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Preschool-Based Physical Activity Interventions in African American and Latino Preschoolers: A Literature Review

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The purpose of this review was to assess the effectiveness of physical activity (PA) interventions in African American and Latino/Hispanic preschool children. A systematic search was conducted for English-language printed research articles published between January 1980 and December 2017. The inclusion criteria for studies in this review were that they were experimental PA studies conducted in the preschool setting in the United States that targeted African American/Black or Latino/Hispanic children between the ages of 2.9 and 5 years. A total of 1,533 articles were located, of which 10 met the inclusion criteria. Overall, studies reported positive changes in preschool-day PA levels, yet only 2 reported significant improvements in total daily PA. Limited scientific literature suggests that preschool-based interventions are effective in improving aspects of PA during the preschool day for children of color. However, minimal evidence exists on the effectiveness of these interventions in changing total daily PA.

Keywords: accelerometer, child care center, preschool children of color

The health benefits of physical activity are well documented in people of all ages. For example, in children, regular participation in moderate to vigorous physical activity (MVPA) has been associated with reduced adiposity, diabetes, and dyslipidemia and improved well-being (U.S. Department of Health and Human Services, 2008). Despite the health impact associated with regular participation in physical activity, most school-age (>5 years) children are not meeting the current physical activity guideline of 60 min of MVPA on most days of the week, as only 42% of children 6–11 years of age meet the guideline (Troiano et al., 2008). Compared with this age group, the adherence prevalence drops to 8% for children age 12–15 years. Due to this decline in physical activity, early childhood has been identified as a unique window of opportunity for establishing lifelong healthy behaviors that could potentially reduce the detrimental impact of physical-inactivity-related health outcomes as children age. Therefore, experts have recommended that physical activity interventions be initiated as early as possible (i.e., preschool age; U.S. Department of Health and Human Services, 2008).

Due to the beneficial impact of physical activity on health outcomes in young children, organizations such as the National Association for Sports and Physical Education (NASPE) and the Institute of Medicine (IOM) have published physical activity guidelines for early childhood (birth to 5 years of age). In 2002 (later updated in 2009), NASPE released its first guidelines for early childhood that state that young children should participate in at least 60 min of structured and 60 min of unstructured physical activity per day, and they should not be sedentary for more than 60 min at a time except for when they sleep (NASPE, 2002, 2009). In 2011, the IOM released its physical activity guidelines, which state that preschool-age (2.9–5 years) children should be provided opportunities for light, moderate, and vigorous physical activity for at least 15 min/hr (IOM, 2011). This guideline translates to approximately 180 min of physical activity over a period of 12 waking hours (IOM, 2011; Pate & O'Neill, 2012).

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The prevalence of all preschool-age children who meet recommendations for physical activity varies depending on which guidelines are used. For example, Tucker (2008) conducted a systematic review of 39 primary studies published between 1986 and 2007 that consisted of 10,316 participants. Physical activity levels were measured using different techniques (i.e., parental report, pedometers, direct observation, accelerometers, and doubly labeled water). Tucker (2008) reported that approximately 54% of preschool-age children met the NASPE physical activity guideline. Recently, in two independent samples of preschool-age children (Children's Activity and Movement in Preschool Study [CHAMPS, $N = 286$] and Study of Health and Activity in Preschool Environments [SHAPES, $N = 337$]), Pate et al. (2015) examined the prevalence of preschool-age children who met the IOM physical activity guideline. In both studies, physical activity was assessed with ActiGraph accelerometers that were initialized to save data in 15-s epochs. In the CHAMPS and SHAPES studies 41.6% and 50.2% of children, respectively, met the IOM physical activity guideline. Regardless of the guideline used, evidence indicates that preschool-age children are not participating at the recommended levels of physical activity.

National data indicate that between childhood and adolescence, children of color (especially girls) face a significant decline in physical activity levels compared with their White counterparts (Kimm et al., 2002). The reported decline in physical activity is evident in children of color as young as 11 years of age (Kimm et al., 2002). It is possible that the observed physical activity disparities occur earlier than age 11. This is unfortunate, as physical activity can track from childhood into adolescence (Troiano et al., 2008). Disparities in physical activity at this early age pose a major public health concern because it is highly likely that low levels of physical activity at an early age can manifest into the adult years and possibly contribute to negative health outcomes (Troiano et al., 2008).

In the United States, 61% of preschool-age children spend the majority of their day (8:00 a.m. to 4:30 p.m.) in early childcare settings (e.g., Head Start, preschool centers, and prekindergarten programs; Federal Interagency Forum on Child and Family Statistics, 2017). Compared with their non-Hispanic White

counterparts (63%), a higher percentage of African American (68%) children spend a significant portion of their day at preschool centers (Federal Interagency Forum on Child and Family Statistics, 2017). On average, all children engage in approximately 8 min of MVPA per hour of preschool attendance (Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004). Consequently, a child who attends a full day (8 hr) of preschool would engage in approximately 60 min of MVPA per day. Due to the schedule of most full-day preschools, it is unlikely that children who attend a full day of preschool would engage in an additional 120 min of physical activity outside of the preschool setting to meet the IOM guidelines. In addition, since physical activity has been shown to track from early childhood into adolescence, it is imperative that effective physical activity interventions be implemented to affect the health of preschool-age children, especially children of color. Unfortunately, there is little information describing if or how children of color (i.e., African American and Latino) respond to preschool-based physical activity interventions. Therefore, the purpose of this systematic review was to examine the impact of physical activity interventions implemented during the preschool day on the physical activity levels of preschool-age children of color.

Method

A systematic search was conducted to identify research articles about preschool-based physical activity interventions in children of color that were published between January 1980 and December 2017 and were written in English. Databases included Academic Search Premier, CINAHL, PsycINFO, PubMed/Medline, ERIC, Cochrane, and SPORTDiscus. We used multiple keywords including *preschool, head start, headstart, early childhood, childcare center, daycare, physical activity, health behavior, exercise, physical education, behavior change, inactivity, sedentary behavior, recess, playtime, structured activity, play time, locomotor skills, physical activity intervention, physical education intervention, Latino, African American,* and *Hispanic*. We also manually examined reference lists of review articles of preschool interventions to identify research articles that were relevant to the purpose of this review. All identified article abstracts were imported into Endnote reference manager (Version 8.0.2), which was used to remove duplicates. The titles and abstracts of the remaining articles (n = 1,533) were examined for inclusion. Full-text versions of the articles were then consulted for final inclusion.

All identified articles were inspected for inclusion and exclusion criteria during the title and abstract examination. Inclusion criteria for this review were interventions that targeted physical activity; experimental study designs (i.e., randomized controlled trials, controlled clinical trials, comparative studies, or quasi-experimental studies); studies conducted in the United States; studies that targeted African American or Latino/Hispanic participants, had a study participant pool consisting of at least 80% African American/Latino/Hispanic children, or presented results that were stratified by race/ethnicity; and studies conducted in preschool, Head Start, or school settings. Studies were excluded if their study designs were not experimental, inferential statistics were not reported on intervention effectiveness, or the intervention components were not described. Two additional articles were excluded because the same sample was used in both studies.

The systematic review (including review of the title and abstract and retrieval of full papers used to inspect for inclusion and exclusion criteria) was conducted by two independent reviewers (C.W.S. and S.B.). On full paper retrieval, the reviewers examined the Methods section of each article to confirm eligibility. For studies that met the inclusion criteria, the following data were extracted and entered into a standardized form developed for this review: author(s) and article citation, description of study population (race/ethnicity, gender, age, sample size), study setting (preschool, daycare/childcare center, Head Start), study design, description of the intervention, duration of intervention and follow-up period(s), measurement time points, outcomes assessed, summary of primary and secondary outcome(s), and any listed limitations. The primary author (S.A.) resolved differences between the reviewers' data.

Results

Figure 1 depicts the search strategy. Ten studies met the inclusion criteria. The descriptions and outcomes of the included studies are listed in Table 1. The results are grouped based on the method used

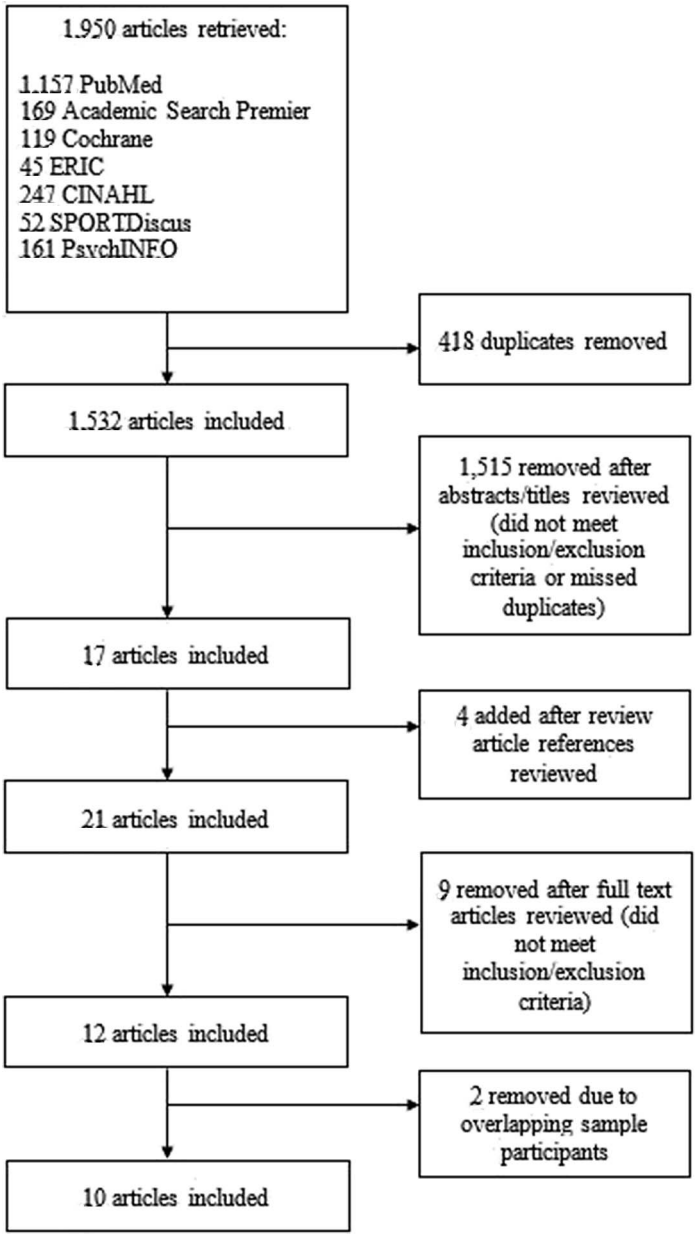

Figure 1 — Inclusion and exclusion flow diagram.

Table 1 Characteristics of Studies Included in the Review

Author, year	Study design • Type • Contrast	Population • Sample size • Age • Race • Location	Intervention • Length • Dose/description • Who led • Control condition • Theoretical framework	Outcomes • Time points • Primary outcome(s) (measurement) • Other outcome(s) (measurement)	Results
			Accelerometer Studies		
Alhassan et al. (2007)	• RCT • INT ($n = 17$ students) vs. CON ($n = 15$ students)	• $N = 32$ (1 center) • 3.6 ± 0.5 years • 100% Latino • Redwood City, CA	• 2 days • 2 additional 30-min outdoor free-play periods • Researcher • Usual care • N/A	• 2 days of baseline and 2 days of intervention • Physical activity (accelerometers—4 days, waking hours, Sirard et al. 2005 cut points) • N/A	• No statistically significant differences between groups in changes from baseline in average total daily counts/min, school-day counts/min, or % time in MVPA.
Alhassan et al. (2012)	• RCT • INT ($n = 46$ students) vs. CON ($n = 32$ students)	• $N = 78$ (2 preschool centers, 8 classrooms) • 4.3 ± 0.6 years • 39% AA, 61% Latino • Square One in Springfield, MA	• 6 months • 30 min of locomotor skill-based physical activity lessons on 5 days/week • Teachers • Usual care (supervised free time) • N/A	• Baseline and immediately postintervention • Physical activity (accelerometers—7 days, waking hours, Sirard et al., 2005, cut points); locomotor skills (Test of Gross Movement Development, 2nd ed.) • N/A	• INT exhibited a significant reduction in during-preschool, $F(1, 16) = 6.34$, $p = .02$, $d = 0.02$, and total daily, $F(1, 16) = 9.78$, $p = .01$, $d = 0.30$, % time spent in sedentary activity. • INT exhibited significant improvement in leaping skills, $F(1, 51) = 7.18$, $p = .01$, $d = 0.80$).
Annesi et al. (2013a)	• RCT • INT ($n = 690$ students, 60 classrooms) vs. CON ($n = 464$ students, 38 classrooms)	• $N = 1{,}154$ students, 98 classrooms (PA data from 18 INT classes and 8 CON classes) • Mean age = 4.4 years • 86% AA, 9% Latino • YMCAs in southeastern United States	• 9 months • Start for Life: 30 min of daily physical activities incorporating gross motor, self-management, and self-regulation skills • Teachers • Usual care • Self-efficacy and SCT	• Baseline and immediately postintervention • Physical activity (accelerometers—1 day, 285 min, cut points unclear), BMI percentile	• INT associated with a significantly greater % of the preschool day in MPVA, $F(1, 883) = 5.87$, $p = .016$, $\eta^2 = .007$, and VPA, $F(1, 883 = 15.93$, $p < .001$, $\eta^2 = .018$ (approximately 30 min/week more). • Sedentary time was unaffected. • INT also associated with a significant reduction in BMI, with effect sizes greatest in overweight and obese children.
Annesi et al. (2013b)	• Cluster RCT • INT ($n = 202$ students, 11 classrooms) vs. CON ($n = 136$ students in 8 classrooms)	• $N = 338$ students, 19 classrooms • Mean age = 4.6 years • 92.2% AA • YMCAs in Atlanta, GA	• 8 weeks • Start for Life: 30 min of daily physical activities incorporating gross motor, self-management, and self-regulation skills • Teachers • Usual care • Self-efficacy and SCT	• Baseline and immediately postintervention • Physical activity (accelerometers—1 day, 4.75 hr, multiple cut points cited), BMI • N/A	• Controlling for age and sex, changes over 8 weeks in MVPA and VPA were significant and significantly more favorable in INT, $F(1, 344) = 4.98$, $p = .026$, and $F(1, 344) = 3.60$, $p = .058$, respectively). • INT associated with an approximate weekly increase of 40 min MVPA.
Fitzgibbon et al. (2011)	• RCT • INT ($n = 325$) vs. CON ($n = 293$)	• $N = 618$, 18 centers • 51.3 ± 6.6 months • 94% Black • Head Start centers in Chicago, IL	• 14 weeks • 2 sessions/week with teacher choice to add third session (each lesson had a 20-min nutrition lesson and a 20-min PA component) • Teachers • 14-week general health intervention • SCT/SDT	• Baseline and post • BMI • PA (accelerometers—7 days during waking hours, Pate et al., 2006, cut points) • Screen time (parent report), diet (24-hr recall)	• At postintervention children in the INT schools engaged in more MVPA than children in the CON schools (difference between adjusted group means = 7.46 min/day, $p = .02$).

(continued)

Table 1 *(continued)*

Author, year	Study design • Type • Contrast	Population • Sample size • Age • Race • Location	Intervention • Length • Dose/description • Who led • Control condition • Theoretical framework	Outcomes • Time points • Primary outcome(s) (measurement) • Other outcome(s) (measurement)	Results
			Direct Observation Studies		
Kirk & Kirk (2016)	• Quasi-experimental • INT ($n = 39$) vs. CON ($n = 15$)	• $N = 54$, 2 centers, 4 classrooms • 4.1 ± 0.2 years • 100% AA • Head Start centers in urban IL	• 8 months • 2 daily 30-min academically integrated PA lessons • Teachers • Usual care • N/A	• Baseline, 4 months, 8 months • Early literacy (Preschool Literacy Individual Growth and Development Indicators) • PA (SOFIT—5 times per week during intervention lessons)	• Over 8 months, rhyming significantly ($p < .01$) improved in the PA group (173% ± 12%) compared with the controls (28% ± 8%), resulting in between-groups differences at 8 months ($p < .01$). • Alliteration significantly ($p < .01$) improved in the PA group (52% ± 16%) compared with controls (13% ± 5%), resulting in between-groups differences at 8 months ($p < .01$). • INT site performed significantly greater levels of PA in the classroom than students at the control site at 4 (INT, 3.5 ± 0.4 vs. CON, 2.5 ± 0.4, $p < .05$) and 8 (INT, 3.5 ± 0.4 versus CON, 2.6 – 0.5, $p < .05$) months.
Kirk et al. (2014)	• Quasi-experimental • INT ($n = 51$) vs. CON ($n = 21$)	• $N = 72$, 2 centers, 7 classrooms • 3.8 ± 0.1 years • 100% AA • Head Start centers in urban IL	• 6 months • 2 daily 15-min academically integrated PA lessons • Teachers • Usual care • N/A	• Baseline, 3 months, 6 months • Early literacy (Preschool Literacy Individual Growth and Development Indicators) • PA (SOFIT—3 days per week on 3 students per classroom during intervention lessons)	• PA significantly increased in the intervention school during free play compared with the control school at both 3 months (INT, 16.1% ± 2.1% vs. CON, –2.2% ± 2.1%) and 6 months (INT, 28.1% ± 2.1% vs. CON, –7.2% ± 2.1%).
Sharma et al. (2011)	• Pre–post design	• $N = 75$, 2 centers, 4 classrooms • 3–5 years • 64% Hispanic, 34% AA • Head Start centers in Harris County, TX	• 6 weeks • 2 lessons/week with daily PA (~20–30 min) • Teachers • No CON • SCT	• Pre- and postintervention • PA (SOFIT-P), diet (direct observation—during a.m. recess, a.m. movement time, p.m. recess, and p.m. movement time, 4 students/class) • Parent and teacher qualitative data (focus groups)	• No statistically significant change in PA or fruit and vegetable consumption.
Winter & Sass (2011)	• Quasi-experimental • INT ($n = 206$) vs. CON ($n = 199$)	• $N = 405$, 4 centers • 3–5 years (treatment 49.93 ± 7.45 months, control 50.11 ± 7.20 months) • 95% Latino • Head Start centers in southern TX	• 24 weeks • General framework curriculum, teacher professional development, and parent education • Teachers • Usual care • SCT and ecological model	• Pre- and postintervention • BMI • PA (SOFIT—sample of 131 participants), gross motor skills (Brigance Diagnostic Inventory of Early Development–II), language development (Peabody Picture Vocabulary Test–III)	• Compared with the CON group, the INT group had significant improvements in growth, gross motor skills, PA levels, and receptive language development.

(continued)

Table 1 *(continued)*

Author, year	Study design • Type • Contrast	Population • Sample size • Age • Race • Location	Intervention • Length • Dose/description • Who led • Control condition • Theoretical framework	Outcomes • Time points • Primary outcome(s) (measurement) • Other outcome(s) (measurement)	Results
			Questionnaire Studies		
Fitzgibbon et al. (2006)	• RCT • INT ($n = 202$) vs. CON ($n = 199$)	• $N = 401$, 12 centers • 50.9 ± 7.2 months • INT (73.3% Latino, 15.8% Black) vs. CON (89.4% Latino, 6.5% Black) • Head Start centers in Chicago, IL	• 14 weeks • 3 sessions/week (each lesson had a 20-min nutrition lesson and a 20-min PA component) • Teachers • 14-week general health curriculum • SCT/SDT	• Baseline, post, 1-year follow-up, 2-year follow-up • BMI • Diet (24-hr recall), PA (parent report—1 week recall of frequency and intensity)	• No significant differences between INT and CON in either primary or secondary outcomes at postintervention, Year 1, or Year 2 follow-ups.

Note. RCT = randomized controlled trial; INT = intervention group; CON = control group; PA = physical activity; MVPA = moderate to vigorous physical activity; AA = African American; VPA = vigorous physical activity; BMI = body-mass index; SCT = social-cognitive theory; SDT = self-determination theory.

to assess physical activity (accelerometry, direct observation, or questionnaire). Five studies assessed physical activity using accelerometers (Alhassan, Sirard, & Robinson, 2007; Alhassan et al., 2012; Annesi, Smith, & Tennant, 2013a, 2013b; Fitzgibbon et al., 2011), four studies assessed physical activity using direct observation (Kirk & Kirk, 2016; Kirk, Vizcarra, Looney, & Kirk, 2014; Sharma, Chuang, & Hedberg, 2011; Winter & Sass, 2011), and one study used a parent recall questionnaire (Fitzgibbon et al., 2006). The study duration ranged between 2 days (Alhassan et al., 2007) and 9 months (Annesi et al., 2013a), and the study population size ranged from 32 (Alhassan et al., 2007) to 1,154 participants (Annesi et al., 2013a).

Accelerometer Studies

Of the five studies that used accelerometers to assess physical activity, two were conducted with African Americans (Annesi et al., 2013b; Fitzgibbon et al., 2011), two included African American and Latino/Hispanic participants (Alhassan et al., 2012; Annesi et al., 2013a), and one was conducted with a Latino/Hispanic sample (Alhassan et al., 2012). The interventions in the remaining studies, except for that of Alhassan et al. (2007) study, were implemented by classroom teachers. Two of the studies focused on improving physical activity (Alhassan et al., 2007, 2012), while the remaining three focused on improving physical activity and body-mass index (BMI; Annesi et al., 2013a, 2013b; Fitzgibbon et al., 2011). Three studies used social-cognitive theory to design the intervention activities (Annesi et al., 2013a, 2013b; Bandura, 1977, 1986; Fitzgibbon et al., 2011). All five studies used ActiGraph accelerometers to assess physical activity. In two studies, physical activity was assessed for 7 consecutive days at each assessment time point (Alhassan et al., 2012; Fitzgibbon et al., 2011), while one assessed physical activity for 4 days (Alhassan et al., 2007). In both studies by Annesi et al. (2013a, 2013b), physical activity was assessed for 1 day. Both studies by Alhassan et al. (2007, 2012) used the Sirard, Trost, Pfeiffer, Dowda, and Pate (2005) preschool-specific cut points, while Fitzgibbon et al. (2011) used the Pate, Almeida, McIver, Pfeiffer, and Dowda (2006) preschooler-specific cut points to process accelerometer data. Both studies by Annesi et al. (2013a, 2013b) did not provide clear information regarding the cut points used to reduce the accelerometer data. Three studies provided wear-time criteria (when participants are classified as wearing or not wearing the accelerometer; Alhassan et al., 2007, 2012; Fitzgibbon et al., 2011), while two did not provide wear-time criteria information (Annesi et al., 2013a, 2013b).

Except for one study (Alhassan et al., 2007), the remaining four accelerometer-based studies found significant improvements in physical-activity-related measures. For example, in a 6-month locomotor-based physical activity intervention, Alhassan et al. (2012) reported significant reductions in preschool-day and total daily percentage of time spent in sedentary time but no change in MVPA. In two separate studies, Annesi et al. (2013a, 2013b) found significant improvements in the percentage of time that the intervention school spent in MVPA during the preschool day (32–40 min/week). Fitzgibbon et al. (2011) conducted a 14-week randomized controlled obesity-prevention study in 18 Head Start programs. Although they observed no significant change in BMI z scores, the intervention led to significant improvements in preschoolers' time spent in MVPA (7.46 min/day).

Direct-Observation and Questionnaire Studies

Five studies assessed physical activity by either direct observation (Kirk & Kirk, 2016; Kirk et al., 2014; Sharma et al., 2011; Winter & Sass, 2011) or questionnaire (Fitzgibbon et al., 2006). Two studies were conducted with African American preschoolers (Kirk & Kirk, 2016; Kirk et al., 2014), two were with combined African American and Latino preschool samples (Sharma et al., 2011; Winter & Sass, 2011), and one was with Latino preschool children (Fitzgibbon et al., 2006). Three studies used social-cognitive theory to design the intervention activities (Sharma et al., 2011; Winter & Sass, 2011), while the remaining studies did not mention the theory used to design the intervention activities (Kirk & Kirk, 2016; Kirk et al., 2014; Sharma et al., 2011; Winter & Sass, 2011). Of the four studies that used direct observation, three used the System for Observing Fitness Instruction Time (SOFIT; Kirk & Kirk, 2016; Kirk et al., 2014; Winter & Sass, 2011) and one used a modified version of the SOFIT (Sharma et al., 2011). Physical activity levels were assessed only during the preschool-day intervention time. The three SOFIT-related studies used 20-s intervals (i.e., 10 s of observation followed by 10 s of recording data) to collect the physical activity data (Kirk & Kirk, 2016; Kirk et al., 2014; Winter & Sass, 2011). The study by Sharma et al. (2011) used 30-s intervals (i.e., 20 s of observation followed by 10 s of recording). The duration of time when physical activity was directly observed was reported in the studies conducted by Kirk and Kirk (2016) and Kirk et al. (2014). Fitzgibbon et al. (2006) used a recall questionnaire to assess preschoolers' physical activity levels. Parents were asked to report the frequency of their children's engagement in activities designed to improve their physical fitness over the course of a week.

The primary outcome of the studies that assessed physical activity by direct observation or questionnaire varied. For example, the two studies by Kirk and Kirk (2016) and Kirk et al. (2014) examined the effect of using physical activity to improve early literacy. The remaining studies focused on improving BMI (Fitzgibbon et al., 2006; Winter & Sass, 2011) or nutrition and physical activity (Sharma et al., 2011). Intervention activities in all of the studies were implemented by classroom teachers, and the studies reported varying levels of improvements in physical activity levels. For example, Kirk and Kirk (2016) and Kirk et al. (2014) reported that children in the intervention preschool were more physically active during free-play time (Kirk et al., 2014) and activity lesson time (Kirk & Kirk, 2016). The remaining studies reported no significant change in physical activity levels.

Discussion

Significant portions of U.S. preschool-age children spend a considerable part of their waking hours (8:00 a.m. to 4:30 p.m.) in the preschool environment, where they spend a significant amount of time participating in sedentary activities (Pate et al., 2004). Therefore, the preschool environment can serve as a socializing agent that could potentially influence children's physical activity levels. Thus, there is a need to design and implement interventions that aim to improve preschoolers' physical activity levels. In the past few decades, several review papers have been published examining the physical activity levels of all preschool-age children, regardless of race or ethnicity (Hodges, Smith, Tidwell, & Berry, 2013; Robinson, Webster, Whitt-Glover, Ceaser, & Alhassan, 2014; Temple & Robinson, 2014; Ward, 2010; Ward, Vaughn, McWilliams, & Hales, 2010). However, none have focused on preschool children of color. The purpose of the current review was to examine the evidence for preschool-based interventions that have targeted increasing physical activity in preschool-age children of color. We identified 10 studies that met the inclusion criteria.

Overall, the limited number of studies included in this review, as well as the variation in intervention activities and physical-activity-assessment methods, limited our ability to evaluate the effectiveness of the identified interventions designed to improve total daily physical activity in preschool children of color.

In changing health behaviors such as physical activity in populations of color, researchers have advocated for the implementation of culturally relevant interventions (Banks-Wallace & Conn, 2002; Bronner & Boyington, 2002; Kumanyika et al., 2007). Culturally relevant and culturally sensitive interventions that include the adaptation of programs, materials, and messages to populations of color have been shown to be effective in adults (Banks-Wallace & Conn, 2002; Bronner & Boyington, 2002; Kumanyika et al., 2007) and children (Choudhry et al., 2011; Flores, 1995; Resnicow et al., 2000; Robinson et al., 2010). In the current review, only the Fitzgibbon et al. (2006, 2011) studies implemented culturally adapted interventions (e.g., using culturally relevant music and dance). The cultural adaption of that intervention was feasible because the centers involved in the study served primarily children of color (Fitzgibbon, Stolley, Dyer, VanHorn, & KauferChristoffel, 2002). Most preschool centers provide service to children from diverse racial/ethnic backgrounds, making it difficult to implement culturally adapted physical activity interventions in these settings. Except for cultural adaptation, there is limited evidence suggesting racial/ethnic differences in factors that affect physical activity interventions implemented during the preschool day. Therefore, in this discussion we focus on factors that affect the effectiveness of physical activity intervention in all preschool children.

The effectiveness of interventions designed to improve preschoolers' physical activity has been related to three factors (Finch, Jones, Yoong, Wiggers, & Wolfenden, 2016). The first factor deals with the implementation of the intervention activities, specifically who leads the activities (i.e., classroom teachers or researchers). Past reviews have shown that studies in which the intervention activities are implemented by researchers tend to report consistent improvements in physical activity levels (Finch et al., 2014). Unfortunately, once the studies end and the researchers are no longer there to implement the intervention, there is a question of the sustainability of these programs. Consequently, a way to improve the sustainability of physical activity programs is to have classroom teachers be the ones to implement the intervention (Ward, Vaughn, McWilliams, & Hale, 2009; Ward et al., 2010). In the current review, with the exception of the Alhassan et al. (2007) study, classroom teachers led the intervention activities. However, due to the lack of follow-up data, we are not able to report on the sustainability of these interventions in objectively measured physical activity.

The second factor reported to influence the effectiveness of physical activity interventions deals with whether intervention activities were implemented as stand-alone programs or whether they were integrated into the academic curriculum (Finch et al., 2016). Reviews of preschool-based physical activity interventions have highlighted the success of intervention strategies that incorporate content into existing classroom lessons (Finch et al., 2016; Ward et al., 2009). In an era when classroom teachers have limited time due to meeting standards for early childhood education and other teaching obligations, it is imperative that physical activity interventions be designed to integrate seamlessly into the academic lesson plans. In addition, by integrating the intervention components into the classroom curriculum, researchers could potentially enhance a study's fidelity (i.e., adherence, compliance, and integrity) and intervention dosage (i.e., intervention quantity and strength; Durlak & DuPre, 2008). Of the eight studies that reported improvements in physical activity, five incorporated the intervention activities into the academic curriculum (Annesi et al., 2013a; Fitzgibbon et al., 2011; Kirk & Kirk, 2016; Kirk et al., 2014; Winter & Sass, 2011). For example, in the studies by Kirk and Kirk (2016) and Kirk et al. (2014), teachers were asked to teach their classroom academic literacy lesson plans using physical activity rather than using large-group circle time, reading, or other classroom activities.

The last factor that has been related to the effectiveness of preschool-based physical activity interventions is the use of a multicomponent approach (i.e., targeting different settings in the preschool day). The findings of the current review align with previous reviews that support the need for multicomponent approaches to improve physical activity (Ward et al., 2009; Ward et al., 2010). For example, in the Fitzgibbon et al. (2011) study, the multicomponent intervention (circle-time activity and increasing structured activities during other times of the day) led to a significant increase (7.46 min/day) in participants' time spent in MVPA. Based on the present and past reviews, it is imperative that interventions designed to improve total preschool-day physical activity target a wide range of settings in the preschool day (i.e., circle time, outdoor playtime) that shape a child's behaviors.

An issue that affected our ability to draw conclusions on the effectiveness of the interventions included in this review is the inconsistencies in physical activity assessment. Due to the movement patterns of children, directly observed physical activity might be the most practical method to obtain information on children's physical activity levels and the context (e.g., where, when, and with whom) related to their physical activity. A disadvantage of direct observation is the high researcher burden and the potential reactivity of the participants. Currently, there are eight observational systems used in the youth physical activity literature (Sirard & Pate, 2001). Six were designed for use in a variety of settings and two for use in physical education sessions. In the current review, SOFIT was used in four studies to assess physical activity during the intervention time. Since SOFIT was validated for use in elementary-school-age children, it may not be an accurate method to assess preschool-day physical activity.

To overcome some of the reported barriers associated with directly observed physical activity measures, researchers have advocated for the use of accelerometers. Regardless of the participant population (e.g., children of color or White), there is large variability in accelerometer-assessed physical activity outcomes. This variability has been related to the use of different monitors, monitor placement (e.g., hip or low back), the specific activities performed during the intervention protocols, wear-time criteria, and cut points used to reduce the accelerometer data (Sirard & Pate, 2001). In the current review, the accelerometer-based studies used either the Sirard et al. (2005) cut points or the Pate et al. (2006) cut points. Compared with Pate et al. (2006), the Sirard et al. (2005) cut point for MVPA is at a higher threshold (Sirard MVPA ≥615 counts/15 s; Pate MVPA ≥420 counts/15 s), resulting in more time spent in MVPA.

An advantage of using accelerometers to measure physical activity in preschool-age children is that they can provide nonreactive data and quantify physical activity over multiple days. In the current review, three studies quantified total daily physical activity by assessing physical activity over 7 consecutive days (Alhassan et al., 2007, 2012; Fitzgibbon et al., 2011). Unfortunately, disadvantages associated with accelerometer use are the

cost associated with purchasing units and the fact that they are not accurate in assessing some forms of physical activity in which preschool-age children frequently participate (e.g., riding a tricycle, upper body movements).

There are several limitations of the current review. It is possible that only a few studies met the inclusion criteria for the current review because researchers are not reporting racial and ethnic characteristics of participants or are not stratifying analyses by race or ethnicity. It is likely that the inclusion and exclusion criteria employed could have resulted in eliminating some studies that might be relevant to the current review. We carefully selected inclusion and exclusion criteria based on previous reviews of the literature and used trained individuals to review abstracts to select relevant publications. However, we may have missed some papers. This review only included studies that took place during the preschool hours and excluded interventions that took place in other settings (e.g., home daycare, home environment, or community centers). Findings from the excluded interventions might provide additional insight into strategies for intervening in preschool children of color. This study also has several strengths. For example, we employed search strategies that have been used in previous review of the literature (Robinson et al., 2014), and we employed a standardized method for extracting data from identified studies. The current review of the literature is one of the first to focus on the effectiveness of preschool-based intervention strategies targeting preschool children of color.

Conclusion

The goal of this review was to provide some insight into what we know about preschool-based interventions designed to improve physical activity in African American and Latino/Hispanic preschool-age children. While the overall findings are limited, the relatively small amount of evidence suggests that physical activity intervention activities led by classroom teachers have the potential to improve the physical activity levels of preschool children of color. However, due to the issues previously stated, the types of intervention activities that could improve physical activity levels in this population are uncertain. To assess the effectiveness of physical activity interventions among preschool children of color, it is imperative for researchers to report the race and ethnicity of participants and stratify their results by race or ethnicity when possible. In addition, to test the effectiveness of a physical activity intervention, it is essential to have accurate assessments of the outcome measures. The inconsistencies in the instruments and measurement protocols used to assess physical activity in the current review make it difficult to compare the effectiveness of the interventions in children of color. Thus, a useful contribution to the literature would be a standardized set of accelerometer cut points and protocols to assess physical activity in preschool children.

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