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PHYSICAL ACTIVITY

Implementing Structured Curriculum in an After-School Physical Activity Program

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Abstract

The purpose of this study was to evaluate the influences of a structured after-school program on student physical activity for third- through fifth-grade students at five schools in southern Colorado. The study utilized a pretest–posttest intervention design in which six elementary schools in a low socioeconomic status school district in southern Colorado were recruited to implement a structured curriculum into their existing after-school physical activity program. Four observations at each school were taken approximately 6 weeks apart during the 2014–2015 academic year. Randomly selected students (n = 187) were measured for height and weight at each observation and wore accelerometers during after-school physical activity. Descriptive statistics and independent sample t tests were calculated for a comparison of physical activity before and after the implementation of the structured after-school program. Students wore accelerometers an average of 45.72 ± 10.28 min/session. Total physical activity increased significantly from 36.21 ± 6.41 to 41.14 ± 6.76 min/session ($p < 0.001$). Moderate physical activity increased significantly from 9.29 ± 3.84 to 12.10 ± 5.96 min/session ($p < 0.001$), whereas vigorous activity

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significantly decreased from 8.02 ± 4.39 to 5.54 ± 5.32 min/session ($p < 0.001$). Overall, implementing a structured after-school program may be beneficial in increasing total physical activity, though its role in improving physical activity intensity is questionable.

The literature has well established that physical activity (PA) is necessary for a person to maintain health and wellness. Regular PA can contribute to a person maintaining a healthy weight (Centers for Disease Control and Prevention, 2016) and decreases the risk of chronic diseases such as osteoporosis, heart disease, and type 2 diabetes (Csabi et al., 2000; Flynn et al., 2006; Twisk, 2001). Performing less than adequate amounts of PA has also been linked to negative mental health effects such as decreased self-esteem, reduced psychological well-being, diminished academic performance, and decreased attention (Biddle & Asare, 2011; Lees & Hopkins, 2013; Liu et al., 2015). Additionally, regular PA has even been found to decrease the risk of early death (Healthy People 2020, 2016). It is evident that regular PA is crucial to a person maintaining health throughout life.

Children are especially affected by a lack of regular PA as their bodies continue to develop, a process that is heavily influenced by lifestyle factors. Furthermore, a lack of PA in childhood can contribute to lifelong negative health effects, as children who struggle with obesity in their childhood are more likely to be obese as adults (Kann et al., 2014). The onset of many chronic physical and mental diseases can begin in early childhood, and thus, childhood is a critical time to instill preventive strategies and establish healthy habits (Twisk, 2001). Unfortunately, the levels of PA throughout childhood and adolescence are declining (Dumith et al., 2011; Nader et al., 2008). In an increasingly sedentary society, it is important that youth are encouraged to engage in daily PA.

The recommended guidelines regarding PA for youth is 60 min/day of moderate-to-vigorous PA (MVPA; Twisk, 2001). Less than 20% of adolescents are achieving the recommended amount of PA daily (Herrick et al., 2012). Research has demonstrated that underrepresented groups often engage in less MVPA than Caucasian groups, and females tend to engage in less MVPA than males (Brockman et al., 2010; Loprinzi et al., 2012). One study found that the higher the intensity of vigorous PA (VPA), the stronger the

inverse association with adiposity (Steele et al., 2009). Interventions for increasing youth PA should target raising MVPA for the most beneficial health outcomes (Saunders et al., 2016).

As the central social institution in a child's life, school is where youth spend a majority of their waking time. Thus, the school atmosphere may be the most optimal setting to successfully intervene and encourage PA for children. At school, there are many opportunities for PA such as recess, physical education classes, before- and after-school activities, and active transportation to and from school. A commonly targeted and researched area to increase PA has been after-school programs (ASP; Beets et al., 2009; Gesell et al., 2013; Trost et al., 2008). Approximately 8.4 million children in the United States attend an ASP regularly, and the parents of over 18 million additional children reported that they would like their children to participate in an ASP if one was available to them (Afterschool Alliance, 2009). Clearly, there is an opportunity to increase the PA of a large group of children by focusing on ASP.

Further cementing the after-school time as an ideal opportunity to increase PA, findings have indicated that students engage in most MVPA immediately following school, with reports of being up to twice as active during this time than during the school day (Brockman et al., 2010). Since this is also the time in which ASP are offered, this may be an effective place to increase MVPA. During the hours immediately following school, students who go home instead of participating in an ASP will engage in, on average, 2 more minutes of sedentary behavior per hour (Taverno Ross et al., 2012). Furthermore, underrepresented females in ASP had higher MVPA levels and lower reports of sedentary behavior compared to those who went home, whereas MVPA for Caucasian females was not influenced by after-school settings (Taverno Ross et al., 2012). This demonstrates that interventions in ASP may be especially beneficial to underrepresented groups. There are many approaches to increasing PA during this after-school time.

Although it is known that ASP are associated with higher PA, it is less known if structured curriculums are more effective than unstructured free play in increasing MVPA in ASP (Gesell et al., 2013; Trost et al., 2008). The purpose of this study was to contribute to the growing body of literature related to the effectiveness of different

ASP. Particularly, this study observed the PA of children participating in an ASP that utilizes a structured curriculum, Five for Life, compared to the baseline observation of PA for students engaging in free play.

Method

Participants

Institutional Review Board approval from Northern Arizona University was obtained for all data reported in this study. The school obtained consent from the students to participate in the data collection method. This study received the deidentified data from the school and conducted the data analysis. The study utilized a pretest–posttest intervention design in which six elementary schools in a low socioeconomic status school district in southern Colorado were recruited to implement a structured curriculum into their existing ASP. Because individual household income data were not available, this study used free and reduced lunch information as a proxy for socioeconomic status (Trost et al., 2008). The district selected has an overall average of 70% of students qualifying for free and reduced lunch, with the sites observed having a range of 79% to 91% (average 82%) of the students qualified for free and reduced lunch. This group of schools consisted of 10.83% of the total district population.

The analysis included students measured at the initial (n = 107) and final (n = 80) observations, for a total of 187 observed students. Most students were Hispanic (n = 74), followed by Caucasian (n = 46) and African American (n = 33). Students ranged between third and fifth grade, and most were 9 or 10 years of age (65%). More males (n = 115, 60%) participated than females. Students were randomly selected to participate at each observation, and the students observed during the initial observation were not necessarily the same students who were observed in any following observations.

Protocol

The selected sites previously implemented an unstructured afterschool program, Keep It Moving!, to allow students at the elementary schools opportunity to accumulate additional PA outside of traditional school physical education hours (Behrens et al., 2016; Schuna et al., 2013). We recruited these schools to implement a structured

curriculum (Five for Life) into the Keep It Moving! after-school program to assess whether the structured curriculum of Five for Life would provide opportunity for additional PA versus a nonstructured ASP. Six schools in the district were selected to participate in the study. One school dropped out of the study after baseline measurements, leaving five schools for analysis.

Height was measured to the nearest 0.5 cm with a portable stadiometer (Seca Road Rod #214; Seca GmbH & Co. KG., Hamburg, Germany). Weight was measured to the nearest 0.5 lb with a digital scale (Model 498KL; Health o Meter Professional Scales, Alsip, IL). Accumulated PA during the observations was objectively assessed with the ActiGraph GT3X accelerometer (ActiGraph LLC, Pensacola, FL). The ActiGraph demonstrated acceptable reliability and validity.

Five for Life is a fitness educational curriculum designed in accordance with physical education standards to keep students moving while engaging in structured activities. Contrary to free play, Five for Life utilizes a variety of specific activities and circuits designed to increase fitness for kindergarten through 12th-grade students, with different sets of curricula tailored for elementary, intermediate, and high school students. The program targets the "five" components of fitness: cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and composition. The Five for Life curriculum-based program was implemented into schools that already had the unstructured after-school Keep It Moving! program. Keep It Moving! sessions are typically led by a PE teacher and do not follow a specific curriculum.

We scheduled observations with the site supervisors, one baseline observation with three follow-up observations. The baseline observations were during the Fall 2014 semester (October), with subsequent observations spaced approximately 6 weeks apart. Posttest observation was approximately 18 weeks from pretest. Site supervisors were trained in the curriculum and given binders containing the PA portion of the curriculum and sample lesson plans prior to the school year beginning.

During each observation, we collected demographic information including age, grade, ethnicity, height, and weight. Three questions were verbally asked of the students prior to being fitted

with an accelerometer and participating in PA: (1) How old are you? (2) What grade are you in? and (3) What ethnicity do you consider yourself? After collecting demographic data, we measured the student's height using the portable stadiometer to the nearest 0.5 cm and weight using the portable scale to the nearest 0.5 lb. Following the height and weight measurements, accelerometers were fit to each child and mounted at the right side of the waist. The time each accelerometer was placed on the student and the accelerometer identification number were recorded. We used the accelerometers to collect data in 30-s intervals during the program observations. Following the lesson, we collected the accelerometers and recorded the ending time of the lesson.

Statistical Analysis

Data were entered into an Excel spreadsheet and checked for data entry errors. SPSS version 22 was used for data analysis. One school withdrew from the intervention following the baseline measurements; the data presented do not include the baseline data for this site in the analysis. During the data cleaning process, we found seven participants who reported grade levels outside those included for this study and they were omitted from the analysis. Descriptive statistics were calculated for grade and ethnicity of the students. Means of height and weight were calculated. We used Evenson et al.'s (2008) cut points in conjunction with the accelerometer data to determine the PA levels of the students who were outfitted with the accelerometers. Independent groups *t* tests were conducted for differences in PA measurements at baseline (pretest) and at the last follow-up (posttest). Because multiple *t* tests were performed, a Bonferroni correction was calculated at $p < 0.01$. We computed total PA by creating a composite variable that included measurements of light, moderate, and vigorous activity. We computed MVPA by summing moderate PA and VPA. Degrees of freedom were adjusted for tests that violated assumptions of equality of variances as indicated by a significant Levene's test. Effects sizes were calculated with Cohen's *d* (Cohen, 1992).

Results

Minutes of PA showed a significant increase from pretest to posttest, $t(185) = -5.08$, $p < 0.001$. This represented a medium-large effect,

d = .75 (Cohen, 1992), suggesting that the structured ASP increased PA levels. Conversely, MVPA at pretest did not significantly differ at posttest, $t(114.75) = -2.65$, $p = 0.791$. Individual analysis of each activity level showed that moderate activity increased from pretest to posttest, $t(126.38) = -3.68$, $p < 0.001$. However, vigorous activity significantly decreased, $t(185) = 3.48$, $p = 0.001$. The increase in moderate activity represented a medium effect, d = .56. Additionally, there was no significant difference in sedentary behavior during the structured curriculum at posttest measurements, $t(185) = .431$, $p = 0.667$. Light activity significantly increased from pretest to posttest, $t(185) = -4.01$, $p < 0.001$. See Table 1.

Table 1
Means and Effect Sizes for Minutes of Measured Physical Activity Levels

	Pretest	Posttest	Cohen's
Activity level	***M* (*SD*)**	***M* (*SD*)**	***d***
Sedentary	5.57 (4.25)	5.28 (4.93)	.06
Light PA	18.89 (6.77)	23.49 (8.93)	0.58*
Moderate PA	9.29 (3.84)	12.10 (5.96)	0.56*
Vigorous PA	8.02 (4.39)	5.54 (5.32)	0.51*
Moderate-vigorous PA	17.31 (5.56)	17.64 (10.07)	0.04
Total PA	36.21 (6.41)	41.14 (6.76)	0.75*

Note. Pretest n = 107, posttest n = 80.
*$p < 0.001$.

Discussion

The purpose of this study was to investigate whether implementing a structured curriculum would increase overall PA and MVPA that students performed after school. As expected, adding the structured curriculum Five for Life to the unstructured afterschool program Keep It Moving! resulted in a significant increase in overall PA from the baseline measurements to the final follow-up measurements (approximately 18 weeks). Although moderate PA significantly increased, VPA significantly decreased, which kept MVPA stable across time measurements.

These findings support studies that have examined PA and MVPA in structured curricula (Gesell et al., 2013; Trost et al., 2008). According to these studies, PA in a structured curriculum appears to successfully increase total PA, but VPA may decrease, keeping MVPA stable. On the other hand, unstructured curricula or free play may lead to less overall PA, but students who choose to engage in activity tend to perform more VPA (Gesell et al., 2013; Trost et al., 2008). These findings contribute to a growing body of literature regarding increasing PA after school.

A study examined two after-school programs: one that had organized activity and one that allowed free play for students. The program with structured activity led to students engaging in 225 more minutes of PA each week (Gesell et al., 2013). Another study, however, found MVPA levels were 24–55% lower during organized activity compared to free play (Trost et al., 2008). Although research in this area is underdeveloped, the research thus far depicts a contradictory pattern. The most effective approach to increasing PA and MVPA in youth participating in ASP remains unclear. Future research should specifically focus on increasing PA and MVPA in all youth during ASP.

Additional factors, besides the program structure, related to the implementation of curricula may influence PA levels and MVPA. For example, a study that investigated PA in ASP across a variety of contexts found that MVPA was significantly higher in structured activity indoors compared to outdoors, although the MVPA for the structured activity was still significantly less than unorganized activity regardless of setting (Trost et al., 2008). Another potential influence on PA is weather and environmental factors. One study that looked at PA and nutrition in a structured curriculum in youth reported decreased MVPA during fall and increased MVPA during spring, indicating the winter months may affect activity levels and motivation (Crouter et al., 2015). To address the stable or decreasing MVPA and VPA that tends to be characteristic of structured curricula, future research should explore whether alternating or hybridization of unstructured and structured curriculums would successfully increase high-intensity activity, for example, providing structured curricula that include time for free play or providing several structured options for children to "free play" within (Crouter

et al., 2015). Additional factors such as the incorporation of nutrition programs, frequency of implementation, and types of activities influence PA and MVPA results, but Beets et al. (2009) could not determine a "best" design from their findings.

To increase the intensity of PA among children and adolescents, studies have also looked at the role of autonomy and self-selection of activities to produce results. One study found that adolescents who self-selected their exercise intensity, compared to those who were assigned PA, performed at a higher intensity (Sheppard & Parfitt, 2008). Another study expanded on this and investigated if adolescents who did not report participating in sports and were at risk for sedentary lifestyles would also choose higher intensity activity (Schneider & Schmalbach, 2015). It found that when asked to select an intensity that feels good, adolescents reported positive mood shifts and worked at a higher intensity without perceiving harder work, which replicates the previous results (Schneider & Schmalbach, 2015).

One particularly important component of this study was specifically recruiting adolescents who were not already active and therefore may be more averse to high-intensity exercise. This may relate to the sample of this study, because low socioeconomic status youth are at higher risk for sedentary lifestyles and therefore may perform higher intensity PA if they are encouraged to make autonomous choices regarding PA. Promoting choice and control in youth PA programs, perhaps even within the model of structured ASP, is one promising way to increase intrinsic motivation and engagement of high-intensity activity. Implementing structured curricula may be one method of increasing overall PA in youth ASP, though additional research needs to determine the ideal ASP structure to increase both overall PA and MVPA.

One inherent limitation is that students may have altered behavior while participating in PA due to our presence and having the accelerometers attached to them. We attempted to minimize the limitations by instructing the site supervisors to execute their lesson plans as they would if we were not present. Additionally, the results may not be generalizable because the sample is within one school district, within a highly active state and thus may not be an accurate representation of all low socioeconomic status schools in the United States. However, because it is known that low socioeconomic status

environments and ethnic minorities are at higher risk for not meeting PA recommendations, a strength of the study is implementing interventions in schools that will reach youth who primarily fall into these at-risk categories.

Conclusion

ASP that implement structured PA curriculums appear to be a successful way to increase overall PA in elementary-aged children. In this study, the students who participated in the structured curriculum showed a large and significant increase in overall PA. Furthermore, aside from vigorous activity, all activity levels increased from baseline to the final posttest. MVPA remained stable and should remain a target research focus in future studies. According to these findings, structured after-school PA programs can increase student activity levels and the after-school period can provide a great opportunity to increase childhood PA. School administrators and education policy makers should focus on making after-school PA programs, especially structured programs, available to students. Future research should focus on increasing the intensity of PA performed by students participating in ASP.

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