leading structured physical activities particularly for children with ASD.

Finally, we modified the OSRAC-P to provide more detailed information regarding the initiator of physical activity, including "peer-initiated" as an option. Though the group composition code provided detailed information of the focal child's social environment, it did not specify whether the child was actually participating socially. According to the OSRAC-P training manual, group composition is coded based on the number of individuals who are engaged or in proximity (within 5 feet) of the focal child and is not dependent on explicit social interaction or engagement (Brown et al., 2006). In other words, children may have been coded with a peer group yet they may not have interacted at all but rather existed in proximity of the group. Given the literature surrounding children with ASD and social interaction and engagement, it would be meaningful to explore this area further.

While limitations must be considered, our study had several strengths. First, we selected a validated observational measure to explore the influence of social environment on physical activity levels of children. Second, participants were matched on age and diagnosis, ensuring that children with ASD and NT peers were observed simultaneously in the same social setting. These pairs were consistent across both structured and free play settings, and all participants were present during observation sessions. Finally, research assistants were required to complete thorough training sessions prior to the study which resulted in high IOA scores across all variables.

Results of the present study support further exploration of the impact of the social environment on physical activity of children with ASD. While it may be easier to provide alternative forms of individual physical activities, it is important for children with ASD to further develop social skills in order to appropriately function in society. Future research should address the issues of social engagement and interaction on physical activity behaviors of children with

ASD. Group composition in structured and free play settings revealed different amounts of time spent in MVPA and LMVPA in this study, suggesting that interventions may need to take different approaches based on the physical activity setting. Future research should examine the effects of peer models in the structured physical activity setting where children spent more time in MVPA alone with a peer than other social contexts. Such an approach has been shown to improve motor skill development (Ward & Ayvazo, 2006) and social skills (Kasari et al., 2012; Harper, Symon, & Frea, 2008) but to our knowledge has not been utilized to increase overall physical activity levels. Social narratives are an additional approach that has been effective in reducing disruptive behaviors and promoting social behaviors among children with ASD (Ozdemir, 2008; Crozier & Tincani, 2006; Barry & Berlew, 2004). We hypothesize that such an approach may be beneficial prior to free play physical activity settings to prepare children for the social interactions that may occur; though to our knowledge social narratives have only been used once in a physical education setting (Zimbelman et al., 2006).

Given the limited literature surrounding physical activity and children with ASD, opportunities for future research are endless. The present findings provide additional insight on the influences on physical activity of children with ASD. The finding that, by setting and diagnosis, children spent different amounts of time in LMVPA and MVPA depending on the group composition suggests that social environmental factors influence physical activity behaviors. Such factors should be considered when designing physical activity interventions for those with ASD, and because social impairments are characteristic of ASD, strategies to overcome these deficits should be employed in order to enhance opportunities for participation. As a result, children with ASD may develop skills to overcome their social impairments and enjoy physical activity, resulting in immediate and lifelong benefits.

Tables

Table 2.1: Descriptive characteristics of all camp participants

Demographic Variables	ALL	NT Peers	ASD
Participants, n	58	35	23
Gender, % (n)			
Male	64.4 (38)	51.4 (18)	82.6 (19)
Female	35.6 (21)	48.6 (17)	17.4 (4)
Socioeconomic Status, % (n)			
Not eligible	71.9 (41)	76.5 (26)	65.2 (15)
Free/Reduced	26.3 (15)	20.6 (7)	34.8 (8)
Race/Ethnicity, % (n)			
Non-Hispanic Caucasian	77.1 (44)	77.1 (27)	77.3 (17)
Racial/ethnic minority	26.3 (13)	22.8 (8)	22.7 (5)
Age, Years (SD)	7.5 (1.97)	7.3 (2.06)	7.9 (1.78)
Child Body Mass Index			
Child BMI, kg/m² (SD)	18.01 (5.19)	17.32 (5.27)	18.86 (5.06)
Child BMI-Z (SD)	.22 (1.90)	-.11 (2.23)	.72 (1.08)
Child Weight Status, % (n)			
Healthy weight	72.4 (42)	80.0 (28)	60.9 (14)
Overweight	10.3 (6)	2.9 (1)	21.7 (5)
Obese	17.2 (10)	17.1 (6)	17.4 (4)
Overweight/Obese	27.6 (16)	20.0 (7)	39.1 (9)
Parent BMI, kg/m² (SD)	25.58 (6.51)	26.01 (7.17)	24.90 (5.35)
Parent Weight Status, % (n)			
Normal	61.8 (34)	58.8 (20)	66.7 (14)
Overweight	18.2 (10)	23.5 (8)	9.5 (2)
Obese	20.0 (11)	17.6 (6)	23.8 (5)
Overweight/Obese	38.2 (21)	41.2 (14)	33.3 (7)

Table 2.2: Descriptive characteristics of study participants

Demographic Variables	ALL	NT Peers	ASD
Participants, n	12	6	6
Gender, % (n)			
Male	100 (12)	100 (6)	100 (6)
Socioeconomic Status, % (n)			
Not eligible	66.7 (8)	66.7 (4)	66.7 (4)
Free/Reduced	33.3 (4)	33.3 (2)	33.3 (2)
Race/Ethnicity, % (n)			
Non-Hispanic Caucasian	75.0 (9)	83.3 (5)	66.7 (4)
Racial/ethnic minority	25.0 (3)	16.7 (1)	33.3 (2)
Age, Years (SD)	5.5 (.52)	5.3 (.52)	5.7 (.52)
Child Body Mass Index			
Child BMI, kg/m² (SD)	16.10 (1.16)	15.32 (0.76)	16.89 (0.95)
Child BMI-Z (SD)	0.30 (.078)	-0.12 (0.65)	0.71 (0.70)
Child Weight Status, % (n)			
Healthy weight	83.3 (10)	100.0 (6)	66.7 (4)
Overweight/Obese	16.7 (2)	0.00 (0)	33.3 (2)
Parent BMI, kg/m² (SD)	25.01 (6.07)	26.91 (7.02)	23.11 (4.81)
Parent Weight Status, % (n)			
Normal	58.3 (7)	50.0 (3)	66.7 (4)
Overweight	16.7 (2)	16.7 (1)	16.7 (1)
Obese	25.0 (3)	33.3 (2)	16.7 (1)
Overweight/Obese	41.7 (5)	50.0 (3)	33.3 (2)

Table 2.3: Inter-observer agreement in percentage by OSRAC-P variable

IOA Session	Activity Level	Activity Type	Location	Playground Context	Activity Initiator	Group Composition	Prompt
1	90	100	100	100	100	96.7	100
2	96.7	93.3	100	100	100	90	96.7
3	100	100	100	100	100	100	100
4	93.3	93.3	100	100	100	100	100
5	93.3	90	100	100	100	80	100
6	93.3	93.3	100	100	100	100	100
7	96.7	93.3	100	96.7	96.7	90	100
8	100	100	100	96.7	100	100	100
Total	**95.4**	**95.4**	**100.0**	**99.2**	**99.6**	**94.6**	**99.6**

Table 2.4: Physical activity intensity of all children by social environment across all settings

			Percentage of intervals by activity level	
Category/Code	Intervals (n)	Time (%)	LMVPA	MVPA
All				
Initiator				
Adult initiated	702	49.1	37.6	12.1
Child initiated	717	50.1	42.5	14.2
Peer initiated	11	0.8	45.5	9.1
Group Composition				
Solitary	155	10.8	70.3	21.9
1:1 Adult	262	18.3	40.8	15.3
1:1 Peer	157	11.0	36.9	8.3
Group (adult present)	682	47.7	37.0	12.0
Group (peers)	174	12.2	27.6	10.9
Prompt				
None	1299	91.0	39.4	13.1
Teacher prompt increase	112	7.2	48.2	15.2
Teacher prompt decrease	13	0.9	46.2	7.7
Peer prompt increase	2	0.1	0.0	0.0
Peer prompt decrease	1	0.1	0.0	0.0
Total	1429		40.2	13.2

Table 2.5: Physical activity intensity of NT and children with ASD by social environment across all settings

Category/Code	Intervals (n)	Time (%)	Percentage of intervals by activity level	
			LMVPA	MVPA
ASD				
Initiator				
Adult initiated	352	49.0	35.8	10.2
Child initiated	366	51.0	39.1	12.8
Peer initiated	0	0.0	0	0
Group Composition				
Solitary	91	12.6	70.3	24.2
1:1 Adult	137	19.0	37.2	12.4
1:1 Peer	63	8.8	33.3	4.8
Group (adult present)	326	45.3	34.7	9.8
Group (peers)	103	14.3	19.4	8.7
Prompt				
None	643	89.7	37.2	11.7
Teacher prompt increase	63	8.8	36.5	11.1
Teacher prompt decrease	10	1.4	50	10
Peer prompt increase	0	0.0	0	0
Peer prompt decrease	1	0.1	0	0
Total	719		37.4	11.5
NT				
Initiator				
Adult initiated	350	49.2	39.4	14
Child initiated	351	49.3	46.2	15.7
Peer initiated	11	1.5	45.5	9.1
Group Composition				
Solitary	64	9.0	70.3	18.8
1:1 Adult	125	17.6	44.8	18.4
1:1 Peer	94	13.2	39.4	10.6
Group (adult present)	356	50.1	39	14
Group (peers)	71	10.0	39.4	14.1
Prompt				
None	656	92.4	41.6	14.5
Teacher prompt increase	49	6.9	63.3	20.4
Teacher prompt decrease	3	0.4	33.3	0
Peer prompt decrease	2	0.3	0	0
Peer prompt decrease	0	0.0	0	0
Total	710		43	14.8

Table 2.6: Physical activity intensity of ASD by setting and group composition

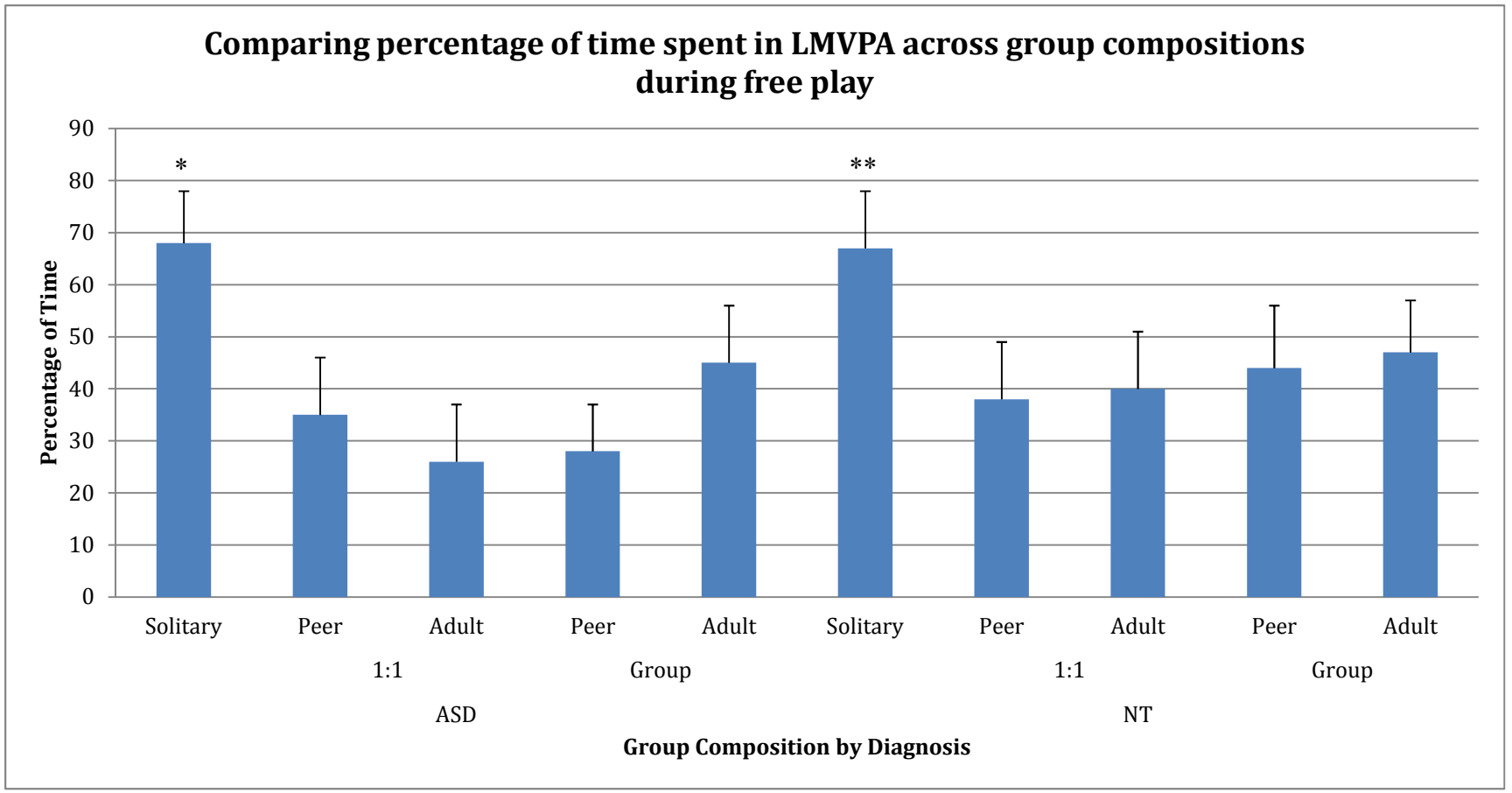
Comparison Group 1	Comparison Group 2	Mu (SEM)	Mu (SEM)	*t-value*	*p-value*
LMVPA					
Free Play					
1:1 Adult	Group - Adult	0.26 (.11)	0.45 (.11)	-1.42	0.16
1:1 Adult	1:1 Peer	0.26 (.11)	0.35 (.11)	-0.67	0.51
1:1 Adult	Group - Peers	0.26 (.11)	0.28 (.09)	-0.20	0.84
1:1 Adult	Solitary	0.26 (.11)	0.68 (.10)	-2.88	0.00
Group - Adult	1:1 Peer	0.45 (.11)	0.35 (.11)	0.81	0.42
Group - Adult	Group - Peers	0.45 (.11)	0.28 (.09)	1.49	0.14
Group - Adult	Solitary	0.45 (.11)	0.68 (.10)	-1.97	0.05
1:1 Peer	Group - Peers	0.35 (.11)	0.28 (.09)	0.58	0.56
1:1 Peer	Solitary	0.35 (.11)	0.68 (.10)	-2.53	0.01
Group - Peers	Solitary	0.28 (.09)	0.68 (.10)	-3.23	0.00
Structured					
1:1 Adult	Group - Adult	0.41 (.11)	0.33 (.08)	0.81	0.42
1:1 Adult	1:1 Peer	0.41 (.11)	0.48 (.21)	-0.33	0.75
1:1 Adult	Group - Peers	0.41 (.11)	0.00 (.00)	0.01	0.99
1:1 Adult	Solitary	0.41 (.11)	0.38 (.16)	0.18	0.86
Group - Adult	1:1 Peer	0.33 (.08)	0.48 (.21)	-0.74	0.46
Group - Adult	Group - Peers	0.33 (.08)	0.00 (.00)	0.01	0.99
Group - Adult	Solitary	0.33 (.08)	0.38 (.16)	-0.31	0.76
1:1 Peer	Group - Peers	0.48 (.21)	0.00 (.00)	0.01	0.99
1:1 Peer	Solitary	0.48 (.21)	0.38 (.16)	0.41	0.69
Group - Peers	Solitary	0.00 (.00)	0.38 (.16)	-0.01	0.99
MVPA					
Free Play					
1:1 Adult	Group - Adult	0.10 (.08)	0.05 (.03)	0.87	0.39
1:1 Adult	1:1 Peer	0.10 (.08)	0.01 (.01)	1.68	0.10
1:1 Adult	Group - Peers	0.10 (.08)	0.12 (.07)	-0.13	0.90
1:1 Adult	Solitary	0.10 (.08)	0.13 (.08)	-0.28	0.78
Group - Adult	1:1 Peer	0.05 (.03)	0.01 (.01)	1.11	0.27
Group - Adult	Group - Peers	0.05 (.03)	0.12 (.07)	-1.17	0.25
Group - Adult	Solitary	0.05 (.03)	0.13 (.08)	-1.34	0.18
1:1 Peer	Group - Peers	0.01 (.01)	0.12 (.07)	-1.98	0.05
1:1 Peer	Solitary	0.01 (.01)	0.13 (.08)	-2.10	0.04
Group - Peers	Solitary	0.12 (.07)	0.13 (.08)	-0.18	0.85
Structured					
1:1 Adult	Group - Adult	0.08 (.05)	0.07 (.04)	0.20	0.84
1:1 Adult	1:1 Peer	0.08 (.05)	0.28 (.23)	-1.27	0.21
1:1 Adult	Group - Peers	0.08 (.05)	0.00 (.00)	0.01	0.99
1:1 Adult	Solitary	0.08 (.05)	0.08 (.07)	-0.11	0.91
Group - Adult	1:1 Peer	0.07 (.04)	0.28 (.23)	-1.46	0.15
Group - Adult	Group - Peers	0.07 (.04)	0.00 (.00)	0.01	0.99
Group - Adult	Solitary	0.07 (.04)	0.08 (.07)	-0.26	0.80
1:1 Peer	Group - Peers	0.28 (.23)	0.00 (.00)	0.01	0.99
1:1 Peer	Solitary	0.28 (.23)	0.08 (.07)	1.05	0.30
Group - Peers	Solitary	0.00 (.00)	0.08 (.07)	-0.01	0.99

Table 2.7: Physical activity intensity of NT peers by setting and group composition

Comparison Group 1	Comparison Group 2	Mu (SEM)	Mu (SEM)	*t-value*	*p-value*
LMVPA					
Free Play					
1:1 Adult	Group - Adult	0.40 (.11)	0.47 (.10)	-0.63	0.53
1:1 Adult	1:1 Peer	0.40 (.11)	0.38 (.11)	0.15	0.88
1:1 Adult	Group - Peers	0.40 (.11)	0.44 (.12)	-0.33	0.74
1:1 Adult	Solitary	0.40 (.11)	0.67 (.11)	-2.16	0.03
Group - Adult	1:1 Peer	0.47 (.10)	0.38 (.11)	0.73	0.47
Group - Adult	Group - Peers	0.47 (.10)	0.44 (.12)	0.22	0.82
Group - Adult	Solitary	0.47 (.10)	0.67 (.11)	-1.71	0.09
1:1 Peer	Group - Peers	0.38 (.11)	0.44 (.12)	-0.46	0.65
1:1 Peer	Solitary	0.38 (.11)	0.67 (.11)	-2.16	0.03
Group - Peers	Solitary	0.44 (.12)	0.67 (.11)	-1.72	0.09
Structured					
1:1 Adult	Group - Adult	0.49 (.12)	0.34 (.08)	1.37	0.17
1:1 Adult	1:1 Peer	0.49 (.12)	0.41 (.14)	0.52	0.61
1:1 Adult	Group - Peers	0.49 (.12)	0.36 (.18)	0.65	0.52
1:1 Adult	Solitary	0.49 (.12)	0.72 (.16)	-1.17	0.25
Group - Adult	1:1 Peer	0.34 (.08)	0.41 (.14)	-0.54	0.59
Group - Adult	Group - Peers	0.34 (.08)	0.36 (.18)	-0.10	0.92
Group - Adult	Solitary	0.34 (.08)	0.72 (.16)	-2.04	0.04
1:1 Peer	Group - Peers	0.41 (.14)	0.36 (.18)	0.25	0.81
1:1 Peer	Solitary	0.41 (.14)	0.72 (.16)	-1.44	0.15
Group - Peers	Solitary	0.36 (.18)	0.72 (.16)	-1.46	0.15
MVPA					
Free Play					
1:1 Adult	Group - Adult	0.11 (.06)	0.08 (.05)	0.44	0.66
1:1 Adult	1:1 Peer	0.11 (.06)	0.07 (.05)	0.51	0.61
1:1 Adult	Group - Peers	0.11 (.06)	0.10 (.06)	0.08	0.94
1:1 Adult	Solitary	0.11 (.06)	0.25 (.12)	-1.35	0.18
Group - Adult	1:1 Peer	0.08 (.05)	0.07 (.05)	0.13	0.90
Group - Adult	Group - Peers	0.08 (.05)	0.10 (.06)	-0.32	0.75
Group - Adult	Solitary	0.08 (.05)	0.25 (.12)	-1.79	0.08
1:1 Peer	Group - Peers	0.07 (.05)	0.10 (.06)	-0.42	0.68
1:1 Peer	Solitary	0.07 (.05)	0.25 (.12)	-1.69	0.09
Group - Peers	Solitary	0.10 (.06)	0.25 (.12)	-1.34	0.18
Structured					
1:1 Adult	Group - Adult	0.14 (.08)	0.07 (.04)	0.91	0.37
1:1 Adult	1:1 Peer	0.14 (.08)	0.14 (.10)	0.00	1.00
1:1 Adult	Group - Peers	0.14 (.08)	0.04 (.06)	0.84	0.40
1:1 Adult	Solitary	0.14 (.08)	0.08 (.07)	1.35	0.18
Group - Adult	1:1 Peer	0.07 (.04)	0.14 (.10)	-0.79	0.43
Group - Adult	Group - Peers	0.07 (.04)	0.04 (.06)	0.43	0.67
Group - Adult	Solitary	0.07 (.04)	0.08 (.07)	0.90	0.37
1:1 Peer	Group - Peers	0.14 (.10)	0.04 (.06)	0.82	0.41
1:1 Peer	Solitary	0.14 (.10)	0.08 (.07)	1.27	0.21
Group - Peers	Solitary	0.04 (.06)	0.08 (.07)	0.30	0.77

Figures

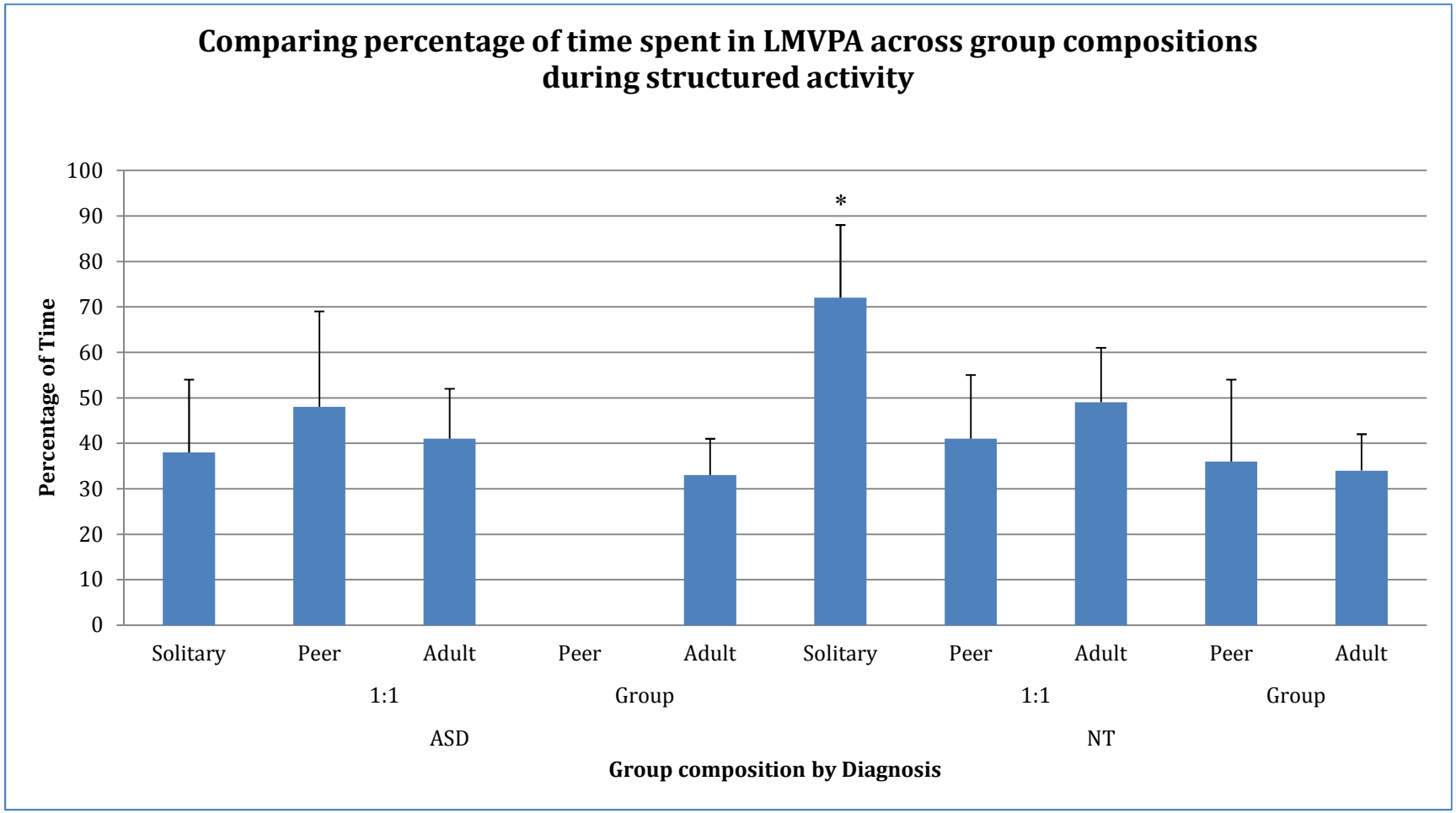
Figure 1: Comparing percentage of time spent in LMVPA by across group compositions during free play



* significant from 1:1 Adult ($p = 0.00$), 1:1 Peer ($p = 0.01$), Group Peer ($p = 0.00$)

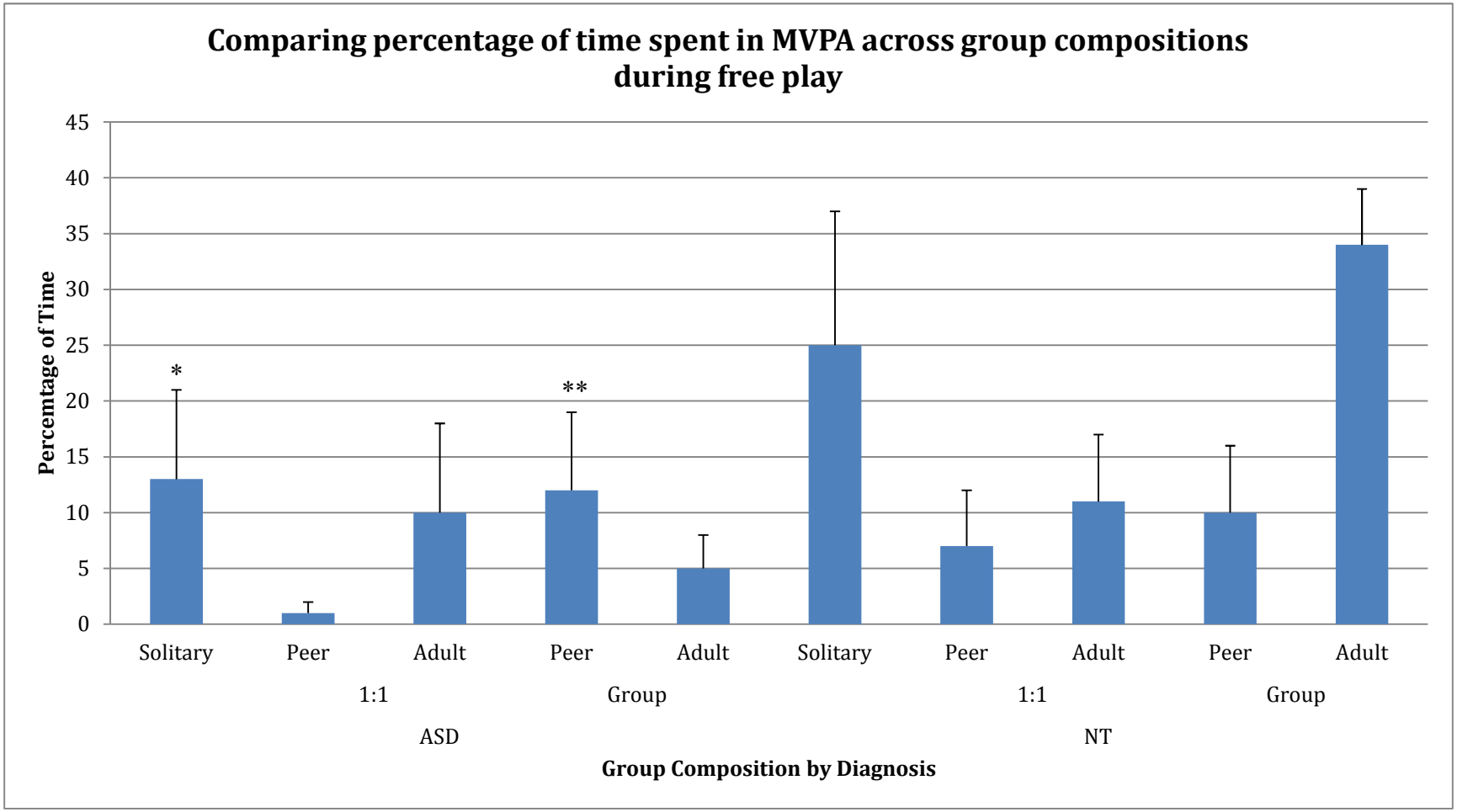
** significant from 1:1 Adult ($p = 0.03$) 1:1 Peer ($p = 0.03$)

Figure 2: Comparing percentage of time spent in LMVPA across group compositions during structured activity



* significant from Group Adult ($p = 0.04$)

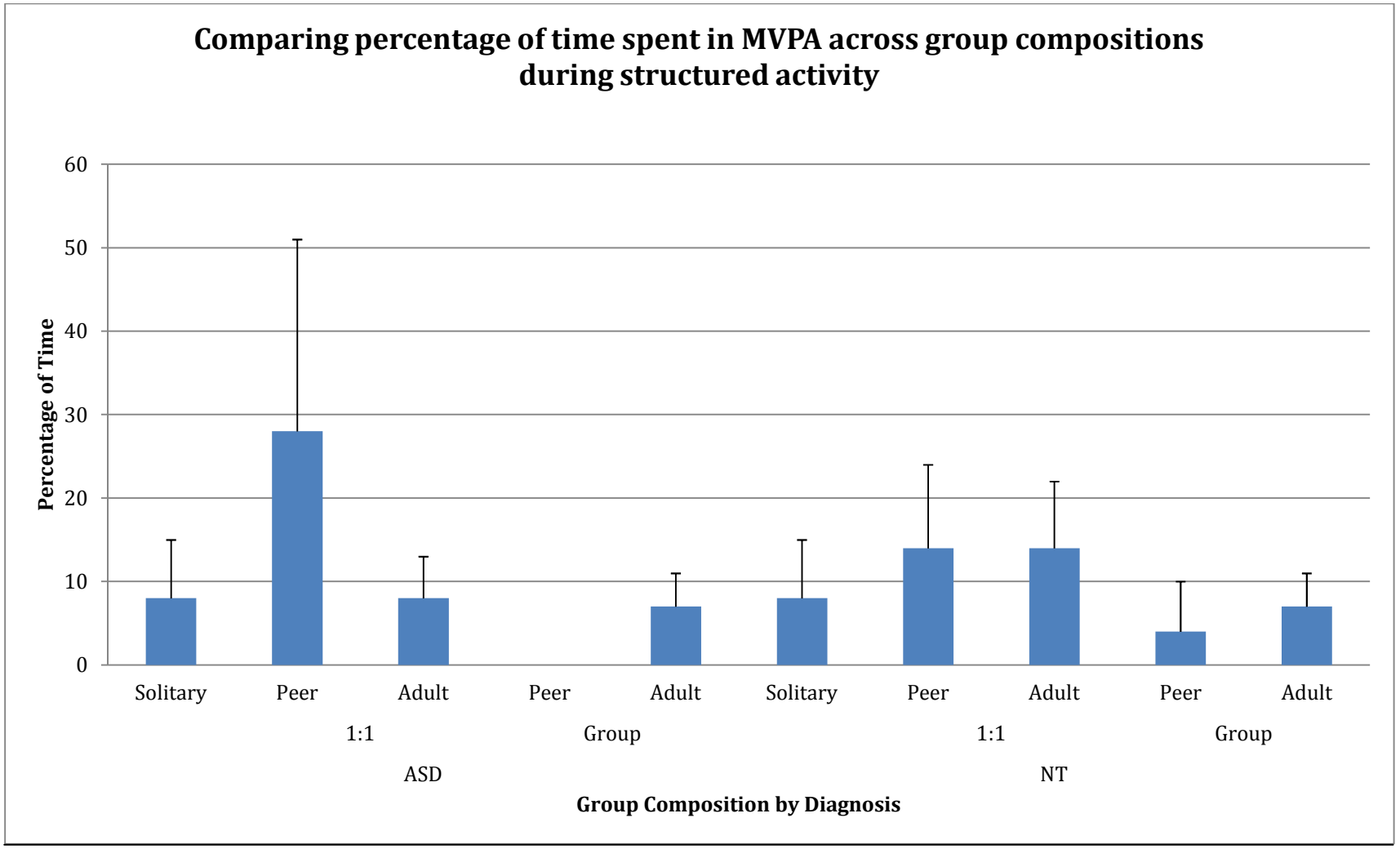
Figure 3: Comparing percentage of time spent in MVPA across group compositions during free play



* significant from 1:1 Peer ($p = 0.04$)

** significant from 1:1 Peer ($p = 0.05$)

Figure 4: Comparing percentage of time spent in MVPA across group compositions during structured activity



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Chapter 3 - Physical Activity Environment at Head Start Sites in Kansas

Introduction

In the United States, childhood obesity has nearly tripled over the past decade (Ogden et al., 2010) and is most prevalent among minority and low-income children (Ogden et al., 2012). Currently, 26.7% of preschoolers (2-5 years) are overweight or obese, with a higher prevalence among males than females (Ogden et al., 2012). Of particular concern are the health disparities between low-income and high-income families. The United States Census Bureau reported that in 2011 nearly 46.2 million individuals lived in poverty and 21.9 percent of American children were living in poverty (DeNavas-Walt, Proctor & Smith, 2012). Furthermore, the Centers for Disease Control and Prevention (CDC) reported that one in seven children in poverty is obese (CDC, 2012).

Contributing to the obesity epidemic may be a lack of sufficient physical activity. To attain health benefits such as decreased body fatness, enhanced cardiorespiratory and muscular fitness, and decreased risk for developing type 2 diabetes, the United States Department of Health and Human Services (USDHHS) emphasizes that regular physical activity is required (USDHHS, 2008). Young children aged 3-5 years should engage in daily light, moderate, and vigorous physical activity (LMVPA) for 15 minutes per waking hour each day (Pate & O'Neill, 2012). For young children, it is speculated that all non-sedentary intensities of physical activity should be considered and a focus should be placed on enhancing all movement (Ward, Vaughn, & Story, 2013).

One setting preschool children spend a large amount of time in is a child care setting. In a national study conducted in 2007, 55% of children 3-6 years were enrolled in center-based child

care arrangements (www.childstats.gov) and several studies have indicated that preschoolers are not achieving adequate amounts of physical activity during child care. Over one thousand Australian children (aged 3-5 years) participated in a study addressing compliance with physical recommendations (Hinkley et al. 2012). Researchers compared accelerometer data to Australian physical activity guidelines (>180 min of daily activity) as well as to guidelines established by the (U.S.) National Association for School Physical Education (NASPE) (at least 60 min structured and 60 min unstructured activity each day). Results suggested that no children met Australian guidelines, which were in nature more stringent than those of NASPE, and 32% met NASPE recommendations. Overall, Hinkley et al. (2012) found that the majority of preschoolers were not participating in enough physical activity.

Environmental influences in child care setting may affect preschoolers' physical activity levels. Pate and colleagues (2004) recruited nine preschools (privately operated, church-based, and government-funded Head Start sites) from South Carolina, and assessed physical activity throughout the day. Results indicated that the preschool a child attended significantly predicted physical activity levels. The quantity and quality of physical activity experiences varied across child care settings. Children in environments supportive of physical activity spent less time in sedentary activities and acquired more moderate-to-vigorous physical activity (MVPA) compared to less supportive sites (Bower et al., 2008). Dowda and colleagues (2004) noted that preschoolers enrolled in sites that offered four or more field trips, consisted of smaller class sizes, and employed college-educated instructors demonstrated significantly higher levels of MVPA.

The physical activity environment at child centers may be shaped by policies and practices. Although best practice recommendations exist, with the exception of Head Start,

regulation of policies and practices of child care facilities falls upon individual states. The Office of Head Start (OHS) describes Head Start as a comprehensive, federally funded early childhood program for low-income and disabled children aged birth to five years that promotes school readiness by enhancing cognitive, social, and emotional development while implementing health, nutrition, and social services (OHS, 2012). Programs must adhere to federal performance standards; however, such standards are intentionally broad to allow them to be adopted to fit the needs of the various Head Start settings. As childhood obesity receives worldwide attention, federal performance standards of particular interest include those for nutrition and physical activity.

Head Start performance standards are defined by the OHS and serve as minimum requirements for all Head Start and Early Head Start services. Detailed nutrition standards state that programs must provide 1/3 of the child's daily nutritional needs through meals and snacks while in part-time care, and 1/2 to 2/3 of the child's daily nutritional needs through meals and snacks for children enrolled in full-time care. Additionally, breakfast must be provided to children who arrive to child care without having eaten. Individual Head Start and Early Head Start sites use their own funds for meal services, yet the United States Department of Agriculture (USDA) Food & Consumer Services Child Nutrition Programs serve as the primary source of funding.

The performance standards regarding children's nutritional needs are well-developed, yet the specific standards around children's physical development are vague. Excluding the term "physical activity," the OHS states that in center-based settings, sites must provide sufficient time for active play and movement that support the development of gross motor skills. Additionally, sufficient time should occur in indoor and outdoor space, equipment and materials

should be accessible, and adults should provide guidance. The term "sufficient" is rather vague and does not provide quantitative guidelines for sites to achieve, perhaps increasing the difficulty of knowing whether or not sites are meeting the performance standard.

In a recent study conducted by Whitaker and colleagues (2009), a self-administered survey was delivered to all Head Start sites (n = 1810). The survey was part of the Study of Healthy Activity and Eating Practices and Environments in Head Start (SHAPES) and aimed to describe obesity prevention practices occurring in Head Start. Out of those who responded to the survey (87%), 74% of programs reported providing structured gross motor activity for at least thirty minutes each day, and 73% claimed that children were provided with unstructured gross motor activity for thirty minutes each day. Fifty-six percent of sites reported both structured and unstructured daily practices. While results indicated that most Head Start programs engage in practices beyond what is required by federal performance standards with regard to gross motor development, such standards have no quantitative guidelines, and it is unknown whether children in these sites are achieving the recommended 15 minutes per hour in care.

To better understand the influence of a supportive physical activity environment on physical activity behaviors of preschoolers, additional research is needed. The purpose of the present study was to describe physical activity practices in Head Start sites in Kansas and to examine how the prevalence of overweight and obesity varies between different physical activity-related environmental variables.

Method

Participants

All Head Start sites (n=24), excluding Early Head Start programs, in Kansas were invited to participate in this cross-sectional study. Each Head Start director was emailed a link to an

online survey, which consisted of 17 questions drawn from the Nutrition and Physical Activity Self-Assessment for Child Care (NAPSACC) instrument and two demographic questions. Due to the nature of this study, only physical activity questions were asked. A total of 21 sites responded, yielding a response rate of 87.5%. Institutional Review Board approval was not deemed necessary for this project and it was conducted under the supervision of the Kansas Head Start Association.

Setting

Participants of this study were Head Start sites in Kansas. Settings varied by program and according to data accessed from the 2011-2012 Program Information Report (PIR) (USDHHS, 2012), 21% were run by a community action agency, 33% were run by a private or public non-profit entity and 46% were run out of the school system. Sites served a total of 8,795 children and child turnover within 45 days or less was 3.2%. Of the children served by Kansas Head Start programs, 72.1% were of non-Hispanic/Latino origin, and race was represented by 50.8% white, 23.3% black or African American and 25.9% were other races (American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, multi-racial, or unspecified). Upon enrollment in the program, 93.3% of children had health insurance.

Measures

Body Mass Index (BMI)

Weight status among children is calculated using a function of height and weight (BMI = weight (kg) / height $(m)^2$). Scores are then plotted on the CDC growth charts (Flegal et al., 2009) to determine weight status in relation to age and sex. For children, underweight is defined as $\leq 5^{th}$ percentile, healthy weight is defined as $>5^{th}$ percentile and $\leq 85^{th}$ percentile, and overweight and obesity are defined as $\geq 85^{th}$ percentile and $\geq 95^{th}$ percentile, respectively. BMI data collected in

the present study were drawn from the 2011-2012 PIR (USDHHS, 2012). Notably, BMI reported to the PIR may be collected from a variety of sources including program directors and various health care providers, so a standardized system is not established.

Physical Activity Environment

The NAPSACC instrument was developed to assess child care provider policies and practices around nutrition and physical activity (Ammerman et al., 2007). After a thorough review of physical activity and nutrition recommendations pertaining to child care and preschoolers, the developers of NAPSACC created key questions for both nutrition and physical activity categories. Results of a pilot study indicated that NAPSACC is a feasible tool to asses environmental factors influencing preschoolers' weight status (Benjamin et al., 2007) and it has since been used in various studies to provide descriptive information on quality of child care environments (Trost et al., 2009; Trost et al., 2011; Sisson et al., 2012).

The present study focuses on the physical activity environment at Kansas Head Start sites, thus only questions related to physical activity were asked. The NAPSACC assesses the physical activity environment practices and policies through six domains: 1) active play and inactive time; 2) TV use and viewing; 3) play environment; 4) supporting physical activity; 5) provider and parental education in physical activity; and 6) physical activity policy. For each question, minimum standards to best practices are reflected through four possible responses: 1) indicated marginally meeting child care standards; 2)_ indicated meeting child care standards; 3) indicated exceeding child care standards; and 4) indicated using best practice (Trost et al., 2011).

Results

At a national level, 13.3% of children enrolled in Head Start (excluding Early Head Start) are considered overweight with another 14.9% considered obese. On average, 15.9% and 17.8%

of children enrolled in Kansas Head Start sites were overweight or obese, respectively. Kansas site level overweight and obesity prevalence ranged from 6.2% to 51.9% (OHS, 2012).

Results of the physical activity environment assessment utilizing NAPSACC are presented in Table 3.1-Table 3.5 by category. Approximately 42.9% of sites reported providing active play time ≤45 minutes per day and 57.1% reported providing 46-90 minutes of daily active play. Most sites offered opportunities for daily outdoor play (90.4%) and on average 28.6% (SD = 9.3). Of children enrolled in sites offering two or more opportunities for daily outdoor play, the prevalence of overweight and obese was 28.6% (SD = 9.3) while children at sites offering outdoor play 2-4 times per week was 31.0% (SD = 3.9) (see Table 3.1). Daily teacher-led physical activity opportunities were provided by 76.2% of sites, and prevalence of overweight and obese children at sites providing these opportunities daily or twice a day was 36.1% (SD = 6.2%) and 33.2% (SD = 9.5%), respectively. Prevalence of overweight and obesity was 18.0% (SD = 16.8) at sites where teacher-led activity was reported one time per week or less. Only 4.8% reported occasionally restricting active play time for misbehavior and 90.5% of sites reported that children sat for greater than 30 minutes at a time less than once a week or never. Most sites (95.2%) reported rare to no television and video use and child overweight and obesity was 31.7% (SD = 9.5) among these sites, while prevalence was 45.7% (see Table 3.1) among sites who reported using the television two hours per week or less.

Sufficient outdoor space for all activities, including a path for wheeled toys, was reported by 85.7% of sites, however only 42.9% of sites reported ample space for all indoor activities (see Table 3.2). Most sites reported having a variety of equipment that accommodates all children (71.4%) and having a variety of options for children to use simultaneously (76.2%). Furthermore, outdoor portable equipment that is freely accessible at all times was reported by

76.2% of sites, though 14.3% of sites reported that this equipment is located out of sight. When children engage in active play, 66.7% of sites reported frequent encouragement of activity and joint active play. Materials supporting physical activity (books, posters, pictures) in every room were reported among 28.6% of sites (see Table 3.3).

Annual physical activity trainings for staff were provided by 66.7% of sites while 4.8% reported bi-annual trainings (see Table 3.4). Furthermore, physical activity education was offered to parents annually (42.9%) and bi-annually (42.9%) while most sites reported providing children with standardized physical activity education one time per week (81.0%). Finally, 14.3% reported no existing policies pertaining to physical activity and 42.9% reported that a written physical policy is available and followed (see Table 3.5).

Discussion

Average overweight (15.9%) and obesity (17.8%) rates of children enrolled in Kansas Head Start sites are higher than the national average. Ogden et al. (2012) reported that in the United States, the prevalence of overweight preschoolers in 2010 was 14.6% while the prevalence of obese preschoolers was 12.1%. Furthermore, overweight and obesity prevalence among children enrolled in Head Start programs nationally was 13.3% and 14.9%, respectively. Children served by Kansas Head Start sites have a high prevalence of overweight and obesity, and with many children spending time in child care environments (www.childstats.gov), targeting this setting to enhance physical activity seems appropriate.

The primary purpose of this study was to describe the physical activity environment of Head Start sites in Kansas. A major area where Kansas Head Starts sites perform well is in the play environment domain. Most, if not all, sites met or exceeded child care standards regarding provision of a variety of fixed play equipment and portable play equipment, and they provided

ample space for physical activities outdoors while 42% reported providing ample space for indoor physical activities. Children have been observed to be more physically active when jumping equipment and playground markings were present; however riding toys, sandboxes, and swings were associated with lower levels of activity (Gubbels et al., 2012). Overall, the provision of a variety and greater amounts of equipment has been associated with an increase of physical activity among preschool aged children (Gubbels et al., 2012; Ward et al., 2010; Bower et al., 2008; Dowda et al., 2009).

In the present study, only 57.1% of sites met the child care standards of providing 46-90 minutes of active play daily. This, however, should be interpreted with caution. Current reports recommend preschoolers should achieve 15 minutes of active play time per hour in care (Pate & O'Neill, 2012). Some sites in the present study simultaneously offer half and full day programs, while others strictly offer one program or the other. Thus, if sites in this study were primarily half day programs that provided three hours of care, most would be meeting or exceeding recommendations. Evidence suggests that children's physical activity levels decline as time in outdoor free play elapses (Cardon et al., 2008; Pate et al., 2013), suggesting that active play should be provided in shorter durations more frequently throughout the day to effectively increase physical activity.

It is important for child care centers to provide opportunities for both free play and structured activity. Teacher-led physical activity is an exceptional opportunity to teach motor skill development, and 76.2% of sites reported providing daily structured activity. An earlier study on child care environments in Kansas showed that 60.3% of providers offered daily structured activity (Trost et al., 2009). Studies have shown that preschool children with poor motor skills are less active than those with better motor skills (Bellows et al., 2013; Williams et

al., 2008; Wrotniak et al., 2006), supporting the importance of teacher-led activity to enhance motor skill development. In a review conducted by Ward and colleagues (2010), it was suggested that 90 minutes of structured physical activity is sufficient for improvements in motor development, however a greater amount of time may be required to increase physical activity levels. Interestingly, the sites that provided daily or twice a day teacher-led physical activity reported overweight and obesity prevalence rates of 36.1% and 33.2%, respectively, while prevalence of overweight and obese children was 18.0% at sites offering teacher-led activity one time per week or less. While this finding should be further explored, it could suggest inadequate staff training.

Providing physical activity training to staff is an intervention strategy that is being used in various settings, and one study in particular clearly demonstrated the importance of adequate teacher training. In a "move and learn" intervention, preschool teachers attended a three-hour training session, but experienced difficulty implementing the lesson. Researchers reiterated the main concepts of the intervention strategies but the one-time training, and even an additional training, was not sufficient to prepare teachers for adequate implementation (Trost, Fees, & Dzewaltowski, 2008). Results from the present study indicated that physical activity training for staff is provided annually for 66.7% of sites and twice per year for 4.8% of sites. An annual training may not be sufficient for ensuring quality structured and unstructured physical activity opportunities. Furthermore, evidence from research conducted in preschools suggests that children's activity levels were correlated with teacher' behaviors and qualifications (Kreichauf et al., 2012). Incorporating teacher-led physical activity into existing curriculum could increase overall activity levels; however this should not be at the expense of free play which is important for the achievement of other developmental outcomes (Kreichauf et al., 2012; Ward et al., 2010).

A final component of the physical activity environment consists of polices promoting physical activity concepts. Policy implementation is a recommended obesity prevention strategy (Ward, Vaughn, & Story, 2013) and policies providing shorter bouts of structured PA throughout the day may increase MVPA during gross motor time (Alhassan et al., 2012). Considering only 42.9% of Head Start sites in Kansas reported a written physical activity policy that is followed, this would serve as a great starting point for enhancing the physical activity environment and opportunities while children are in care. Child care sites should implement and monitor physical activity policies to ensure children are receiving adequate opportunities to be active and should consider policies that designate 15 minutes per hour in care to active play time.

Several limitations of this study exist. Participants were only Head Start sites located in Kansas; therefore national sites were not invited to participate in the study. Furthermore, the survey was self-report, and it is possible that directors identified the emphasis placed on physical activity and gauged their responses accordingly. Directors may have reported answers that aligned best with national Head Start recommendations, thus overestimating physical activity environmental variables, so further steps should be taken to validate responses of this study. In regards to the reported amounts of active play time, we did not consider the possibility that Head Start sites operated full-day and half-day classrooms which could influence the amount of sites achieving best practice recommendations.

Strengths of the study include the voluntarily completion of the questionnaire by providers and efforts to increase response rate through reminder emails. The email reminders and easy-to-use online survey format perhaps contributed to this study's high response rate as it minimized participant burden. NAPSACC is a validated instrument used to assess the environment of child care sites and was well received by the providers. It provides an

exceptional opportunity for creating a supportive physical activity environments and increasing preschoolers' physical activity behaviors. Furthermore, this study allows for the comparison of previous childcare work in Kansas and elsewhere on the same scale.

Findings of this study provided a descriptive view on the physical activity environment of Kansas Head Start sites, and due to the descriptive nature of the analyses, we did not conduct comparisons to seek statistically significant differences. The next steps would be to perform such analyses and conduct additional assessments to ensure validity of responses. Future research should explore the implications of physical activity environment on preschoolers' physical activity levels and weight status, and such research could better inform physical activity interventions in the child care setting. Head Start sites in the present study may use these results to identify areas of change necessary to provide an optimal environment supporting physical activity. Furthermore, the findings support the need to ensure children are being provided adequate amounts of daily structured and unstructured activity. Since there is no specific national-level Head Start policy encompassing physical activity, we recommend that Head Start sites consider developing such interventions at the site or state-level. Additionally, sites should continue to ensure they are providing sufficient amounts of active equipment, promoting physical activity, and training staff members in order to enhance the physical activity environment.

Table

Table 3.1: Prevalence of weight status by active play and inactive time variables as measured by the NAPSACC

NAPSACC Category	Mean (%)	NW Mean, % (SD)	OW Mean, % (SD)	Obese Mean, % (SD)	Mean OW/Obese, % (SD)
Active play is provided to all children:					
45 minutes or less each day	42.9	62.3 (12.5)	16.5 (5.7)	17.6 (6.8)	34.1 (11.7)
46-90 minutes each day	57.1	61.8 (9.1)	14.4 (4.8)	16.7 (4.8)	31.1 (8.4)
Teacher-led physical activity is provided to all children:					
1 time per week or less	9.5	79.2 (20.7)	9.6 (8.3)	8.4 (8.4)	18.0 (16.8)
2-4 times per week	14.3	62.4 (5.9)	13.3 (4.9)	14.8 (6.3)	28.1 (10.9)
1 time per day	47.6	57.5 (7.0)	17.5 (3.3)	18.5 (4.3)	36.1 (6.2)
2 or more times per day	28.6	63.6 (9.1)	14.6 (5.2)	18.6 (4.5)	33.2 (9.5)
Outdoor active play is provided for all children:					
2-4 times per week	9.5	63.3 (8.7)	16.0 (0.7)	15.0 (4.6)	31.0 (3.9)
1 time per day	71.4	61.5 (11.8)	15.9 (5.7)	17.7 (5.9)	33.6 (10.6)
2 or more times per day	19.0	63.4 (6.6)	13.0 (4.2)	15.6 (5.4)	28.6 (9.3)
Active play time is withheld for children who misbehave:					
Sometimes	4.8	55.1	17.4	24.9	42.3
Never	95.2	62.4 (10.5)	15.2 (5.3)	16.7 (5.4)	31.9 (9.8)
Children are seated:					
1 or more times per day	9.5	63.5 (9.0)	13.5 (2.7)	17.4 (1.2)	31.0 (3.9)
less than once a week or never	90.5	61.9 (10.7)	15.5 (5.4)	17.0 (5.9)	32.5 (10.3)
Television and video use consists of:					
TV turned on for 2 hours per week or less	4.8	52.6	22.4	23.3	45.7
TV used rarely or never	95.2	62.5 (10.4)	15.0 (5.1)	16.7 (5.5)	31.7 (9.5)

Table 3.2: Prevalence of weight status by supportive physical activity environment variables as measured by the NAPSACC

NAPSACC Category	Mean (%)	NW Mean, % (SD)	OW Mean, % (SD)	Obese Mean, % (SD)	Mean OW/Obese, % (SD)
Fixed play equipment is:					
Different equipment, suits most children	28.6	71.9 (11.0)	13.1 (4.9)	12.5 (5.4)	25.6 (9.8)
Wide variety of equipment, accommodates all children	71.4	58.0 (7.2)	16.2 (5.2)	18.9 (4.7)	35.1 (8.7)
Portable play equipment consists of:					
Good variety but children must take turns	23.8	62.4 (5.7)	14.4 (3.5)	19.3 (3.0)	33.7 (4.9)
Lots of variety for children	76.2	61.9 (11.6)	15.6 (5.7)	16.4 (6.1)	32.0 (11.0)
Outdoor portable play equipment is:					
Staff must access	14.3	64.1 (6.1)	15.6 (8.1)	12.9 (4.6)	28.6 (12.7)
Available on request	9.5	55.9 (1.7)	16.1 (0.9)	21.2 (4.1)	37.3 (5.0)
Freely available by children at all times	76.2	62.4 (11.5)	15.2 (5.2)	17.3 (5.6)	32.5 (9.9)
Outdoor play space includes:					
Open running space, no track/path	14.3	61.4 (14.4)	13.7 (2.5)	14.7 (2.6)	28.4 (0.3)
Open running spaces, track/path	85.7	62.1 (10.1)	15.6 (5.5)	17.5 (5.9)	33.0 (10.5)
Indoor play space is available:					
For some active play	57.1	63.6 (12.1)	15.5 (5.7)	17.4 (6.3)	32.9 (11.4)
For all activities, including running	42.9	59.9 (7.7)	15.1 (4.7)	16.6 (4.9)	31.7 (7.7)

Table 3.3: Prevalence of weight status by support for physical activity variables as measured by the NAPSACC

NAPSACC Category	Mean (%)	NW Mean, % (SD)	OW Mean, % (SD)	Obese Mean, % (SD)	Mean OW/Obese, % (SD)
During active play time staff:					
Sometimes encourage, join in active play	33.3	71.6 (10.0)	11.1 (4.6)	12.3 (5.5)	23.4 (9.0)
Often encourage, join in active play	66.7	57.2 (6.8)	17.4 (4.2)	19.7 (4.0)	36.9 (6.7)
Support for physical activity is displayed in:					
A few rooms	23.8	69.7 (13.8)	13.6 (5.6)	13.3 (6.3)	26.9 (11.9)
Most rooms	47.6	61.6 (8.1)	15.9 (5.4)	17.2 (5.5)	33.1 (10.0)
Every room	28.6	56.3 (8.0)	15.8 (5.1)	20.0 (3.8)	35.8 (6.7)

Table 3.4: Prevalence of weight status by physical activity education variables as measured by the NAPSACC

NAPSACC Category	Mean (%)	NW Mean, % (SD)	OW Mean, % (SD)	Obese Mean, % (SD)	Mean OW/Obese, % (SD)
Training opportunities for staff:					
Rarely or never	14.3	67.9 (22.5)	12.6 (7.7)	17.1 (12.7)	29.7 (20.4)
Less than 1 time per year	14.3	63.8 (3.9)	14.1 (3.9)	17.5 (3.2)	31.7 (3.5)
1 time per year	66.7	61.6 (7.4)	16.3 (5.1)	17.0 (4.6)	33.4 (8.8)
2 times per year or more	4.8	44.8	13	15.7	28.7
Physical activity education (curriculum):					
Rarely or never	14.3	73.7 (17.3)	11.9 (7.1)	11.4 (7.9)	23.3 (14.9)
2-3 times per month	4.8	54.7	16.8	24	40.8
1 time per week	81.0	60.3 (8.1)	15.9 (5.0)	17.6 (4.7)	33.5 (8.4)
Physical activity education for parents:					
Rarely or never	14.3	63.7 (3.9)	16.0 (1.3)	15.6 (2.3)	31.6 (3.6)
1 time per year	42.9	60.9 (5.6)	15.0 (4.8)	17.6 (4.4)	32.6 (7.6)
2 times per year or more	42.9	62.5 (15.2)	15.4 (6.6)	17.0 (7.5)	32.4 (13.3)

Table 3.5: Prevalence of weight status by physical activity policy variable as measured by the NAPSACC

NAPSACC Category	Mean (%)	NW Mean, % (SD)	OW Mean, % (SD)	Obese Mean, % (SD)	Mean OW/Obese, % (SD)
A written policy on physical activity:					
Does not exist	14.3	63.0 (5.2)	16.3 (7.2)	17.1 (3.1)	33.4 (6.5)
Exists informally, not written or followed	23.8	65.3 (5.2)	12.7 (4.2)	14.9 (4.6)	27.6 (7.4)
Is written but not always followed	19.0	72.0 (15.2)	12.1 (6.1)	12.9 (7.1)	25.0 (13.0)
Is written, available, and followed	42.9	55.5 (7.7)	17.9 (3.8)	20.1 (4.9)	38.0 (7.8)

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Appendix A - Measurement Tools

BMI Collection Form

CHILD ID: ☐☐☐☐

Flint Hills Summer Fun Camp Study
HEIGHT AND WEIGHT DATA SHEET

June 2012

BMI
Cover Sheet

CHILD NAME: _____

CHILD GENDER: _____

Flint Hills Summer Fun Camp Study
HEIGHT AND WEIGHT DATA SHEET

CHILD ID ☐☐☐☐ CHILD GENDER: ☐Male ☐Female

FORM COMPLETED BY : ☐☐☐ (initials) DATE: ☐☐ / ☐☐ /☐☐ ☐☐

Weight Data **(in kilograms to 0.1 kg):**

MEASURE #1 ☐☐☐ . ☐ kg

MEASURE #2 ☐☐☐ . ☐ kg

MEASURE #3 ☐☐☐ . ☐ kg (if necessary)

Height Data **(in centimeters to 0.1 cm):**

MEASURE #1 ☐☐☐ . ☐ cm

MEASURE #2 ☐☐☐ . ☐ cm

MEASURE #3 ☐☐☐ . ☐ cm (if necessary)

Please indicate if there were any problems retrieving an accurate measurement on any section.

COMMENTS:

_____

_____

_____

Parent Survey

Flint Hills Summer Fun Camp – Physical Activity Study

Parent Survey

Child Name: _____

(Last Name) (First Name)

Child Age: _____ **years**

Child Date of Birth: _____/_____/_____

(month / date / year)

Parent (Caregiver) Name: _____

(Last Name) (First Name)

This cover sheet will be torn off by the researchers so that your name will NOT be on the questionnaire.

INSTRUCTIONS:

Please read all of the instructions and questions carefully.

Do not put your name on any part of the survey on the following pages.

Fill in the circle next to each question that indicates your best answer. Some questions have a blank space for you to write your answer.

When referring to your child, please refer to your **child enrolled in the Flint Hills Summer Fun Camp**.

This is not a test, so there are no right or wrong answers. If you do not find an answer that fits exactly, use the one that is closest.

1. Has a doctor or other health care provider ever told you that your child (who is enrolled in the Flint Hills Summer Fun Camp) had Autism, Asperger's Disorder, pervasive developmental disorder, or other autism spectrum disorder?

   O Yes (please specify, _____)
   O No
   (if no, please skip to question 4)

2. How old was your child when he/she began receiving services?

   _____ years

3. Is he/she currently receiving services?
   O Yes
   O No
   O Don't know
   O Prefer to not answer

4. I am the child's:
   O Mother (Female Caregiver)
   O Father (Male Caregiver)

5. I am currently:
   O Married
   O Divorced or separated
   O Widowed
   O Single

6. Are **you** Hispanic or Latino?
   O Yes
   O No
   O Don't know / not sure
   O Prefer to not answer

7. Is **your child** (who is enrolled in camp) Hispanic or Latino?
   O Yes
   O No
   O Don't know / not sure
   O Prefer to not answer

8. **I describe my family as**: (Select one or more for each)

	Parent (Caregiver)	**Child enrolled in camp**
American Indian or Alaska Native	O	O
Asian	O	O
Black or African American	O	O
Native Hawaiian or Other Pacific Islander	O	O
White	O	O
Don't know/not sure	O	O
Prefer to not answer	O	O

9. **Highest level of education** completed for child's parents or adult caregivers:

	Mother (female caregiver)	**Father** (male caregiver)
Less than high school	O	O
High school	O	O
Some college or associates degree	O	O
Graduated college	O	O
Master's degree or above	O	O
Does not apply	O	O

10. My age: _____

11. What is Your Height? _____feet, and _____inches

12. What is Your Weight? _____ pounds

13. Is your child eligible to receive school breakfast or lunch for free or at a reduced cost? (mark one)
    - O Yes
    - O No
    - O Prefer to not answer

Please indicate the number of days your child (who is enrolled in the camp) resides in your home: _____

The survey continues →

14. Please indicate your child or children's ages, gender, height and weight:

Age	Gender	Height	Weight

End of survey.

Thank you for your participation!

OSRAC-P Coding Sheet