



How We Play— *Cultural Determinants of Physical Activity in Young Children*



*Authored by—
Lorelei Emma, M.Ed, and Marian Jarrett, Ed.D.*

[Head Start Body Start National Center for Physical Development and Outdoor Play](#) is a joint project of the [American Association for Physical Activity and Recreation \(AAPAR\)](#) and the [National Association for Sport and Physical Education \(NASPE\)](#) and funded by the [Office of Head Start](#), Administration for Children and Families, U.S. Department of Health and Human Services.

Grant number 90YD0274/01



How We Play— *Cultural Determinants of Physical Activity in Young Children*

With alarming evidence that the obesity epidemic now jeopardizes the health and well-being of our nation's youngest citizens (U.S. Department of Health and Human Services, 2001), promoting energy balance through healthy eating and physical activity has become a national priority in the United States. Promoting physical activity in young children is presently in the national spotlight with prominent figures such as First Lady Michelle Obama spearheading the investment in young children's physical health. Endeavors seeking to prevent obesity have fueled an increased interest in understanding behaviors associated with obesity, including physical activity behaviors, during the early childhood years.

However, physical activity in children, especially preschool-age children, has traditionally been considered a "neglected aspect of play" (Pellegrini & Smith, 1998, p. 577). A paucity of research has been available to guide the relatively recent movement to prevent obesity in young children in the United States. Measurement and description of young children's physical activity may be considered the first wave of research on this topic. Due to consistent findings that young children are overwhelmingly sedentary at both home and preschool, researchers continue to more precisely measure physical activity while also now investigating biological, environmental, and socio-cultural factors related to physical activity levels.

This second wave of research includes focused attention to socio-cultural risk factors for obesity in early childhood (e.g., race/ethnicity or family income). The literature review below analyzes and synthesizes the accumulating, yet still small, body of research related to the influence of socio-cultural factors upon physical activity behaviors in young children. A systematic search of research publications related to physical activity in young children identified 18 studies that met the inclusive criteria defined below. Analysis suggests that socio-cultural factors in both the home and school settings may influence the physical activity behaviors of young children. The analysis concludes with recommendations for future research, policy, and practice in the field of early childhood education.

Method

The following analysis resulted from a systematic review of research related to cultural determinants of physical activity and movement in indoor and outdoor contexts for young children, birth to five years of age, published from January 1995 through December 2009. The lower limit of the inclusive date range was set to include research published after the Council on Physical Education for Children (COPEC) first released its position statement related to physical activity in preschool settings in 1994. A cross-disciplinary computer search of electronic databases was conducted in December 2009 (Medline, PsychINFO, ERIC, and SPORTDiscus) for research related to cultural determinants of physical activity play in young children published in peer-reviewed journals. Book chapters, dissertations, expert opinion, and articles written in languages other than English were excluded from the analysis. Keyword search terms included physical activity, movement, exercise play, preschool, early childhood, young children, culture, socio-economic, ethnicity, parent, and teacher. A manual search of included articles was then performed to identify research meeting the inclusive criteria but not discovered with electronic searches. Research with participants older than age five was excluded unless findings related to the physical activity of children age five and younger was reported as a separate subgroup of the sample. A total of 18 studies met the inclusive criteria for analysis in the review below. Note that studies investigating the relationship among screen time, physical activity, and obesity were excluded due to inconsistent findings in a small body of research focused on preschool-age children (Burdette & Whitaker, 2005). Evidence suggests that sedentary activity (e.g., screen time) is not the opposite of physical activity and the interaction between these two behaviors is not yet well understood.

Definition of Key Terms

Definitions for the following terms guided the literature search and review:

- 1) The National Association for the Education of Young Children (NAEYC) defines culture as “...the customary beliefs and patterns of behavior, both explicit and implicit, that are inculcated by the society—or by a social, religious, or ethnic group within the society—in its members” (NAEYC, 2009, p. 13). Guided by NAEYC’s definition of culture, this review considered cultural determinants of physical activity to include social (e.g., parents, teachers, peers), religious, and ethnic factors influencing the physical activity behaviors of young children. Gender is included as a socio-cultural factor in this analysis due to the evidence base supporting the influence of culture, rather than exclusively biological factors related to sex, on the development of gender-specific behaviors in early childhood.
- 2) The definition established by Pellegrini and Smith’s (1998) influential publication for physical activity play guided inclusion and exclusion of research for this review. They defined physical activity play as “a playful context combined with a dimension of physical vigor...such that metabolic activity is well above resting metabolic rate. Examples include running, jumping, climbing, chasing, and play fighting” (p. 577). In this review, exercise play, rough-and-tumble play, and movement experiences (defined below) are included as types of physical activity play.
 - 2a) **Exercise play** is characterized by gross motor movement carried out within the context of play (Pellegrini & Smith, 1998).
 - 2b) **Rough-and-tumble play** is characterized as social play that is rough and physical, appearing aggressive if taken out of the context of a playful interaction (Smith, 1997, p. 48). Rough-and-tumble play include wrestling, grappling, kicking, tumbling, and chasing. For the purposes of this study, early parent-child physical play is included within the category of rough-and-tumble play.
 - 2c) **Movement experiences** may be child- or adult-directed activities that provide opportunities for young children to engage in developmentally appropriate movement patterns supporting the development of fundamental movement skills and knowledge of movement concepts such as action, effort, space, and body awareness (NAEYC, 2002). Research focused exclusively on the development or fundamental movement skills was not included in this review due to a current lack of understanding regarding the relationship between fundamental movement skill proficiency and physical activity in early childhood. Research studies that measured fundamental movement skills, as well as physical activity, met the inclusion criteria and are evaluated below.
- 3) **Moderate to Vigorous Physical Activity (MVPA)** is not consistently defined in the studies below. For example, studies using direct observation typically refer to active behaviors such as walking as moderate physical activity and running as vigorous physical activity, while studies that measure physical activity with accelerometers or pedometers define MVPA in terms of activity counts within a specified time period. However, the term generally refers to gross motor movement that is carried out with sufficient intensity and duration to increase heart rate above resting level.
- 4) **Screen Time** refers to activities involving viewing of a screen, including watching television or videos, playing video games, and also spending time on the computer. The American Academy of Pediatrics strongly discourages screen time for children younger than age two and recommends that screen time for preschool-age children should involve only quality age-appropriate programs/activities and not exceed two hours per day. As explained above, screen time as a sedentary behavior and physical activity are not opposing behaviors with consistent negative correlations defining their relationship (Burdette & Whitaker, 2005); a child may engage in both high levels of screen time and high levels of physical activity.

- 5) **Early childhood** in this review refers to children from birth to age five. Although the term is typically inclusive of children through age eight, this review has limited the term due to 1) observed differences between the physical activity behaviors of children in preschool and early primary years (e.g., Dwyer et al. 2009; McKenzie, Sallis, Elder, Berry, Hoy, Nader, Zive, & Broyles, 1997) and 2) the constraint that research studies tend to focus on children in preschool as a separate sample than children in elementary school. The term young children is used interchangeably with the term early childhood in this review.

Physical Activity Play During the Early Childhood Years

While the nature of physical activity during the early childhood years is not fully understood, research indicates that the physical activity behaviors of young children differ in quality and quantity from those of older children and adults (Oliver, Shofield, & Kolt, 2007; Pellegrini & Smith, 1998). Young children tend to engage in physical activity in short, sporadic bursts rather than continuous activity. Also, the role of play is central to physical activity during the early childhood years (Dwyer, Bar, & Hardy, 2009), whereas physical activity for older children and adults primarily occurs in the form of exercise (e.g., playing an organized sport or running on the treadmill). While converging measurements of physical activity and physical activity play are problematic due to methodological differences (Oliver et al., 2007), exercise play has been observed to follow an inverted U-shape pattern, with an increase in exercise play from the toddler to preschool years peaking around ages four and five (Pellegrini & Smith, 1998).

Although exercise/physical activity play has not historically received equal or adequate attention in the research community, young children's play behaviors have been intensely investigated. Play behaviors such as symbolic play have been measured, interpreted, and understood in relationship to theories that guide pedagogy in the early years. Therefore, the analysis of findings related to cultural determinants of physical activity play in young children are similarly interpreted through the predominant theoretical frameworks informing the educational experiences of the majority of young children in the United States and beyond.

Socio-Cultural Model of Development and Learning in Early Childhood

Biological factors alone do not determine developmental outcomes. From the womb, a multitude of socio-cultural factors interact with neurological and physiological systems to influence how and what an individual learns; key socio-cultural factors impacting child development include socioeconomic status, religious beliefs and practices, cultural beliefs and practices, family values and routines, educational experiences, and peer interactions (Bronfenbrenner & Morris, 2006). Ecological Systems Theory organizes these socio-cultural factors into a series of nested environments surrounding the child, each interacting with the child in varying degrees throughout the lifespan. Due to the focus of this review, the ecological systems (or nested environments) forming the theoretical framework for investigating physical activity play in early childhood have been defined using the terms NAEYC provided for each system in the 2009 position statement regarding developmentally appropriate practice in early childhood education (described below). Diagram 1 illustrates the relationship between these systems (child's family, educational setting, community, and society) and socio-cultural factors associated with physical activity play during the early childhood years.

Developmentally Appropriate Practice in Early Childhood

The influence of socio-cultural factors on development and learning in early childhood is a central premise of developmentally appropriate practice (DAP). As coined and defined by NAEYC, DAP serves as a comprehensive set of guidelines for the provision of early childhood programming in the United States. Although originating in 1987, the most current revision of DAP occurred in 2009, largely due to issues related to providing culturally competent programs for young children from culturally, linguistically, and socioeconomically diverse families (NAEYC). These guidelines inform educators of the central importance of socio-cultural factors in learning and development, with

knowledge of the child's socio-cultural context joining knowledge of child development and learning as core areas of knowledge for the early childhood educator. The National Association for Sport and Physical Education (NASPE) partnered with NAEYC, using DAP as a theoretical framework, to develop *Appropriate Practices in Movement Programs for Young Children Ages 3-5* (NASPE, 2000). The review of the literature below organizes the analysis of research related to cultural determinants of physical activity in young children according to the socio-cultural contexts that NAEYC recognizes as influential in the development and learning of young children: the home environment and school environment.

Adult Involvement in Young Children's Physical Activity in the Home Setting

Research studies aiming to understand the relationship between physical activity and factors within the child's home environment have primarily been conducted with children older than age five. Lindsay, Sussner, Kim and Gortmaker (2006) caution against applying the findings of these studies with older children to the physical activity of young children due to developmental differences in the physical activity behaviors of children, as well as key differences in the socio-cultural contexts that make the early childhood years a unique period. Studies that have investigated relation-

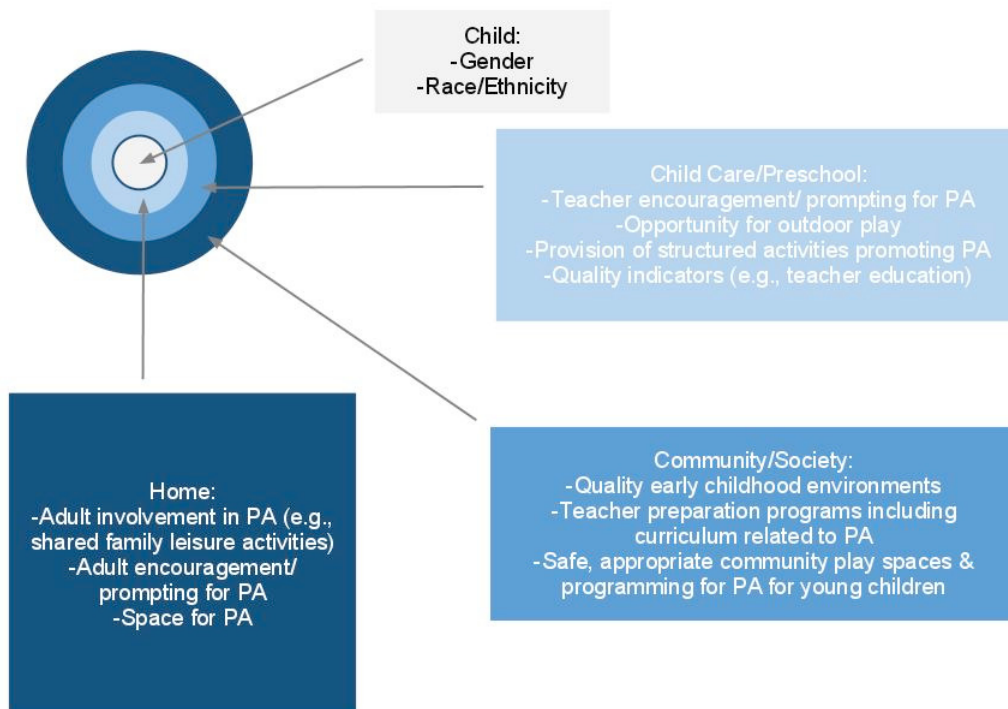


Diagram 1: Socio-cultural Model of Physical Activity in Early Childhood

ships between socio-cultural factors in the home environment and physical activity with children birth to 5 years are reviewed below. Findings suggest that adults' beliefs and behaviors related to physical activity may either impede or promote physical activity for young children in their care.

A small body of ethnographic research indicates that adult involvement in young children's physical activity play may influence young children's physical activity behaviors and that differences in patterns of adult involvement may be culturally mediated. For example, adults in an Italian town and also a Botswana hunter-gatherer village encourage children to play in multi-age groups with little adult supervision beginning around age two (Bock, 2005; New, 1994), while adults in low-income Caribbean families have been observed playing with children during outdoor, gross motor activities (Lange & Rodman, 1992). Although ethnographic studies have described cultural variations

in parent-child interactions in the context of play, including physical activity play (e.g., Bock, 2005; Fry, 2005; Gosso, Ottoa, delima Salum e Morais, Leite Riberio, & Raad Bussab, 2005), very few studies have systematically examined the relationship between young children's physical activity play and parental behaviors and attitudes related to this type of play.

A handful of studies have indicated that adults may serve as role models for children's physical activity play behaviors. In 1991 Moore, Lombardi, White, Campbell, Olivaria, and Ellison reported results from a longitudinal study investigating the physical activity (among other variables) of 100 young children and their parents. Activity counts indicated that four-year-old children with two active parents were significantly more likely to be physically active than same-age peers with inactive parents. Subsequent studies have further investigated variables implicated by Moore et al., including adult involvement, encouragement, and modeling as social factors in the home environment that may influence physical activity levels of young children.

McIver, Brown, Pfeiffer, Dowda & Pate (2009) directly observed the physical activity play behaviors of 13 preschool-age children in the home setting with the Observational System for Recording Physical Activity in Children-Home version (OSRAC-H), documenting not only the physical activity behaviors of young children at home but also contextual factors and parental engagement behaviors associated with the child's physical activity. While the primary purpose of McIver et al. was to describe the sociometric properties of the OSRAC-H, data indicated that young children were significantly less active during indoor play interactions with family members. This relationship was not found for outdoor play interactions. Due to the focus of this pilot study, the authors merely report this finding without providing further information to put the data in context (e.g., adult prompting, type of activity). The small, although diverse, sample size and the lack of validation for the OSRAC-H prevent generalization of this finding and support the need for further research.

Interested in contextual factors in the home environment related to children's physical activity, **Goodway and Smith (2005)** conducted semi-structured interviews of 59 young African American children and their mothers or primary female caregivers living in low-income urban neighborhoods. Adult interactions and encouragement of physical activity emerged as potential socio-cultural factors influencing the physical activity behaviors of young children in this sample. Both children and adults explained that mothers were not typically involved in the play of their preschool-aged children. In fact, mothers actively discouraged physical activity play behaviors indoors, preferring sedentary, quiet activities such as watching television or playing video games. Interestingly, young girls in this study explained that adult women do not engage in physical activity. The early internalization of adult models, particularly gender-specific models, is supported by ethnographic research of children's play behaviors (e.g., Fry, 2005).

Goodway and Smith's (2005) study was conducted with a very specific demographic population. In 2009 Lindsay, Sussner, Greaney, and Peterson expanded the demographic focus of research on this topic. They carried out focus group and one-on-one interviews of Latina mothers to investigate contextual factors related to the physical activity behaviors of young Latino children living in a low-income urban environment. These Latina mothers reported that adults did participate in physical activity with young children and described their family's preferred active play leisure activities. Mothers explained that they engaged in physical activity play with their preschool-aged children, enjoying such activities as dancing to music and taking walks together. However, they related that their family's lifestyle was primarily sedentary, which they attributed to differences in the socio-cultural and physical environments between their home country and the U.S. city in which they currently lived.

Goodway and Smith (2005) and Lindsay et al. (2009) suggest that cultural beliefs and values do influence adult engagement in physical activity with young children. Both samples interviewed families living in low-income urban neighborhoods and found that beliefs related to adult participation in physical activity play were different for low-income African American and Latina mothers raising children in urban settings. However, neither study directly measured the physical activity behaviors of children or adults. Therefore, no conclusions related to a causal relationship between adult involvement in and children's levels of physical activity can be drawn from the results of these studies.

Diversity

The obesity epidemic in the United States disproportionately impacts children and adults from diverse backgrounds. Individuals who are from Latino, African American, and low-income socio-cultural groups are at increased risk for obesity (Ogden et al. 2006). Additionally, gender-based differences in activity patterns associated with obesity have been noted in research with children older than age five. Therefore, research has aimed to better understand behaviors associated with obesity that may be influenced by cultural and socioeconomic diversity. Studies investigating physical activity in young children from diverse backgrounds that are at-risk for obesity are analyzed below.

Gender

Although a child's sex is biologically determined, gender is a socio-cultural construct. From birth, experiences with gender-specific materials and interactions that encourage the development of gender-specific behaviors contribute to a young child's gender identity. A body of research with diverse samples is accumulating to support the influence of gender on physical activity levels during early childhood. Studies employing both direct observation and accelerometry converge to indicate that young boys tend to engage in more MVPA than young girls. McKenzie et al. (1997) and Pate, McIver, Dowda, Brown & Addy (2008) used direct observation to measure the physical activity levels of preschool age children. Both studies reported that boys spent more time in activities coded as active play than girls. McKenzie et al. measured the physical activity of 115 European-American and 172 Mexican-American preschool-age children living in southern California during one outdoor recess period with Behaviors of Eating and Activity for Child Health Evaluation System (BEACHES). Boys engaged in significantly more intervals of MVPA than girls; Mexican-American girls were the least active group in the sample. Pate et al. measured the activity levels of 438 preschool-aged white (41.3%) and black (58.7%) children living in South Carolina with the OSRAC-P. This study reported that boys were observed in significantly more active play behaviors than girls.

Four studies in this review measured physical activity with accelerometry, with all studies reporting gender-based differences in physical activity behaviors of young children. Finn, Johannsen, and Specker (2002) recorded activity counts in one minute intervals for 214 preschool-age children in South Dakota, finding that boys spent significantly more time in vigorous activity and had higher total daily activity counts than girls in the sample. In 2008 Cardon and Bourdeaudhuij measured physical activity of 76 preschool-age children living in Flanders, Belgium, with an accelerometer that recorded activity counts in 15-second intervals. Boys engaged in significantly more minutes of moderate activity than girls in this sample. Interestingly, both Finn et al. and Cardon & Bourdeaudhuij reported that mean activity counts were not significantly different according to gender, suggesting that gender-based differences may be related to level or intensity of activity during outdoor play or recess periods. Grontved, Pederson, Andersen, Kristensen, Moller, & Froberg (2009) followed with a study of physical activity in 190 preschool-age children residing in Odense, Denmark. Using the same accelerometer as Cardon & Bourdeaudhuij, Grontved et al. they again found that boys spent significantly more time engaged in MVPA than girls, with boys spending an average of nearly 18 more minutes in active play during a seven-hour period.

Parent-report of young children's physical activity through survey instruments, however, did not support gender-based differences in physical activity behaviors. Anderson, Economos, and Must (2008) analyzed data from the U.S.-based National Health and Nutrition Examination Surveys (NHANES), 2001-2004, to investigate levels of active play, screen time, and active play and screen time combined. Parents of 777 children aged four to five were asked to report the times per week that their child played hard enough to sweat or breathe hard. "Low active play" was defined as engaging in less than seven episodes of active play (as defined above). This criteria was based on the guidelines by health organizations (e.g., American Academy of Pediatrics) recommending that preschool-age children should be physically active for at least sixty minutes each day. While Anderson et al. measured frequency of active play, Nelson, Carpenter, and Chiasson (2006) measured duration of active play in their parent-report survey of 526 children receiving WIC support in New York City. Based upon the NHANES format, the survey in Nelson et al. asked parents to report minutes or hours per day that their child engaged in active play.

While parent report of young children's physical activity has been found to correlate with accelerometer counts, parent recall is not an optimal method for collecting data related to young children's physical activity. As Oliver et al. (2007) explains, "No standardized questionnaire has been developed and sufficiently evaluated for the assessment of physical activity in preschool-aged children" (p. 1061). Therefore, findings from Anderson et al. (2008) and Nelson et al. (2006) should be interpreted cautiously because measurements were obtained through parent recall on one survey item.

Socioeconomic Status (SES)

Research has linked socioeconomic status with physical activity. Children from low-income families are at increased risk for obesity. Children from low-income families tend to be more sedentary than children from middle- or upper-income families (U.S. Department of Health and Human Services, 1997). The studies reviewed below investigated the relationship between socioeconomic factors and the physical activity of young children, identifying 1) access to safe and appropriate physical spaces and 2) access to resources as key barriers to physical activity for young children living in low-income families and communities.

Access to outdoor contexts. Research examining physical activity behaviors of young children across contexts indicates that young children engage in increased intensity and duration of physical activity in outdoor, rather than indoor, settings (e.g., Baranowski, Thompson, DuRant, Baranowski, & Puhl, 1993; Klesges, Eck, Hanson, Haddock, & Klesges, 1990). Adult family members control children's access to outdoor environments such as playgrounds or yards that promote physical activity play. Three studies included in this review applied qualitative methodologies to examine issues related to parent perception of access to safe outdoor play spaces and the physical activity of young children from diverse backgrounds.

Both Goodway & Smith (2005) and Lindsay et al. (2009) identified lack of access to safe and appropriate outdoor play spaces as a barrier to physical activity for young African American and Latino children living in low-income urban neighborhoods. Even though activities associated with increased physical activity (e.g., bike riding; Brown et al. 2009a) were identified as preferred activities, young children in Goodway & Smith had access to these activities only when visiting relatives who lived elsewhere due to parental concerns over neighborhood safety. Parents explained that children were not safe playing outdoors and that there were limited to no organized affordable programs available to safely support physical activity for young children in their neighborhood. Similarly, Latina mothers in Lindsay et al. described the physical environment in their low-income urban community as a barrier to physical activity. These mothers explained that they often did not have time or resources to organize a trip to a playground, and that children were not safe playing outside in their neighborhood. Cold weather was also a barrier to outdoor physical activity for these mothers living in the Boston area.

Furthermore, Latino and African American children living in low-income urban neighborhoods may spend increased amounts of time in indoor settings that are not conducive to physical activity play. Rich et al. (2005) interviewed 76 mothers/caregivers of young, mostly Latino, children receiving WIC support to study potential factors impacting soaring obesity rates in this population. While 82% of the participants reported that the child had access to a safe place to play, 48% of these same participants identified an indoor context as the safe place for play. Barriers to physical activity in indoor settings were identified by mothers in Goodway & Smith (2005) and Lindsay et al. (2009), particularly for children living in apartment buildings. Some mothers explained that they encouraged children to engage in sedentary quiet activities (i.e., screen time activities) so that neighbors would not report noise complaints.

Interestingly, Burdette & Whitaker (2005) did not find an association between maternal perception of neighborhood safety and young children's physical activity. Burdette & Whitaker surveyed 3,141 mothers participating in the Fragile Families and Child Wellbeing Study. Mothers were asked to recall the amount of time the child typically spent outdoors on week and weekend days and also completed the eight-item Neighborhood Environment for Children Rating Scale. In this study, maternal perception of neighborhood safety was correlated with amount of screen time but not physical activity.

Access to resources. Children from low-income families and communities may have fewer resources to support physical activity. Mothers of young African American children living in low-income urban communities expressed lack of time and energy for directly supporting and participating in the physical activity play of their young child. (Goodway & Smith, 2005). Similarly, Latina mothers of young children living in low-income urban communities explained that their own work schedules and domestic responsibilities left little time for supervising children in outdoor play. These mothers related that they did not have a social network in the United States to help share these tasks, which would then allow for increased time to support the physical activity play of their young children (Lindsay et al., 2009). Furthermore, access to material resources was implicated as a barrier to participation in a variety of activities (including physical play activities) for young children from low-income, less acculturated Spanish-speaking families (see description of study below; Stoffel & Berg, 2008).

While these studies do offer insights into the physical activity experiences of young children from low SES families, further research is necessary to comprehensively understand the relationship between SES and young children's physical activity play. Even though Burdette & Whitaker (2005) surveyed a large number of children who were at risk of living in low-income environments associated with decreased access to safe outdoor spaces, physical activity was measured by parent recall alone, which is not an optimal method for collecting this data. And Goodway & Smith (2005) and Lindsay et al. (2009) employed only qualitative methods to collect data. The purpose of qualitative inquiry is not to directly and precisely measure an event (i.e., physical activity) but to better understand the socio-cultural mechanisms impacting or impacted by the event. Furthermore, the purpose of Stoffel & Berg was not to provide information related to SES and physical activity, per se. Therefore, quantitative experimental research is necessary to systematically evaluate the relationship between SES and young children's physical activity to expand the evidence-base on this topic.

Race/Ethnicity

In the United States the obesity epidemic disproportionately impacts Latino/Hispanic, African American, and White (non-Hispanic) children. Studies conducted with children older than age six from these racial/ethnic groups have reported a relationship between race/ethnicity and physical activity (e.g., Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Anderson et al. 2008; Troiano, Berrigan, Dodd, Masse, Tilert, & McDowell, 2008). Studies investigating this relationship in the home environment with children younger than age six are described below. Comparative analysis of these studies is segmented according to measurement methodology.

In 1997 McKenzie, Sallis et al. identified racial/ethnic differences in level of physical activity for European American and Mexican American preschoolers at recess through direct observation with BEACHES. European American preschoolers were significantly more active than Mexican American preschoolers. Prompting and compliance to prompting for physical activity (by adults or peers) did not differ by race/ethnicity. Yet Pate et al. (2008) also employed direct observation methodology to the measurement of preschool children's physical activity and did not find a relationship between race/ethnicity and physical activity for African American and white preschoolers. This study documented physical activity type, physical activity level, and also characteristics of the social and nonsocial environment with the Observational System for Recording Physical Activity in Children-Preschool Version (OSRAC-P) for 438 preschool children (58% African American). These authors note that previous research examining racial/ethnic differences in young children's physical activity play have yielded inconsistent results and that results are also inconsistent with prior research conducted on older children. Clearly, a body of evidence does not yet exist to accurately explain the interaction between race/ethnicity and the levels of children's physical activity.

Nelson et al. (2006) conducted a survey of 526 parents of young children enrolled in the WIC program to investigate factors related to obesity, including daily time the young child spent engaged in active play. Interestingly, findings indicated a statistically significant relationship between physical activity and ethnicity, not gender or age. Young black children spent more time engaged in physical activity play than young Hispanic children. Additionally, children from families with U.S. or Puerto Rican origin engaged in more physical activity play than children from other origins.

However, Anderson et al.'s (2008) survey data did not show that race/ethnicity was related to physical activity for preschool-age children. Anderson et al. did find racial/ethnic differences in physical activity play (and screen time) for children older than age five. It is important to note that Nelson et al.'s sample consisted of children from low-income families who were at increased risk for obesity, while Anderson et al. analyzed data from the NHANES study, which is a nationally representative sample. It is not possible to separate SES from race/ethnicity when comparing these two sets of results.

Stoffel & Berg (2008) identified level of acculturation as a factor impacting access to resources that promote physical activity play. Thirty-seven parents (26 Spanish speaking) were interviewed to assess the validity of the Spanish version of the Preschool Activity Cart Sort (PACS). Results indicate that level of acculturation impacted the types of activities in which young children from Spanish-speaking homes engaged. Data suggests that children living in less acculturated families participate in fewer types of activities (including physical play activities) than children living in more acculturated families. During the interview, less acculturated parents explained that they did not know how to access the resources needed for leisure activities (e.g., bike riding or participation in group sports programs) because they did not know how to become involved in community activities, and this information was not provided in Spanish.

Disentangling SES from race/ethnicity for studies conducted in the United States is a difficult task, particularly with a research base as limited as the one pertaining to the intersections of race/ethnicity, SES, and physical activity for young children. The majority of studies reviewed above sampled culturally, linguistically, and socioeconomically diverse families. Interestingly, the two studies that did not over-sample low-income families did not find a relationship between race/ethnicity and physical activity for young children. Therefore, it is essential that findings are interpreted cautiously. These studies should be used to inform the design of future studies, rather than intervention or policy, related to this topic at this time.

Summary

Research indicates that young children are primarily sedentary while at home (7.1% of observed intervals spent in MVPA; McIver et al., 2009). Findings from the studies detailed above suggest that parent involvement, encouragement, and modeling of physical activity may be important variables impacting young children's physical activity and are worthy of further systematic study. Focused research investigating the socio-cultural mechanisms that contribute to reduced activity in young girls, and also interventions that increase the physical activity of young girls, are key areas for future research. Unsettling statistics that highlight the relationship of race/ethnicity and SES with obesity mandate that future research endeavors investigate the socio-cultural factors that support this relationship.

Physical Activity Play and the Young Child's School Environment

Unfortunately, young children appear to also engage in low levels of physical activity at preschool. Research has consistently demonstrated that young children living in modern societies today are surprisingly sedentary at preschool (e.g., Pate et al., 2004; Cardon & Bourdeaudhuij). With over 60% of young children in the United States attending a form of preschool or child care, it is important to better understand factors inherent in the preschool environment that influence the physical activity behaviors of young children. A paucity of studies has examined the influence of preschool-related socio-cultural factors upon the physical activity of young children attending those programs. These studies suggest that characteristics of the preschool setting, and also beliefs and behaviors of preschool teachers, influence the physical activity of young children attending these programs.

School Environment

A growing body of research links factors associated with the preschool environment to the physical activity play behaviors of the young children attending these programs. Studies conducted in and outside the United States converge

to indicate that individual preschool programs are significantly associated with levels of physical activity in preschool children. In 2002 Finn et al. indicated that the individual child care center contributed 46 % of the variance in activity counts for 214 young children attending centers in this sample from South Dakota. The authors offered speculative reasons for this finding; however, the study did not investigate characteristics of individual centers that could support their hypotheses.

In 2003 Louie & Chan built upon Finn et al.'s finding regarding the importance of the individual preschool with a study examining the relationship between a preschool's physical environment and physical activity play of young children. The physical activity of children attending three preschools in Hong Kong was measured with pedometers and direct observation (CARS). Preschools were differentiated by characteristics of play spaces for physical activity play. As in Finn et al., the individual preschool was significantly related to children's physical activity, with increased indoor and outdoor play spaces for physical activity identified as the contributing factor for this finding.

Dowda, Russell, Trost, Almeida, & Sirard followed in 2004 with a study measuring factors related to the individual preschool's support of physical activity. With a sample of nine preschools, this study collected the following data: 1) preschool policies/practices for physical activity (interview and document review), 2) preschool quality (ECERS-R), and 3) young children's physical activity (OSRAP). Findings did not support a relationship between program model (private, church-related, Head Start) and percentage of observed time engaged in MVPA. Rather it was characteristics of the individual preschool that contributed significant variance to children's physical activity. Factors that were associated with increased levels of physical activity were providing 1) four or more physical activity-related field trips per month, 2) smaller class sizes, 3) less time outdoors and less free play, and 4) college educated teachers. Space available for physical activity play or amount of teacher-structured physical activity play were not assessed.

Recently, Grontved et al. (2009) published results that extended Dowda et al. (2004) and Finn et al.'s (2002) findings, supporting a significant relationship between individual preschool program and young children's physical activity. This study measured the physical activity of 190 Danish preschoolers attending either programs with or without policies and practices for promoting physical activity. Children's activity was measured with the same accelerometer as that used in Finn et al.; however, activity counts were recorded for five preschool days, rather than two continuous days. Like Dowda et al. and Finn et al., individual preschools explained the greatest amount of variance in the children's activity, not the type of preschool program. However, the type of program was differentiated by a presence or lack of policies and practices for promoting physical activity. Although this finding appears to contradict Dowda et al., it is important to explain that these two studies measured this variable differently. Furthermore, all preschool teachers in Denmark are required to have a college degree, which is not only an indicator of increased physical activity, but also a difference in sample characteristics between Dowda et al. and Grontved et al.

The diversity in measurement tools and sample characteristics allows for increased generalization of this finding. Studies employing accelerometry, pedometry, and direct observation methods for measuring physical activity all found an association between the individual preschool and the physical activity of young children attending that preschool. Also, children from a variety of communities and geographical locations and a variety of types of programs were included within the samples of these four studies. However, the number of preschools involved in each study was small, with Dowda's inclusion of nine preschools being the largest number of preschools sampled across these four studies. Further research should increase the number of preschools sampled, while also continuing to investigate factors related to the individual preschool that are associated with physical activity levels of young children.

Teacher Behaviors

Studies published recently have shifted in focus from examining factors related to the individual preschool, as a whole, to factors related to the individual teacher that are associated with levels of physical activity play in young children. Three studies used direct observation methodology to record not only children's physical activity levels but also social and environmental variables associated with physical activity play, such as prompting and materials avail-

able for supporting physical activity play. One study interviewed child care providers and their supervisors to gather their perspectives related to the physical activity of young children in child care, including teacher involvement and barriers.

In a longitudinal study of children's physical activity during outdoor recess, McKenzie et al. (1997) found that preschool teachers offered more prompts related to either increased or decreased physical activity than elementary school teachers. Data indicated that preschool-age children were highly compliant to teacher prompting related to physical activity. They did document a large degree of variability in the frequency of teacher prompting during the preschool years. Approximately 37% of children received no physical activity-related prompts during the observed preschool recess period, even though teachers were observed to be in close proximity to children during the preschool observation. This study identified teacher prompting for physical activity as an important target of future research.

Over a decade later Brown, Pfeiffer, McIver, Dowda, Addy, & Pate (2009b) published a cross-sectional study that investigated social and environmental (nonsocial) influences upon physical activity at preschool for 476 children with the OSRAC-P. Results indicate that teacher support of physical activity play significantly impacted the activity levels of preschoolers. Teacher encouragement or structure of physical activity was rare, occurring for less than 3% of observed intervals. Yet young children engaged in MVPA for 16% of the intervals associated with these teacher-related behaviors. Children were also significantly more active while participating in organized games (11% of intervals coded as MVPA), but these games only occurred for 1.1% of total intervals observed. Additionally, use of portable equipment such as tricycles and balls occurred during only 1.5% of total observed intervals, but children engaged in MVPA for 14% of observations in which they interacted with these materials. Both participation in games and use of portable equipment may be considered teacher-related behaviors due to the developmental reality that young children typically require adult support during organized games with same-age peers and also need assistance and permission to access portable play equipment.

Brown et al. (2009b) suggests that specific teacher-related behaviors are associated with significant increases in MVPA for preschoolers under their supervision. Brown, Google, McIver, & Rathel (2009a) reinforced these findings by demonstrating the direct impact of teacher-structure and prompting upon the physical activity of young children. Through a single-case withdrawal of intervention research design, this study demonstrated the powerful impact of a developmentally appropriate teacher-structured physical activity upon the physical activity behaviors of five young children. All five children engaged in a significantly higher percentage of time in MVPA during the structured physical activity versus "business as usual" recess play. For example, a child who typically engaged in very low levels of MVPA during recess (mean = 10% of intervals recorded for baseline conditions) was observed to spend a mean of 92% of recorded intervals in MVPA while participating in the teacher-structured physical activity. Importantly, the study design also demonstrated a link between teacher encouragement and prompting of physical activity play. The provision of a developmentally appropriate physical activity alone did not lead to substantial increases in MVPA. Rather, teacher encouragement, prompting, and reinforcement of participation and increased levels of activity were followed by significant increases in MVPA. However, it is important to emphasize that this study did only include five children, investigated the impact of primarily one structured activity, and did not examine which aspects of the structured physical activity were actually responsible for these changes in MVPA.

Williams, Carter, Kibbe, & Dennison (2009) did pilot-test a 10-unit curriculum intended to promote structured physical activity in preschool settings with 270 children and 32 teachers in 9 Head Start centers in New Mexico. Teachers received a 90-minute training, which included simulation of curricular activities, information related to the importance of physical activity, and also instructions regarding completing forms for the research study. The authors reported that classrooms averaged approximately 47 minutes of structured physical activity per week across the 10-week intervention period and that the curriculum received positive ratings from the teachers. Measurement relied on teacher report of completed activities from the curriculum, rather than direct observation, to estimate time engaged in structured physical activity. Teacher report of provision of an activity is not a precise method for actually measuring the amount

of time children participated in the activity. Therefore, results should be interpreted cautiously and primarily used to inform future research.

The studies detailed above were conducted with samples from U.S. preschools. O’Conner & Temple (2007) turned to home child care providers, child care supervisors, and parents of children attending child care facilities in Victoria, Australia, to collect information related to views of young children’s physical activity and also physical activity play in the child care environment. Transcripts of focus groups and parent responses to open-ended questionnaire items were analyzed for emerging themes and relevant content. Child care providers identified barriers to providing structured physical activity, including a need for training and a belief that children’s play should be unstructured. A theme related to individual preference emerged from child care provider responses: The provision of opportunities for physical activity play was subject to the individual preferences of each child care provider rather than a fundamental part of every child care program. Interestingly, supervisors also identified lack of training as a barrier but also shared concerns regarding the negative influence of child care provider behaviors, such as lack of modeling of physical activity and even purposeful discouragement of physical activity.

Collectively, these five studies demonstrate the necessity for further research to more clearly understand how teacher beliefs and behaviors influence the physical activity of young children. Beliefs about the appropriateness of teacher-structured play and the role of the teacher during recess should be the subject of future research on this topic. Additionally, research should systematically examine the relationship between specific teacher behaviors (e.g., prompting or encouragement) as well as specific components of structured physical activity, with young children’s engagement in physical activity. It is recommended that research related to structured physical activity in the preschool setting focus on teacher-implemented programs or activities, such as those included in Brown et al. (2009a) and Williams et al. (2009). While a few studies have demonstrated positive results related to structured physical activity programs during preschool, the structured activities provided in these studies were guided by trained consultants rather than the children’s actual preschool teachers (Fitzgibbon, Stolley, Schiffer, Van Horn, KauferChristoffel, & Dyer, 2005; Mosuwan, Pongprapai, Junjana, & Puetpaiboon, 1998). Since research now suggests that teacher-related factors influence the physical activity of preschool children in their care, it is important that future research is conducted with early childhood educators rather than trained consultants.

Implications

Research

While it is evident that research-based knowledge related to physical activity during early childhood is deepening, it is also evident that the current research base is not sufficient for adequately informing and guiding prevention and intervention efforts. Research conducted with humans, and especially children, in natural settings is always limited by factors that are difficult, if not unethical, to control. Therefore, the recommendations below pertain specifically to limitations in research related to physical activity in early childhood.

Limitations of current research

First, and most fundamentally, issues related to precise measurement of young children’s physical activity still plague the research community. Lack of consensus in measurement protocol undermines convergence of findings across studies. Recommendations for amount of daily physical activity in this population should be based upon accurate measurement of actual activity duration, intensity, and type. Therefore, researchers must continue with efforts to validly and reliably measure physical activity behaviors in young children. See Oliver et al. (2007) for an in-depth analysis of measurement issues.

Second, the sheer diversity present in preschool children, staff, and programs in the United States considerably complicates comparisons of findings across studies. Young children attending programs in the United States are increasingly culturally, linguistically, and economically diverse (NAEYC, 2009). With statistical evidence that the obesity

epidemic disproportionately affects children from Latino/Hispanic, African American, and low-income families in the United States, it is imperative that samples accurately represent the demographics of the defined population, avoiding issues such as overrepresentation and clouding of race/ethnicity with SES. Furthermore, the diversity of the early childhood workforce in the United States is problematic from a research standpoint. Sampling of teachers and early childhood programs complicates convergence of findings across studies since current research does suggest that teacher and program quality may impact young children's physical activity (e.g., Dowda et al., 2004). Lack of comparable samples across studies limits generalization of findings and hinders progress toward establishing a contextualized evidence base.

Third, research focused on peer-related factors influencing physical activity play were not identified for inclusion in this review. Ethnographic studies suggest that peers may influence physical activity, but few studies of Western samples even measured factors related to peers. These studies (McKenzie et al., 1997; Brown et al., 2009b) did not provide in-depth measurement of peer-related variables. Additionally, rough and tumble play is an inherently social form of physical activity in the early childhood year, but the current research on this topic investigates this form of physical activity play in children older than preschool-age.

Future Research

Efforts to understand physical activity in young children are in its infancy. Therefore, avenues for future research are many and are described within each section of the review above. The following areas of research are particularly warranted at this time:

- 1) Impact of adult behaviors (e.g., prompting, encouragement, participation) upon the physical activity of young children in home, school and community settings.
- 2) Impact of adult beliefs related to physical activity in young children upon the physical activity behaviors of young children at both home and school community settings, including parent and teacher beliefs about their role in promoting physical activity during outdoor recess.
- 3) Aspects of parent and teacher training models that increase physical activity in young children.
- 4) Barriers to implementing structured physical activity in preschool settings for teachers who have received training related to promoting physical activity.
- 5) Cultural beliefs, dispositions, and behaviors related to physical activity in young children.
- 6) Specific community-level interventions that promote increased physical activity in young children from low-income families.
- 7) Peer influences upon physical activity play.
- 8) Rough-and-tumble play in the early childhood years.

Policy

Increased funding for obesity-related initiatives supports the research community's ability to engage in systematic in-depth study of young children's physical activity. Findings from these studies are informing recommendations to guide the physical activity of young children across settings. Many national health and education organizations have issued guidelines and suggestions for promoting healthy, developmentally appropriate physical activity in young children (e.g., CDC, NASPE). The recommendations have yet to transfer into consistent policies. Regulations related to physical activity opportunities in child care settings vary substantially from state to state, with some states offering limited to no guidance for physical activity play in these settings (Story, 2006). Head Start has established guidelines for physical activity, and many preschools do follow NAEYC's (in collaboration with NAPSE) guidelines for physical

activity; however, there is still variability across programs and even classrooms. Specific research-guided regulations related to physical activity in early childhood settings would improve consistency across programs and allow all children to benefit from practices and environments that promote developmentally appropriate physical activity. Additionally, policies aimed at health care providers could also increase physical activity in the home environment through parent/family education. Finally, research does indicate that community-level factors may influence physical activity. Policies guiding community development, including availability of appropriate indoor and outdoor space for physical activity play in housing complexes, may be warranted as the evidence-base for intervention at this level expands.

Practice

While research related to practice is limited, the current evidence-base does point out several key ways that early childhood teachers and programs could increase physical activity in young children who attend these programs.

- 1) Young children respond positively to adult involvement (e.g., McKenzie et al. 1997). Verbal encouragement and prompting, provision of portable materials that promote physical activity, and organization of simple and relatively short structured physical activities throughout the day are ways that adults can support increased physical activity in young children.
- 2) Offering a variety of structured and unstructured opportunities for physical activity may increase the number of children who engage in and enjoy activities that promote MVPA. Children have demonstrated increased physical activity when engaging in self-selected activities (Brown et al. 2009b). Providing a variety of activities would allow for increased child-choice.
- 3) Guidelines for appropriate practice in early childhood settings explain that teachers must partner with parents to promote healthy development in children (NAEYC, 2009). Teachers should gather information about children's physical activity at home to inform classroom practices (e.g., provision of activities and materials the child prefers) and also to understand the amount of physical activity that the child engages in at home. Teachers, parents, and programs should work together to understand why physical activity is important for young children and how they can work as a team to provide these opportunities for children.
- 4) Teachers have identified lack of training in structured physical activity as a barrier. Training should not only tell teachers how to provide structured activities and offer suggestions for activities, but also help teachers understand why physical activity is important for young children's healthy development. Teachers are not robots and, therefore, have beliefs that impact their willingness to change.
- 5) Increasing physical activity in young girls should be a priority for the early childhood community. Young girls have been found to be highly responsive to teacher encouragement and prompting to increase physical activity (McKenzie et al. 1997). Participation in teacher-organized structured physical activity has been shown to dramatically increase physical activity for young girls who traditionally exhibited low levels of physical activity during unstructured outdoor play periods. Therefore, early childhood settings should offer opportunities for young girls (and all children) to engage in developmentally appropriate structured physical activity with teachers who are modeling and encouraging increased physical activity.

Table 1. Summary of Studies Included in Review

Survey			
Study & sample	Measurement protocol	Physical activity(PA)-related variable(s)	Physical Activity (PA)-related findings
<p>Anderson et al. 2008 U.S. nationally representative sample, N = 777 4- to 5-yr olds (sub-group of sample aged 4-11) 59.6% M, 57.3% W, 14.4% AA,, 14.3% MA</p>	<p>Cross-sectional analysis of NHANES 2001-2004 data. 1 question related to physical activity Parent recall/ response.</p>	<p>Low active play (defined as reported to play or exercise hard enough to sweat less than 7 times per week). Screen time.</p>	<p>No gender differences found for children ages 4-5 years. AA 4-5 year old boys had higher percentages of screen time than MA boys. AA 4-5 year old girls had higher percentages of screen time than W and MA girls.</p>
<p>Burdette & Whitaker 2005 N=3141 3-yr-olds living in 20 large U.S. cities, 53% M, 35% <U.S. poverty threshold 50% AA, 24% W, 26% L</p>	<p>Cross-sectional survey, including completion of Neighborhood Environment for Children Rating Scale to measure parent perception of neighborhood safety. Parent recall/ response</p>	<p>Number of hours child typically spends playing outdoors each day. Number of hours child typically spends watching TV/video (does not specify video/computer games or activities).</p>	<p>More time playing outdoors on weekends than weekdays. TV viewing and outdoor play were not significantly correlated. Neighborhood safety was not correlated with time spent outdoors.</p>
<p>Nelson et al. 2006 N=526 2- to 4-yr-old brought for a certification visit at WIC site in NYC</p>	<p>Survey administered to parents/caregivers bringing child to certification visit at WIC site (16 sites total). Survey questions adapted from NHANES instrument.</p>	<p>Time child spent playing actively or exercising. Time spent watching TV/playing computer.</p>	<p>No gender difference was found for time spent playing actively. Significantly more B (50%) than L (34%) children spent 1 or more hours playing actively each day. Significantly more children from U.S.-born families spent more than 1 hr/day playing actively than other children. Asthma was not correlated with time spent playing actively.</p>

Direct Observation

Study & sample	Measurement protocol	Physical activity(PA)-related variable(s)	Physical Activity (PA)-related findings
<p>Brown et al. 2009b N = 476 3-to 5-yr-olds in 24 community based preschools in Columbia, SC, 50% F, 50% M</p>	<p>Cross-sectional direct observation with OSRAC-P Observations varied across children, days, and preschool schedule in indoor and outdoor contexts.</p>	<p>PA level. Type of activity. Social factors related to PA play. Nonsocial factors related PA play.</p>	<p>Indoor teacher-arranged PA & music – infrequent (<1% of total intervals) – resulted in 8% & 4% of intervals, respectively, coded as MVPA. Outdoor teacher-arranged PA – infrequent (2.6% of total intervals) – resulted in 16% of intervals coded as MVPA, Infrequent teacher prompting of PA, Portable equipment – infrequent (1.5% of total intervals) – resulted in 14% of intervals coded as MVPA. Adults initiated 81% of activities; children initiated activities more frequently in outdoor contexts with MVPA increasing to 19.5% for child vs. adult initiated activities. PA occurred in groups of children 85% of observations.</p>
<p>Dowda et al. 2004 N=266 3- to 5-yr-olds in 9 community based preschools in Columbia, SC; 53% F; 66% AA</p>	<p>Cross-sectional direct observation with OSRAP ECERS-R for 1 class/school. Children observed for 1 hour on 2-3 days at preschool.</p>	<p>PA level. Type of activity. PA/sedentary activity policies & practices of preschool. Teacher education. Number of children/class.</p>	<p>MVPA higher in preschools with 4+ PA-related field trips/month & smaller class sizes. Increased MVPA on playground for children attending school providing less time outdoors & more college educated teachers.</p>

<p>McKenzie et al. 1997 N=287 pre-K children in 63 preschools in San Diego, CA. 115 W 172 MA</p>	<p>Longitudinal direct observation with BEACHES. Observations during outdoor recess-1 during preschool & 1 during elementary school 2 yrs later.</p>	<p>PA level. Percentage of time in MVPA. Prompts for PA. Compliance to PA prompts.</p>	<p>Inconsistent and infrequent teacher prompting, with 37% of children receiving no prompts during the preschool observation. Children were compliant to prompting (89.5% compliance rate); girls were significantly more compliant than boys. W boys were significantly more active than MA boys. Children were most active at the beginning of recess.</p>
<p>McIver et al. 2009 N=13 pre-K children from divergent SES & geographical backgrounds 54% M, 46% W, 38% AA</p>	<p>3 observations in the home for 1.5 hours each with OSRAC-H</p>	<p>PA types. Social factors related to PA play. Nonsocial factors related to PA play. Engagement with parents or peers TV use.</p>	<p>Children were more sedentary indoors. Activities associated with increased PA were chores, transition, rough-and-tumble play, & gross motor. Children were engaged with adults for 13% of recorded intervals, with peers/siblings for 17% of recorded intervals, and both adults & peers/siblings for 11% of recorded intervals; when engaging with adults or peers/siblings indoors, children were significantly more sedentary.</p>
<p>Pate et al. 2008 N=438 3- to 5-yr-olds in 24 preschools in Columbia, SC; 58.7% AA, 41.3% W</p>	<p>Cross-sectional direct observation with OSRAC-P.</p>	<p>PA level. Type of activity. Social factors related to PA play. Nonsocial factors related to PA play.</p>	<p>M engaged in significantly more MVPA than F. No significant difference for race/ethnicity. Individual preschool attended accounted for a significant portion of variance in predicting activity level (more than demographic characteristics).</p>

Accelerometry

Study & sample	Study & sample	Study & sample	Study & sample
<p>Cardon & de Bourdeaudhuij 2008 N=76 4- to 5-year-olds in 5 pre-schools in Flanders, Belgium; F=39, M=37</p>	<p>Actigraph Model 7164 with 15-sec intervals worn 2 weekdays and 2 weekend days. Brief parent & teacher questionnaires.</p>	<p>Minutes spent in physical activity. Minutes spent outside at pre-school, home. Minutes engaged in screen time and sedentary play at home. Access to a yard at home.</p>	<p>No gender differences found for mean counts/minute; but boys engaged in significantly more minutes of moderate activity. Children participated in more sedentary activity during weekdays (school days) than weekend days. No school/center-related activity differences</p>
<p>Finn et al. 2002 N=214 3- to 5-year-olds in 10 child care centers in South Dakota</p>	<p>Actiwatch Model AWIC with 1-min intervals worn for 48 continuous hours.</p>	<p>Percent time in vigorous activity. Total daily counts. Average counts between 9 a.m.-5 p.m.</p>	<p>Child care center contributed the most variance to prediction of activity. Boys were more active than girls, except in 9-5 counts. Premature children were less active than children born at term. Level of child's activity was negatively correlated with father's BMI.</p>
<p>Grontved et al. 2009 N=190 pre-K in Municipality of Odense, Denmark; 3 preschools with & 3 without explicit policies & practices for promoting PA</p>	<p>Actigraph Model 7164 with 15-sec intervals worn 5 consecutive days while children were in preschool;</p>	<p>Total daily counts in preschool; Percent time in MVPA while in preschool.</p>	<p>Boys spent a significantly higher % time in MVPA & had higher total PA levels than girls. Individual preschool contributed most variance to prediction of MVPA, but not the type of preschool (with or without policies & practices for PA).</p>

Pedometry

Study & sample	Measurement protocol	Physical activity(PA)-related variable(s)	Physical Activity (PA)-related findings
<p>Louie & Chan 2003 N=148 3- to 5-yr-olds in Hong Kong; 3 preschools varying in location & size of play spaces</p>	<p>Yamax Digiwalker DW-200 pedometer CARS to categorize intensity of physical play. Measurement occurred during 25-minute physical activity class period.</p>	<p>Total pedometer counts during class period. Percent observations per activity level (CARS, levels 1-5).</p>	<p>Boys were significantly more active than girls. Children in school with large outdoor & indoor space for PA were significantly more active than children at centers with smaller outdoor space and no indoor space.</p>

Qualitative Investigations of Physical Activity

Study & sample	Measurement protocol	Physical activity(PA)-related variable(s)	Physical Activity (PA)-related findings
<p>Goodway & Smith 2005 N=59 urban, at-risk predominantly AA pre-K children from low SES families attending 3 preschools within 2 miles of each other in US.</p>	<p>Constant comparison method using the following data sources: Semi-structured interview transcripts of primary caregivers and children. Field notes from observations at home and preschool. Document review.</p>	<p>Contextual factors that may influence children’s physical activity.</p>	<p>Emergent themes related to PA: Unsafe outdoor environments in low-income neighborhoods decreased opportunities for PA. Children were encouraged to engage in sedentary activities indoors. Lack of role models and parent involvement in PA, particularly for young girls. Children identified types of PA as preferred activities.</p>

<p>Lindsay et al. 2009 N=31 for focus groups N=20 for interviews Spanish-speaking Latina mothers in Boston with a child born 48 months prior to initiation of study 48% with household income < \$20,000</p>	<p>Content analysis of themes emerging from focus groups and interviews.</p>	<p>Focus group questions focused on feeding and perceptions of weight, but themes related to physical activity emerged. Interview questions included prompts related to physical activity and sedentary behaviors of children and families.</p>	<p>Emergent themes related to PA: Lack of adequate social support for PA outings, with much time needed for competing sustenance activities (i.e., work). Differences between life in US and home country related to PA patterns, with primarily sedentary family patterns in US. Decreased neighborhood safety and cold weather as environmental barriers to outdoor PA. PA reported in terms of family patterns not individual child.</p>
<p>O'Connor & Temple 2007 N=24 child care providers N=3 coordination unit staff N=45 parents of pre-K children Victoria, Australia</p>	<p>Content and theme analysis of focus groups transcripts involving child care providers and coordination unit staff & responses to open-ended questions on parent questionnaire.</p>	<p>Views pertaining to physical activity and young children. Physical activity in the child care environment.</p>	<p>Barriers to PA included: Child care providers perceived parents as barriers to PA (e.g., not dressing children for outdoor play appropriately). Competing demands by children of different ages. Lack of appropriate space outdoors prohibiting PA indoors. Lack of adult role models for PA. Lack of training & knowledge, especially structured activities.</p>
<p>Rich et al. 2005 N=76 parents/primary caregivers of overweight, low SES toddlers or preschoolers in Dallas, TX; N=66 L, N=7 B, N=3 W</p>	<p>Content analysis of interview transcripts to identify themes and codes that were analyzed quantitatively.</p>	<p>Family play patterns (e.g., including physically active play and sedentary behaviors).</p>	<p>82% reported that children had a safe place to play, but 48% of these respondents specified an indoor setting as the safe place. Statistically significant difference for M and F for access to playground. Many families reported enjoying physical activities with their children.</p>

Intervention Studies

Study & sample	Measurement protocol	Physical activity(PA)-related variable(s)	Physical Activity (PA)-related findings
<p>Brown et al. 2009a Study 1: N=3 pre-K children, 2 F, university-affiliated pre-K Study 2: N=2 pre-K children, 2 F, Title 1 funded pre-K</p>	<p>Single-case with-drawal of intervention with OSRAC-P. Observations during outdoor recess.</p>	<p>Percentage of intervals in MVPA.</p>	<p>Percentage of intervals spent in MVPA increased substantially for all children during intervention play periods.</p>
<p>Williams et al. 2009 270 pre-K children, 32 pre-K teachers in 9 Head Start centers in New Mexico; 50% M, 79% L, 15% W, 2% B, 8% bi/multi-racial</p>	<p>Analysis of teacher-completed weekly planning sheets to determine which activities were implemented and approximate duration of each activity.</p>	<p>Amount of structured PA per week; goal set at 50-min per week in each classroom.</p>	<p>Children participated in an average of 47 minutes of PA per classroom (some programs were 4 day/week, not 5). Teacher-preparation time averaged 7.23 minutes. Teacher-ratings of the program were positive.</p>

Other Types of Studies Measuring Socio-cultural Factors and Physical Activity

Study & sample	Measurement protocol	Physical activity(PA)-related variable(s)	Physical Activity (PA)-related findings
<p>Stoffel & Berg 2008 N=37 parents of pre-K children, 26 Spanish-speaking, 11 English-speaking</p>	<p>Structured interview of parents with Pre-school Activity Card Sort/Tarjetas de Actividades Preescolares.</p>	<p>Participation in activities (e.g., leisure, self-care).</p>	<p>Children from less acculturated families participated in less leisure activities (including physical activity leisure activities). Barriers to accessing physical activity leisure activities were cited by less acculturated families.</p>

M=Male; **F**=Female; **W**=Non-Hispanic white; **AA**=African American/Non-Hispanic Black; **L**=Latino/Hispanic; **MA**=Mexican American; **BEACHES** = Behaviors of Eating and Activity for Children’s Health Evaluation System; **CARS** = Child Activity Rating Scale; **OSRAP** = Observation System for Recording Activity in Preschools; **OSRAC-P** = Observational System for Recording Physical Activity in Children-Preschool; **OSRAC-H** = Observational System for Recording Physical Activity in Children-Home

References

- Andersen, R. E., Crespo, C., Bartlett, S. J., Cheskin, L. J., & Pratt, M. (1998). Relationship of physical activity and television watching with body weight and level of fatness among children: Results from the Third National Health and Nutrition Examination Survey. *Journal of the American Medical Association*, 279, 938-942.
- Anderson, S., Economos, C., & Must, A. (2008). Active play and screen time in US children aged 4 to 11 years in relation to socio-demographic and weight status characteristics: A nationally representative cross-sectional analysis. *BMC Public Health*, 8, 366. Retrieved from BMC Public Health Web site: <http://www.biomedcentral.com/1471-2458/8/366>.
- Annie E. Casey Foundation (2004). *Kids count data book: Moving youth from risk to opportunity*. Baltimore, MD: Annie E. Casey Foundation. Retrieved from Annie E. Casey Foundation Web site: www.aecf.org.
- Baranowski, T. Thompson, W. O., DuRant, R. H., Baranowski, J., & Puhl, J. (1993). Observations on physical activity in physical locations: Age, gender, ethnicity, and month effects. *Research Quarterly in Exercise Sports*, 64, 127-133.
- Bock, J. (2005). Farming, foraging and children's play in the Okavango Delta, Botswana. In A. Pellegrini & P. Smith (Eds.), *The nature of play: Great apes and humans* (pp. 254-281). New York, NY: The Guilford Press.
- Bronfenbrenner, U. & Morris, P. A. (2006). The bio-ecological model of human development. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology, Vol. 1: Theoretical models of human development*, (6th ed.). Hoboken, NJ: John Wiley & Sons.
- Brown, W. H., Googe, H. S., McIver, K. L., & Rathel, J. M. (2009a). Effects of teacher-encouraged physical activity on preschool playgrounds. *Journal of Early Intervention*, 31(2), 126-145. doi:10.1177/1053815109331858.
- Brown, W. H., Pfeiffer, K. A., McIver, K. L., Dowda, M., Addy, C. L., & Pate, R. R. (2009b). Social and environmental factors associated with preschoolers' non-sedentary physical activity. *Child Development*, 80(1), 45-58. doi:10.1111/j.1467-8624.2008.01245.x.
- Burdette, H. L. & Whitaker, R. C. (2005). A national study of neighborhood safety, outdoor play, television viewing, and obesity in preschool children. *Pediatrics*, 116(3), 657-662. doi:10.1542/peds.2004-2443.
- Cardon, G. M. & De Bourdeaudhuij, I. M. M. (2008). Are preschool children active enough? Objectively measured physical activity levels. *Research Quarterly for Exercise and Sport*, 79(3), 326-332.
- Carson, J., Burks, V., & Parke, R. D. (1993). Parent-child physical play: Determinants and consequences. In K. MacDonald (Ed.), *Parent-child play*. Albany, NY: State University of New York Press.
- COPEC (Council on Physical Education for Children) (2000). *Appropriate practices in movement programs for young children ages 3-5: A position statement of the National Association for Sport and Physical Education (NASPE)*. Reston, VA: NASPE.

- Deal, T. B. (1993). The preschool mover: A comparison between naturally-occurring and program-directed physical activity patterns. *Early Child Development and Care, 96*, 65-80. doi:10.1080/0300443930960107.
- Dowda, M., Russell, R. P., Trost, S. G., Almeida, M. J. C. A., & Sirard, J. R. (2004). Influences of preschool policies and practices on children's physical activity. *Journal of Community Health, 29*(3), 183-196. doi:10.1023/B:JOHE.0000022025.77294.af.
- Dwyer, G. M., Baur, L. A., & Hardy, L. L. (2009). The challenge of understanding and assessing physical activity in preschool-age children: Thinking beyond the framework of intensity, duration, and frequency of activity. *Journal of Science and Medicine in Sport, 12*(5), 534-536. doi: 10.1016/j.jsams.2008.10.005.
- Finn, K., Johannsen, N., & Specker, B. (2002). Factors associated with physical activity in preschool children. *The Journal of Pediatrics, 140*(1), 81-85. doi:10.1067/mpd.2002.120693.
- Fitzgibbon, M. L., Stolley, M. R., Schiffer, L., Van Horn, L., KauferChristoffel, K., & Dyer, A. (2005). Two-year follow-up results for Hip-Hop to Health Jr.: A randomized controlled trial for overweight prevention in preschool minority children. *The Journal of Pediatrics, 146*(5), 618-625. doi:10.1016/j.jpeds.2004.12.019.
- Fry, D. R. (2005). Rough and tumble social play in humans. In A. Pellegrini & P. Smith (Eds.), *The nature of play: Great apes and humans* (pp. 54-85). New York, NY: The Guilford Press.
- Goodway, J. D., & Smith, D. W. (2005). Keeping all children healthy: Challenges to leading an active lifestyle for preschool children qualifying for at-risk programs. *Family and Community Health, 28*(2), 142-155.
- Gosso, Y., Ottoa, E., delima Salum e Morais, M., Leite Riberio, F. J., & Raad Bussab, V. S. (2005). Play in hunter-gatherer society. In A. Pellegrini & P. Smith (Eds.), *The nature of play: Great apes and humans* (pp. 213-253), New York, NY: The Guilford Press.
- Grontved, A., Pederson, G. S., Andersen, L. B., Kristensen, P. L., Moller, N. C., & Froberg, K. (2009). Personal characteristics and demographic factors associated with objectively measured physical activity in children attending preschool. *Pediatric Exercise Science, 21*, 209-219.
- Holmes, R. M., Pellegrini, A. D., & Schmidt, S. L. (2006). The effects of different recess timing regimens on preschoolers' classroom attention. *Early Child Development and Care, 176*(7), 735-743. doi:10.1080/03004430500207179.
- Hood, M. Y., Moore, L. L., Sundarajan-Ramamurti, A., Singer, M., Cupples, L. A., & Ellison, R. C. (2000). Parental eating attitudes and the development of obesity in children. The Framingham Children's Study. *International Journal of Obesity, 24*(10), 1319-1325. doi:10.1038/sj.ijo.0801396.
- Hui-Ling, W. P. (1994). Children's play in Taiwan. In J. Roopnarine, J. Johnson, & F. Hooper (Eds.), *Children's play in diverse cultures* (pp. 31-50). Albany, NY: State University of New York Press.
- Klesges, R. C., Eck, L. H., Hanson, C. L., Haddock, C. K., & Klesges, L. M. (1990). Effects of obesity, social interactions, and physical environment on physical activity in preschoolers. *Health Psychology, 9*, 435-449.

- Lange, G. & Rodman, H. (1992). Family relationships and patterns of childrearing in the Caribbean. In J. Roopnarine & D. Carter (Eds.), *Parent-child socialization in diverse cultures* (pp. 185-198). Norwood, NJ: Ablex Publishing Corporation.
- Lindsay, A. C., Sussner, K. M., Greaney, M. L., & Peterson, K. F. (2009). Influence of social context on eating, physical activity, and sedentary behaviors of Latina mothers and their preschool-age children. *Health Education and Behavior, 36*(1), 81-96. doi:10.1177/1090198107308375.
- Lindsay, A. C., Sussner, K. M., Kim, J., & Gortmaker, S. (2006). The role of parents in preventing childhood obesity. *The Future of Children, 16*(1), 169-186. Retrieved from The Future of Children Web site: <http://futureofchildren.org/futureofchildren/publications/journals/article/index.xml?journalid=36&articleid=100>.
- Louie, L. & Chan, L. (2003). The use of pedometry to evaluate the physical activity levels among preschool children in Hong Kong. *Early Child Development and Care, 173*(1), 97-107. doi:10.1080/0300443022000022459.
- Martini, M. (1994). Peer interactions in Polynesia: A view from the Marquesas. In J. Roopnarine, J. Johnson, & F. Hooper (Eds.), *Children's play in diverse cultures* (pp. 73-103). Albany, NY: State University of New York Press.
- McIver, T. L., Brown, W. H., Pfeiffer, K. A., Dowda, M., & Pate, R. R. (2009). Assessing children's physical activity in their homes: The Observational System for Recording Physical Activity in Children-Home. *Journal of Applied Behavior Analysis, 42*(1), 1-16. doi:10.1901/jaba.2009.42-1.
- McKenzie, T. L., Sallis, J. F., Elder, J. P., Berry, C. C., Hoy, P. L., Nader, P. R., Zive, M. M., & Broyles, S. L. (1997). Physical activity levels and prompts in young children at recess: A two-year study of a bi-ethnic sample. *Research Quarterly for Exercise and Sport, 68*(3), 195-202.
- Moore, L. L., Gao, D., Bradlee, M. L., Cupples, L. A., Sundarajan-Ramamurti, A., Proctor, M. H. (2003). Does early physical activity predict body fat change throughout childhood? *Preventive Medicine, 37*, 10-17. doi:10.1016/S00917435(03)000483.
- Moore, L. L., Lombardi, D. A., White, M. J., Campbell, J. L., Oliveria, S. A., & Ellison, R. C. (1991). Influence of parents' physical activity levels on activity levels of young children. *Journal of Pediatrics, 118*(2), 215-219.
- Mo-suwan, L., Pongprapai, S., Junjana, C., & Puetpaiboon, A. (1998). Effects of a controlled trial of a school-based exercise program on the obesity indexes of preschool children. *American Journal of Clinical Nutrition, 68*, 1006-11.
- NAEYC (National Association for the Education of Young Children) (2009). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8: A position statement of the National Association for the Education of Young Children*. Washington, DC: NAEYC. Retrieved from NAEYC's Web site: www.naeyc.org/dap.
- Nelson, J., Carpenter, K., & Chiasson, M. (2006). Diet, activity, and overweight among preschool-age children enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). *Preventing Chronic Disease, 3*(2), A49.

- New, R. S. (1994). Child's play—una cosa naturale: An Italian perspective. J. Roopnarine, J. Johnson, & F. Hooper (Eds.), *Children's play in diverse cultures* (pp. 123-147). Albany, NY: State University of New York Press.
- O'Connor, J. & Temple, V. (2005). Constraints and facilitators for physical activity in family day care. *Australian Journal of Early Childhood*, 30(4), 1-9. Retrieved from <http://www.earlychildhoodaustralia.org.au/australian-journal-of-early-childhood/ajec-index-abstracts/constraints-and-facilitators.html>.
- Oliver, M., Schofield, G. M., & Kolt, G. S. (2007). Physical activity in preschoolers: Understanding prevalence and measurement issues. *Sports Medicine*, 37(12), 1045-1070.
- Pate, R. R., McIver, K., Dowda, M., Brown, W. H., & Addy, C. (2008). Directly observed physical activity levels in preschool children. *Journal of School Health*, 78 (8), 438-444. doi:10.1111/j.1746-1561.2008.00327.x.
- Pellegrini, A. D. & Smith, P. K. (1998). Physical activity play: The nature and function of a neglected aspect of play. *Child Development*, 69(3), 577-598. doi:10.2307/1132187.
- Rich, S. S., DiMarco, N. M., Huettig, C., Essery, E. V., Andersson, E., & Sanborn, C. F. (2005). Perceptions of health status and play activities in parents of overweight Latino toddlers and preschoolers. *Family and Community Health*, 28(2), 130-141.
- Roopnarine, J. L., Hossian, Z., Gill, P., & Brophy, H. (1994). Play in the East Indian context. In J. Roopnarine, J. Johnson, & F. Hooper (Eds.), *Children's play in diverse cultures* (pp. 9-30). Albany, NY: State University of New York Press.
- Stoffel, A. & Berg, C (2008). Spanish translation and validation of the Preschool Activity Card Sort. *Physical & Occupational Therapy in Pediatrics*, 28(2). Retrieved from <http://informahealthcare.com/doi/pdf/10.1080/01942630802031859>.
- Story, M., Kaphingst, K. M., & French, S. (2006). The role of child care settings in obesity prevention. *The Future of Children*, 16(1), 143-168. Retrieved from The Future of Children Web site: <http://futureofchildren.org/publications/journals/article/index.xml?journalid=36&icleid=99>.
- Takeuchi, M. (1994). Children's play in Japan. In J. Roopnarine, J. Johnson, & F. Hooper (Eds.), *Children's play in diverse cultures* (pp.51-72). Albany, NY: State University of New York Press.
- U.S. Department of Health and Human Services (1997). *Physical activity and health: A report of the surgeon general*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from Center for Disease Control and Prevention Web site: <http://www.cdc.gov/nccdphp/sgr/index.htm>.
- Williams, C. L., Carter, B. J., Kibbe, D. L., & Dennison, D. (2009). Increasing physical activity in preschool: A pilot study to evaluate Animal Trackers. *Journal of Nutrition Education and Behavior*, 41(1), 47-52.

