10-1-2014

Physical Activity Change Through Comprehensive School Physical Activity Programs in Urban Elementary Schools

Erin E. Centeio
Wayne State University, erin.centeio@wayne.edu

Nate McCaughtry
Wayne State University, aj4391@wayne.edu

Lila Gutuskey
Wayne State University, lgutuskey@gmail.com

Alex C. Garn
Louisiana State University

Cheryl Somers
Wayne State University, c.somers@wayne.edu

See next page for additional authors

Physical Activity Change through Comprehensive School Physical Activity Programs in Urban Elementary Schools

Erin E. Centeio[a], Nate McCaughtry[a], Lila Gutuskey[a], Alex C. Garn[b], Cheryl Somers[a], Bo Shen[a], Jeffrey J. Martin[a], and Noel L. Kulik[a]

[a]Wayne State University; [b]Louisiana State University

Keywords: Coordinated School Health, Physical Education, Whole-of-School Approach, Quantitative

Abstract

The impact of CSPAPs on urban children's, educators', and parents' physical activity (PA) is relatively unknown. The purpose of this study was to explore overall changes in student, educator, and parent PA after an 8-month CSPAP-based program. This longitudinal, exploratory study implemented a CSPAP model in 20 urban elementary schools, with six randomized for research. In-school PA was measured pre-post for all fourth grade students using accelerometers. Parent and educator PA was self-reported using the IPAQ. RM-ANOVAs revealed significant pre-post increases in minutes of student MVPA ($p<.001$). Parents significantly increased PA ($p<.01$) and although educators' reported change in PA, it was not statistically significant ($p=.50$). This exploratory study provides unique information about the potential influence of one CSPAP model on students' overall PA, PA by individual context within the school, the differential PA patterns by race, and PA changes for educators and parents.

Children's participation in physical activity (PA) can lead to significant physiological and cognitive benefits (Centers for Disease Control and Prevention [CDC], 2010, 2011; Institute of Medicine [IOM], 2013). Physiological benefits experienced by children who regularly participate in PA at moderate to vigorous intensities include reduced incidences of obesity and risk of heart disease, diabetes, high blood pressure and cholesterol (American Alliance for Health, Physical Education, Recreation and Dance [AAHPERD], 2013; CDC, 2011). Academic achievement, on-task behaviors, and various cognitive skills have also been documented as associated with PA (Castelli et al., in press; CDC, 2011). National organizations recognize the importance of participation in PA for the overall well-being of children and have responded with parents' and educators' recommendations to ensure appropriate and ample PA opportunities are provided both at home and in the school setting (CDC, 2011; U.S. Department of Health and Human Services [USDHHS], 2012; U.S. White House Task Force on Childhood Obesity, 2010).

The 2008 PA Guidelines identified national standards for the frequency, intensity, type, and amount of time children should participate in PA (USDHHS, 2008). Children and adolescents aged 6 to 17, should engage in at least 60 minutes of PA daily, primarily comprising of moderate to vigorous intensity aerobic activity, with vigorous-intensity PA included at least three days a week. Muscle and bone strengthening activities, such as gymnastics and running should also be incorporated at least three days a week. The 60 minutes does not need to occur all at once; short bouts of PA throughout the day are often more conducive to children's daily lives. However, most children are currently not meeting these recommendations (Troiano et al., 2008). PA participation for urban children, in particular, has been reported significantly lower than children in small cities and rural areas

(Joens-Matre et al, 2008). Providing additional opportunities for all children, especially those in low-income, urban areas to participate in PA could increase the proportion of children who meet recommended guidelines (USDHHS, 2008).

Schools are a convenient place to reach most children and should play an important role in providing children with the knowledge, skills, and opportunities to be physically active (IOM 2013; Pate et al., 2006). Through schools, children can gain the knowledge and opportunities to be physically active throughout the school environment and school day, and families can learn how to reinforce active lifestyles (AAHPERD, 2013). However, since the enactment of No Child Left Behind in 2001, schools have cut time from traditional school PA opportunities like physical education (PE) classes and recess to accommodate the additional focus on English Language Arts and Math (McMurrer, 2007). These cuts are particularly noticeable in urban areas where schools are often low performing, potentially generating greater potential for health disparities among students. Consequently, to bolster the role of schools in helping children achieve 60 minutes of activity time daily, many studies have suggested that schools should offer additional PA opportunities beyond traditional venues (Carson, 2012; Erwin, Beighle, Carson, & Castelli, 2013; Metzler, McKenzie, van der Mars, Barrett-Williams, & Ellis, 2013a, 2013b).

A comprehensive school physical activity program (CSPAP) that provides children with multiple times to be physically active throughout the day (before, during and after school) in multiple locations (PE, recess, classrooms) has been promoted as an evidence-based model to increase children's PA levels (AAHPERD, 2013; CDC, 2013; National Association for Sport and Physical Education [NASPE], 2008). The Health Optimizing Physical Education (HOPE) curriculum is one model that encourages PA throughout the

school day and beyond (Metzler et al., 2013a, 2013b). Let's Move! Active Schools (LMAS) is a nationwide program that promotes the CSPAP model and provides resources on how to enact it (SHAPE America, 2014; www.letsmove.gov/active-schools).

The five components of a CSPAP are: (1) quality PE, (2) PA during school, (3) PA before and after school, (4) staff involvement, and (5) family and community engagement. These components are discussed in detail in Chapter 1 of this monograph and therefore will not be elaborated on within this article (see Chapter 1; XXX, 2014). While an ideal CSPAP should include each of the five components, school personnel can individualize the model based on their school's unique needs and preferences.

School-based PA interventions incorporating individual CSPAP components have shown some success at increasing MVPA minutes for children. Pate and O'Neill (2009) conducted a review of after-school PA programs and found that four of six randomized controlled trials reported significant increases in PA for intervention children. Overall, after-school programs reported high attendance and were well-received by parents and children. A review of active school transport programs intended to increase children's PA participation identified significantly positive results in 9 of 13 studies (Faulkner, Buliung, Flora, & Fusco, 2009). Interventions targeting PA during school break periods, such as recess and lunch, have reported significant increases to children's time spent in MVPA (Jago & Baranowski, 2004). Furthermore, quality PE curriculum that focuses on health-related outcomes has also shown an increase in children's MVPA (Sallis et al., 1997). Overall, significant evidence exists to support the individual CSPAP components capability to increase children's PA.

Family and community engagement as well as staff involvement should not be forgotten as a means to increase children's daily PA. Staff healthy habit adoption and positive role-modeling might also play an important role in youth PA engagement at school. Engaging parents in CSPAP related school efforts might also lead to enhanced school PA for youth through parental encouragement and role modeling at home. After all, parental and educator role models of PA have been associated with youth participation in PA (Brustad, 1996). In addition, youth with physically active parents are significantly more active than children with inactive parents (Anderssen & Wold, 1992; Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2005; Moore et al., 1991), and parental support for youth to be physically active has also been linked (Sallis et al., 1992).

Moreover, influences in PA participation can be bi-directional as children's participation and support has shown to impact parental perceptions and levels of PA. A study conducted by Dorsch, Smith, and McDonough (2009) found that parents whose children participated in youth sport gained many psychological and emotional benefits including a strong connection to sport and PA similar to their children. Other studies such as that conducted by Seefeldt, Malina, & Clark (2002) discussed how family support leads to increased participation in PA.

While comprehensive models for school-based PA should lead to positive PA outcomes for youth and potentially educators and parents, there is currently a gap in research examining the impact of delivering multiple CSPAP components simultaneously (Erwin, Beighle, Carson, & Castelli, 2013). To date, most research has not examined the incorporation of all five components of the CSPAP model. Hence, the impact of multi-component CSPAP programs on cumulative youth PA is relatively unknown, much less a

more fine-grained analysis of how each segment of the school environment may or may not contribute uniquely. In addition, the role that CSPAP programs might play in bi-directionally influencing educators' and parents' own PA behaviors and perceptions remain fully unexplored. Therefore, the purpose of this study was to identify overall changes in student, educator, and parent PA during an 8-month CSPAP program, as well as student PA changes by locations within schools, and the influences of gender and race.

Theoretical Framework

The Social Ecological Framework (SEF) suggests that multiple levels of factors are working in harmony to influence health behaviors; including both the physical and social environment (Sallis, Owen, & Fisher, 2008; Stokols, 1992). Sallis et al. (2008) identified these levels as intrapersonal, interpersonal, organizational, community and public policy (Figure 1, see appendix). Examples of influences to children's participation in PA include; self-efficacy and PA enjoyment (intrapersonal), parent modeling and social support (interpersonal), school equipment and opportunities for PA (organizational), access to facilities, and programs (community), National and State policies on PE and feasibility of active transport (public policy; Sallis et al., 2008). Historically, the individual level has been the primary focus for health programs, but there is growing evidence supporting interventions impacting multiple levels of influence (Metzler et al., 2013a; Stokols, 1992).

Consequently, health interventions guided by SEF should include program components affecting at least two levels of influence (Sallis et al., 2008). CSPAPs are well aligned with SEF since the five components of CSPAP impact youth PA behavior across multiple influential levels described in SEF, described in table 1 (Metzler et al., 2013a). For example, PE experiences can provide youth with self-efficacy to participate in PA and

increase their perceptions of confidence, impacting the intrapersonal level of SEF. PA during school can provide students opportunities to increase the amount of PA they engage in and practice the skills and continue to build the confidence gained in PE, impacting the intrapersonal and organizational levels of the framework. PA before and after school through programming such as active transport, PA clubs and organized sports could impact all levels of SEF. Staff involvement through role modeling and advocacy can impact the intrapersonal and organizational levels. Engaging the family and community through education, role modeling, events and awareness can also impact all levels of the model.

Similar to Social Cognitive Theory, reciprocal determinism is equally applicable in ecological frameworks (McAlister, Perry, & Parcel, 2008). Reciprocal determinism suggests that as factors embedded in one level of intervention change, they can simultaneously and relationally lead to changes in other levels. For instance, as school staff becomes more involved in the enactment of CSPAP, they can influence the organizational level by changing time allotted to PA for recess and classroom activity breaks, which in turn can lead to changes within children's feelings and experiences about PA. Additionally, as children's self-efficacy and enjoyment of PA increase through PE or before/after school opportunities, children may seek out and ask parents to enroll them in an after-school sport or PA clubs. A little differently, as educators enact CSPAP and see positive influences on children, they themselves might engage in behavior change, which could lead to educator PA increases and positive perceptions as health role models, which might even further cement the importance of PA for students. Similarly, as parent see their children's energy around CSPAP activities at school and receive educational resources at home and at school events, they could impact parental PA; thereby, similar to teachers,

have a reifying effect for their children and parents' own activity levels. In this way, the levels of influence on children's PA are inter-connected and might work together synergistically to either encourage or discourage PA behavior among the multiple groups directly or indirectly embedded in the CSPAP system.

Methods

Research Setting

During 2012-2013, 20 urban elementary schools in the Midwestern United States participated in this research study. Schools applied to participate in a program called *Building Healthy Communities* (BHC). BHC implements a whole-school approach to PA and nutrition programming designed to reach students, educators, and parents. Schools who participated in the BHC program attended a one-day workshop to initiate them to the program and its components as well as introduce key support staff for the program. Each school was assigned a trained coordinator that provided technical assistant, support, and education to the school throughout the entire year. BHC coordinators were full time employees of the grant. There were a total of three coordinators for the 20 schools.

For this paper, the four components that specifically targeted additional PA opportunities at school will be addressed: (1) quality PE, (2) classroom PA (split into classroom time and specials), (3) lunch and recess, and (4) after school PA club. Of the sixteen schools that participated in BHC, six were randomly selected to participate in the research and all fourth grade students in each school who provided informed consent participated.

Quality PE. PE teachers were trained to implement the Exemplary Physical Education Curriculum (EPEC) into their PE classes. EPEC was chosen because of its

strong emphasis on promoting health through PA in PE. It is a state-drive curriculum that is used widely and developed by the Michigan Fitness Foundation (MFF) as a public health initiative by the Michigan Governors Council on Physical Fitness, Health and Sports (Michigan Department of Education [MDE], 2001). Additionally, each teacher received a day-long professional development workshop, regular at-school mentoring, the packaged curriculum, and a full set of PA equipment designed to teach EPEC with classes of 30 students (i.e. basketballs, soccer balls, jump ropes, hula hoops, and cones). The implementation of EPEC was tracked over the entire school year. First, PE teachers kept monthly logs showing the specific EPEC lessons that were taught each day to their fourth grade classrooms. The EPEC logs were collected on a monthly basis and reviewed by the research team. In addition to the EPEC logs that were kept, fidelity checks in the form of school visits occurred at least twice a month by members of the research team for informal observation and oversight that EPEC was being taught in the PE classroom.

Classroom PA. Classroom teachers were mentored to provide regular PA breaks during academic learning time. BHC project staff modeled five Fit Bits (classroom PA breaks; http://www.michiganfitness.org/fitbits) in each fourth grade classroom, and provided the Fit Bits and encouragement to continue the activity breaks throughout the year. The teachers were also encouraged to adopt a culture of PA in their classroom, such as encouraging PA as homework, reading PA "tips of the day", and not using recess as punishment (e.g., taking away recess for not completing homework, talking out of turn, or misbehaving during classroom time). Classroom teachers maintained a daily log of their activity break implementation and the research team conducted regular fidelity checks. In

this study, general classroom time was separated from specials (e.g. art, music, and media center time) because this time was spent with a teacher other than the homeroom teacher.

Lunch and Recess. Active recess was a core component of the BHC program. Each school received a mobile recess cart with a wide variety of PA equipment (i.e. jump ropes, playground balls, soccer and basketballs, hula hoops, etc.). In addition to equipment, recess activity cards were provided to help encourage students to play games and be active during their recess time. PE teachers taught the games on the cards in PE classes so that students would be familiar with them during recess. In addition to the recess cart, schools were encouraged to have an "active" recess monitor to model PA for the students. All schools provided a recess monitor to oversee the implementation of active recess, however this person varied by school (i.e. classroom teacher, principal, lunchroom monitor, etc.) and was not required to attend any formal training. The recess carts were moved to the recess area at the beginning of each day and returned to storage at the end of the day. The research team conducted regular fidelity checks to verify that the equipment carts were regularly available of student use during recess. Specifically, members from the research team randomly showed up weekly at each school to ensure the recess cart was present during recess time and was being monitored appropriately. Schools were also asked to log monthly about the overall use of their recess carts and implementation of active recess.

After School PA. Each school hosted an after school PA program titled *Healthy Kids Club* (HKC). The HKC's consisted of three segments that averaged 62 minutes. First, students ate a healthy snack while listening to nutrition education (15 min). Second, after eating, students participated in a 20-minute walking club followed by 20 minutes of fun

and highly active games. Third, the HKCs ended with a 5-minute recap on the activities and the nutrition messages.

The BHC program also targeted staff by promoting and encouraging them to be active role models for their students. A BHC coordinator was in the schools on a weekly basis promoting a culture of healthy living. Furthermore, newsletters and other materials were sent home to parents promoting PA and schools also hosted PA events for the whole family offered both during and beyond school hours.

Participants

Students. At time one (T1) 344 fourth grade students (M_{age}= 9.39; *SD* = .44; female = 57%) participated in the study. Each school contributed a similar amount of students to the total number in the study (i.e., range 43-66). Students reported their ethnicities as African American (53%), Caucasian (23%), Other (20%), Hispanic (2%), Asian/Pacific Islander (1%), and American Indian (1%). A majority of the students in the other category identified themselves as Arab American. Approximately 88% percent of the students (*n*= 301) completed the post measure of PA eight-months later at time two (T2).

Parents. All fourth grade parents were asked to complete the International Physical Activity Questionnaire (IPAQ; IPAQ, 2014). Of the 344 students, 260 parents (212 mothers, 45 fathers, 2 female guardians, and 1 male guardian; 58% African American, 24% Caucasian, 15% Other, 2% Hispanic, <1% Asian) consented and completed the IPAQ questionnaire at T1 (M_{age} = 36.49; *SD* = 6.37). At T2, 109 or 42% of the T1 parents (M_{age} = 36.38; *SD* = 6.04; 91 mothers, 17 fathers, and 1 male guardian; 53% African American, 29% Caucasian, 1% Hispanic, and 17% Other) completed the IPAQ questionnaire.

Educators. Fourth grade teachers and school administrators in the research schools consented to be a part of the research. All but two teachers and administrators completed the IPAQ at T1 & T2. There were a total of 22 fourth grade teachers ($M_{experience}$ = 10.8 years, *SD* = 8.64) and 12 administrators ($M_{experience}$ =1.76 years, *SD* = 2.89) who completed the IPAQ at T1 & T2 (M_{age} = 38.93, *SD* = 10.30 Female = 31; 67% Caucasian, 30% African American, and 3% Other).

Measures

Student PA measurement. Student PA was collected using accelerometers (ActiGraph GT3X+) recording accelerations on three axis as well as step data. The monitors were initialized to save data in 15-second intervals (epochs) to detect the spontaneous activities of school-aged children. Children wore the accelerometers on the right hip, secured with an elastic belt. The ActiGraph GT3X+ has demonstrated outstanding criterion validity and reliability in previous research (Melanson & Freedson, 1995). Accelerometer data were collected over a three-day period of time from the beginning to the end of the school day, which created a total of six school-days measured. Using the manufacturer's software (ActiLife version 6), data were downloaded and washed through the program using the Freedson (1998) cut-points. Once the raw data were exported from ActiLife into Excel, student PA was aggregated separately in five contexts (PE, lunch and recess, classrooms, specials, and HKCs).[1] Table 2 (see appendix) provides a summary of the average amount of total minutes that students spent in each part of the school (PE, lunch and recess, classrooms, specials, and HKCs). Then, a total number of

[1] Researchers were able to aggregate data into five contexts given they were present in each classroom during data collection and were assigned the task to conduct fidelity checks and recordings during every minute of the school day.

average minutes of moderate-to-vigorous PA (MVPA; MET > 3) and sedentary and light PA (SLPA; MET < 2.99) per day were calculated for each. It is important to note that HKC accelerometer data was only collected at T2 on those fourth grade students who were consented, and attended the HKC on the day of data collection (N = 24; 8% of total consented students).

Adult PA measurement. Self-reported PA data was collected among parents and educators using the short version of the IPAQ (Craig et al., 2003; Lee, Macfarlane, Lam, & Stewart, 2011). The IPAQ asked participants to report activities performed for at least 10 minutes during the previous seven days. Respondents were asked to report the amount of days and time spent performing PA at various levels of intensity (i.e. vigorous, moderate, and light), while giving specific examples within each level (e.g., moderate examples include: carrying light loads, bicycling at a regular pace, or doubles tennis). Each participant was given a total score, using the IPAQ scoring system (IPAQ, 2005) of total number of MET-minutes/week expended.

Data Collection

In September 2012 and May 2013, PA data were collected from students, parents, and educators. First, children whose parents provided informed consent wore accelerometers for three full school days starting when they arrived at school and ending when they left the school (whether at the end of the official school day or after the HKC). Second, IPAQ PA self-report instruments and directions were sent home and completed by parents. Last, all educators (classroom teachers and administrators) also completed the IPAQ.

Data Analysis

Descriptive statistics were analyzed and all variables were screened for outliers, missing data, and normality issues. A series of repeated measures analyses of variance (RM-ANOVAs) were run to determine pre-post differences in student and parent PA levels, while a paired sample t-test was used to determine differences among the educators, due to a small sample size. A series of multivariate measures analyses of covariance (MANCOVA) were run to examine student differences in MVPA and SLPA by race and gender, controlling for socioeconomic status (SES), as well as parental differences in MET-min expended by race and gender. Partial η^2 (eta squared) was presented as an index of effect size (i.e., small effect size, $\eta^2 = .01$; moderate effect size, $\eta^2=.06$, and large effect size, $\eta^2 = .14$; Cohen, 1988; Portney & Watkins, 2009). All statistical analyses were conducted using SPSS (v.21), and *p* values of .05 or less were considered statistically significant.

Results

Descriptive Statistics

Correlation tables were run to determine the relationship between gender, ethnicity, and SES with student MVPA and SLPA, as well as with parent MET-min reported[2]. Outliers were tested using z-scores causing four student outliers to be removed from the data set along with two parents. Missing values were list-wise deleted and there were no issues with normality.

[2] Lack of space would not allow correlation tables included within the article. Please contact first author for correlation matrix.

Student PA

A series of RM-ANOVA's were used to determine how student PA levels (MVPA and SLPA) changed over an eight-month period. The dependent variable was minutes, while the independent variables were the pre and post PA categories by instructional locations during the school day (e.g. total MVPA and SLPA throughout the school day in total, in PE, at lunch and recess, in classrooms, at specials). Additionally, a MANCOVA was run to determine if ethnicity and gender influenced changes in SLPA and MVPA after controlling for SES. The dependent variables for the MANCOVA included changes in PA from pre to post during PE, lunch and recess, classrooms, and specials. The independent variables were gender and ethnicity, while the covariate was SES.

An overall RM-ANOVA revealed a significant difference in total MVPA across the entire school day from pre to post data collection [Pillai's Trace, $F(1,308) = 100.09$, $p < .001$, $\eta^2 = .25$]. Students increased their MVPA during school (excluding HKCs) an average of almost 4.5 minutes per day (M_{pre} = 7.37 min, SD_{pre} = 7.48, M_{post} = 11.67 min, SD_{post} = 9.22). Similarly, when accounting for a decrease in the total time during the school day (397 min_{pre}; 389 min_{post}), there was a 58% increase in the percent of time that students spent in MVPA. Although there were significant changes in overall MVPA, there were no overall significant differences in the amount of total school day SLPA from pre to post [Pillai's Trace, $F(1,308) = 3.02$, $p = .08$, $\eta^2 = .01$]. Separate RM-ANOVA's were run to determine specifically where changes occurred during the school day.

Overall significant differences were found from pre to post time spent in MVPA in PE, lunch & recess, and classroom time ($p < .01$; see Table 3). Total minutes of SLPA significantly increased within lunch and recess, and specials ($p < .01$), while decreasing

during classroom minutes ($p < .01$; see Table 4). Tables 3 and 4 also report the change in MVPA and SLPA as a percent of total minutes spent within each category (PE, lunch and recess, classroom time, and specials; Table 2). For example, total lunch and recess time increased from pre (51 minutes) to post (60 minutes), so one might expect to see an increase in the minutes of MVPA. However, when taking into account the percent of minutes in MVPA, lunch and recess increased from 6.8% of total time in MVPA to 7.6%, representing an 11.7% increase. Effect sizes were small-to-moderate indicating meaningful increases in PA.

The HKCs did not have a pre-measurement as none of the six schools offered free after-school PA opportunities prior to the BHC program. Since there was only a post measurement of the HKCs the amount of PA time offered during programming went from zero in all schools to an average of 8.69 minutes of MVPA, and 53.63 minutes of SLPA. MVPA accounted for 14% of the total time spent in the HKCs ($n = 24$).

MANCOVA results revealed that MVPA varied by ethnicity Pillai's Trace = .15, $F(24, 1148) = 1.88$, $p < .01$, $\eta^2 = .04$, but not by gender Pillai's Trace = .01, $F(4, 284) = .06$, $p = .99$, $\eta^2 = .01$, or the intersection of gender and ethnicity Pillai's Trace = .04, $F(24, 1148) = .52$, $p = .97$, $\eta^2 = .01$.

Follow up post hoc tests revealed that changes in lunch & recess MVPA [$F(6, 294) = 2.77$, $p < .01$, $\eta^2 = .06$, *Adj.* $R^2 = .08$], classroom MVPA [$F(6, 294) = 2.42$, $p < .05$, $\eta^2 = .05$, *Adj.* $R^2 = .04$], and specials MVPA [$F(6, 294) = 4.40$, $p < .001$, $\eta^2 = .09$, *Adj.* $R^2 = .09$] were significantly different by ethnicity. However, MVPA in PE did not differ by ethnicity ($p = .11$). Further investigation revealed that African American students significantly

increased MVPA minutes more than their Caucasian ($p < .01$) and other ($p < .001$) counterparts in lunch and recess, classroom time, and specials.

MANCOVA results revealed that SLPA significantly varied by ethnicity Pillai's Trace = .25, $F(24, 1144) = 3.20$, $p < .001$, $\eta^2 = .06$ and the intersection of gender and ethnicity Pillai's Trace = .13, $F(24, 1144) = 1.64$, $p < .05$, $\eta^2 = .03$, but not by gender alone Pillai's Trace = .01, $F(4, 283) = .06$, $p = .92$, $\eta^2 = .01$.

Follow up post hoc tests revealed that change in PE SLPA [$F(6, 286) = 16.74$, $p < .001$, $\eta^2 = .06$, *Adj.* $R^2 = .08$], and classroom SLPA [$F(6, 286) = 4.93$, $p < .001$, $\eta^2 = .09$, *Adj.* $R^2 = .08$] were significantly different by ethnicity. However, SLPA at lunch and recess ($p = .77$) and specials did not differ by ethnicity ($p = .23$). The interaction of gender and ethnicity also revealed significant changes in SLPA among students when participating in PE [$F(6,286) = 3.54$, $p < .01$, $\eta^2 = .07$], but not during lunch and recess ($p = .49$), classroom time ($p = .43$), or specials ($p = .36$). Further investigation revealed that African American students significantly decreased SLPA minutes in PE more than their Caucasian ($p < .001$) and Hispanic ($p < .05$) counterparts, while Caucasian students significantly increased their SLPA minutes during PE over those students who identified as other. During classroom time, post hoc tests revealed that Caucasian students significantly decreased their amount of SLPA minutes significantly more than their African American ($p < .001$) and other ($p < .001$) counterparts, while African American students significant decreased their SLPA during classroom time over their Hispanic counterparts ($p < .001$).

Parental and Educator PA

A RM-ANOVA was used to determine change over time in parental PA. The independent measure was time, while the dependent measures were pre and post MET-min

reported. In addition, a two-way ANOVA was run to determine the effects of gender and ethnicity on the change in parents' total MET-min. The dependent variable for this analysis was change in MET-min from T1 to T2 and the independent variables were gender and ethnicity.

The RM-ANOVA showed a significant overall change in MET-min of PA reported from pre to post [Pillai's Trace, $F(1,115) = 13.39$, $p < .001$, $\eta^2 = .10$; M_{pre} = 10,402 MET-min, M_{post} = 18,181 MET-min]. Using a two-way ANOVA there were no significant effects of gender and ethnicity on the change in MET-min reported $F(6,102) = .783$, $p = .59$, $\eta^2 = .04$.

Given the low number of educators who were included in the study a paired sample t-test was used to determine significant changes from pre to post. While educators reported change in MET-min of PA, it was not statistically significant ($p = .50$; M_{pre}=4015 MET-min, M_{post}=4849 MET-min). This could be due to a small sample size.

Discussion

The purpose of this study was to identify overall changes in student, parent, and educator PA during an 8-month CSPAP program, as well as student PA changes by locations within schools, and the influences of gender and race. BHC exemplified a complete CSPAP program by integrating all five components into a comprehensive PA reform initiative. While previous research has examined the effectiveness of individual components of CSPAPs (e.g., Pate & O'Neil, 2009), this study provides informative evidence about multiple components of a CSPAP. PE was the centerpiece supplemented with after school programming, during school activity opportunities in classrooms and at recess, staff engagement as facilitators and role models, and multiple points of engagement

with parents. From an ecological perspective, the initiative sought to influence interpersonal, intrapersonal, organizational, and community change.

The main goal of the initiative was to increase the amount of time that students spent in MVPA during the school day. This, in fact, occurred as students significantly increased their MVPA by 4.5 minutes from 7.37 to 11.67 minutes per day, representing a 58% increase. This improvement, while significant, can be viewed from different perspectives. On the one hand, adding an additional 4.5 minutes of MVPA to each students' time at school is important and its value from a public health perspective should not be overlooked. Although it does not seem considerable compared to the national recommendation of 60 minutes each day, it is a start. For example, an average of 4.5 minutes a day is equivalent to 22.5 additional minutes of MVPA per week. Given students in these schools often participate in one 30 minute PE class per week, this is equivalent to almost 1.5 additional PE classes (if you use the gold standard of 50% of PE time spent in MVPA). Over one school year this totals 810 minutes of MVPA, 27 separate bouts of 30 minutes of MVPA or an extra 54 PE classes. From a public health perspective, a 4.5-minute increase in MVPA per day also has beneficial effects. This increase totals 22.5 minutes a week, 90 minutes of MVPA a month, and over a 1000 minutes a year.

Of course, an extra 4.5 minutes of MVPA per day also has to be viewed in light of the links between PA and academic achievement, attention, behavior, and cognition. Although this study did not use a comparison group, or measure variables related to academic or cognitive performance, the links between PA and learning seem strong (Castelli, Hillman, Hirsch, Hirsch, & Drollette, 2011; Castelli, Centeio, Hwang, & Nicksic, in press; Donnelly et al., 2009; Hillman et al., 2009; Kamijo et al., 2011; Sallis et al., 1999;

Strong et al., 2005); hence, we might guess that a daily MVPA increase of nearly five minutes might reap benefits in an academic sense, in addition to health enhancement. In an era where urban children are often in low performing schools, increasing the amount of PA could potentially affect academic achievement as well as address looming health disparities. A randomized control trial seems highly warranted to determine whether these gains in MVPA are attributable to BHC and, if so, whether they concomitantly impact academic achievement.

This study also offers the unique ability to examine PA changes across the various places in the school environment where students spend time. Similar to other findings in this monograph multiple opportunities for PA matter (see Chen et al., 2014). In this present study students significantly increased their MVPA in PE, lunch/recess, and classrooms, with the most significant increases occurring in PE and classrooms, especially when calculated in comparison to the total time spent in school per day. In addition, SLPA in PE and classrooms stayed static, while significantly decreasing in lunch/recess. From a cost-benefit perspective, these data might suggest that all three locations represent viable school-based MVPA intervention sites.

Analyses of MVPA changes across ethnicities yielded some noteworthy results, especially in relation to African American students. African American students, for example, increased their MVPA significantly more than students from the other ethnic groups in classrooms, lunch/recess, and specials. Although they did not increase their MVPA in PE, they did decrease their SLPA in PE more than Caucasian or Hispanic counterparts. These results might suggest that the activities inside BHC may have been particularly attractive to African American students and encouraged them to participate in

more school-based PA. In light of the vast urban and ethnic health disparities reported in health literature, interventions that have potential to be effective with populations that are disproportionately affected by health disparities ought to be investigated further.

Interestingly, there were virtually no significant differences by gender in total MVPA/SLPA or by MVPA/SLPA by location in the school. By and large, girls' MVPA/SLPA seemed to be consistent with the male students. This is noteworthy in contrast to the PA and school PE literature documenting girls' decreased participation in school PE and PA generally compared to boys. PA disparities between boys and girls seem to be especially wide in communities with high numbers of low socio-economic and minority populations. The results in this study seem to contradict wider research trends and again illustrate the need for additional inquiries, both quantitative and qualitative. It would be interesting to identify whether this contradiction would persist using a randomized control trial design. It would likely be equally illuminating to conduct ethnographic fieldwork to understand whether there were differences in the ways that boys and girls perceived and appreciated different aspects of the program.

The MVPA results for the HKCs should also be viewed in context. Overall, students on average spent 8.69 minutes (14%) in MVPA and 53.63 minutes (86%) in SLPA activity during each session. However, the HKCs were designed with four parts: 15 minutes – snack and nutrition education, 20 minutes – mileage club, 20 minutes – active games, and 5 minutes – review and messaging. Hence, in the typical session only 40 minutes were ideally devoted to activity, meaning that on average students spent 21.7% of the available activity time in MVPA and 78.3% in SLPA. While this is positive in the sense that these students had no opportunities for before or after school PA prior to BHC, it is also concerning that

MVPA rates are so low, not even coming close to the 50% MVPA benchmark for PE classes. Moreover, only 25 fourth grade students across the six schools attended HKCs pre/post. Therefore, while HKCs in this context provided a marginal amount of MVPA, they were also plagued by sedentary activities and poor attendance. Future research ought to examine successful strategies to increase MVPA and attendance.

One of the most unique aspects of this study was the connections between the BHC school based initiative and the PA patterns of parents/guardians and school educators. The program intersected with parents in many ways from presentations at parent/teacher conferences and school board meetings, hosting family fitness nights, sending regular correspondence to parents about the program and healthy living education, and implementing healthy living homework for students to complete with their parents/guardians. Results suggest that parents increased their PA levels significantly, increasing their daily MET-min count from an average of 10,402 to 18,181. In many respects, parents reported higher activity gains than their children. Of course, parent PA was measured through self-report techniques so the results need to be considered with caution. However, there does seem to be some bidirectional impact between the school initiatives and adult PA levels. Additional inquiries may be able to better understand the causal links between the two and explain the mechanisms that may have resulted in adults increasing their PA. Maybe they wanted to support their children's school reform, maybe they felt pressured when their children came home emphasizing activity, or maybe the educational outreach had a substantial impact? More inquiries are needed to unravel those details.

Although not to the same degree, similar results occurred for the school educators. Their self-reported MET-mins increased 17% from 4,015 to 4,849. These results were not significant, but that was likely attributed to the fact that there were only 22 administrators and fourth grade teachers at the six research schools. While not significant, the raw data suggests that in a larger trial educators' PA may have increased commensurate with both students and parents, which, again, would leave open the debate as to why educators' health behaviors may have changed as a result of simply offering students more at-school PA opportunities and encouragement.

To our knowledge, this research provides several unique insights into the CSPAP literature. It examines total school day PA using objective methods (accelerometers for students) and differentiates results by school location, gender and race, allowing readers a more nuanced understanding of impact across the school and student subgroups. It also connects student PA changes with those self-reported by both parents and educators. Understanding the impact of multiple components of CSPAP on school PA levels is in its infancy and this study begins sheds light on this issue. As an initial investigation, it ties together a number of important issues including: how much additional total PA will result from a CSPAP intervention? Which segment of the school environment will interventions be most successful? Will boys/girls and different ethnic groups benefit equally? How might parents and educators PA be impacted during a CSPAP intervention. Although some preliminary answers to these questions are offered in this study, it also opens the door to the need for more inquiries that embrace more stringent quantitative designs and embed qualitative approaches to help answer the "why" behind much of the quantitative data.

Acknowledgments

We would like to thank Blue Cross Blue Shield of Michigan and the Blue Cross Blue Shield of Michigan Foundation for their generous financial support of this research.

References

American Alliance for Health, Physical Education, Recreation and Dance [AAHPERD]. (2013). *Comprehensive school physical activity programs: helping students achieve 60 minutes of physical activity each day* [Position statement]. Reston, VA: Author.

Anderssen, N., & Wold, B. (1992). Parental and peer influences on leisure-time physical activity in young adolescents. *Research Quarterly for Exercise and Sport, 63*, 341-348.

Bois, J.E., Sarrazin, P.G., Brustad, R.J., Trouilloud, D.O., & Cury, F. (2005). Elementary schoolchildren's perceived competence and physical activity involvement: The influence of parents' role modeling behaviours and perceptions of their child's competence. *Psychology of Sport and Exercise*, *6*(4), 381-397.

Brustad, R.J. (1996). Attraction to physical activity in urban schoolchildren: Parental socialization and gender influence. *Research Quarterly for Exercise and Sport, 67*(3), 316-323.

Carson, R. (2012). Certification and duties of a director of physical activity. *Journal of Physical Education, Recreation & Dance*, *83*(6), 16-29.

Castelli, D.M., Centeio, E.E., Hwang, J., Barcelona, J., Glowacki, E., Calvert, H., & Nicksic, H. (in press). The History of physical activity and academic performance research: Informing the future. *Monographs of the Society for Research in Child Development.*

Castelli, D., Hillman, C., Hirsch, J., Hirsch, A., & Drolette, E. (2011). FIT Kids: Time in target heart zone and cognitive performance. *Preventive Medicine, 52*(11), S55-S59.

Centers for Disease Control and Prevention [CDC]. (2010). *The association between school based physical activity, including physical education, and academic performance.* Atlanta, GA: U.S. Department of Health and Human Services.

CDC. (2011). *Physical activity and health*. Retrieved from http://www.cdc.gov/physicalactivity/everyone/health/index.html. Last access on: October 6th, 2014.

CDC. (2013). *Comprehensive School Physical Activity Programs: A Guide for Schools*. Atlanta, GA: U.S. Department of Health and Human Services

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Craig, C.L., Marshall, A.L., Sjostrom, M., Bauman, A.E., Booth, M.L., Ainsworth, B.E., . . . & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise, 35*(8), 1381–1395.

Donnelly, J. E., Greene, J. L., Gibson, C. A., Smith, B. K., Washburn, R. A., Sullivan, D. K., . . . Williams, S. L. (2009). Physical activity across the curriculum (PAAC): A randomized controlled trial to promote physical activity and diminish overweight and obesity in elementary school children. *Preventive Medicine, 49*, 336-341.

Dorsch, T.E., Smith, A.L., & McDonough, M.H. (2009). Parents' perceptions of child-to-parent socialization in organized youth sport. *Journal of Sport and Exercise Psychology, 31*, 444-468.

Erwin, H., Beighle, A., Carson, R. L., & Castelli, D. M. (2013). Comprehensive school-based physical activity promotion: A review. *Quest*, *65*(4), 412-428.

Faulkner, G. E., Buliung, R. N., Flora, P. K., & Fusco, C. (2009). Active school transport, physical activity levels and body weight of children and youth: a systematic review. *Preventive medicine*, *48*(1), 3-8.

Freedson, P.S., Melason Jr, E.L., & Sirard, J. (1998) 'Calibration of the computer science and applications, Inc. accelerometer'. *Medicine and Science in Sports and Exercise 30*(5), 777–81.

Hillman, C. H., Pontifex, M. B., Raine, L. B., Castelli, D. M., Hall, E. E., & Kramer, A. F. (2009). The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children. *Neuroscience*, *159*, 1044-1054.

Institute of Medicine (2013). *Educating the Student Body: Taking Physical Activity and Physical Education to School.* Washington, DC: National Academy

IPAQ (2014). Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)—Short and Long Forms. IPAQ Web site. http://www.ipaq.ki.se/downloads.htm. Last access on: October 6th, 2014.

Jago, R., & Baranowski, T. (2004). Non-curricular approaches for increasing physical activity in youth: a review. *Preventive medicine*, *39*(1), 157-163.

Joens-Matre, R. R., Welk, G. J., Calabro, M. A., Russell, D. W., Nicklay, E., & Hensley, L. D. (2008). Rural–urban differences in physical activity, physical fitness, and overweight prevalence of children. *The Journal of Rural Health, 24*(1), 49-54.

Kamijo, K., Pontifex, M.B., O'Leary, K.C., Scudder, M.R., Wu, C.T., Castelli, D.M., Hillman, C.H. (2011). The effects of an afterschool physical activity program on working memory in preadolescent children. *Developmental Science, 14,* 1046-1058.

Lee, P.H., Macfarlane, D.J., Lam, T.H., & Stewart, S.M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 8, 115 doi:10.1186/1479-5868-8-115

McAlister, A.L., Perry, C.L., Parcel, G.S. (2008). How Individuals, Environments, and Health Behaviors Interact. In Glanz, K., Rimer, B.K., & Viswanath, K. (Eds.). *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed., pp.169-188). San Francisco: Jossey-Bass.

McMurrer, J. (2007). *NCLB year 5: Choices, changes, and challenges: Curriculum and instruction in the NCLB era*. Retrieved from Center on Education Policy website http://www.cep-dc.org/publications/index.cfm?selectedYear=2007

Melanson, E.L., Jr. & Freedson, P.S. (1995). Validity of the computer science and applications, Inc. (CSA) activity monitor. *Medicine and Science in Sports and Exercise*, *27,* 934-940.

Metzler, M. W., McKenzie, T. L., van der Mars, H., Barrett-Williams, S. L., & Ellis, R. (2013a). Health Optimizing Physical Education (HOPE): A new curriculum for

school programs—Part 1: Establishing the need and describing the model. *Journal of Physical Education, Recreation & Dance*, *84*(4), 41-47.

Metzler, M. W., McKenzie, T. L., van der Mars, H., Barrett-Williams, S. L., & Ellis, R. (2013b). Health Optimizing Physical Education (HOPE): A new curriculum for school programs—Part 2: Teacher Knowledge and Collaboration. *Journal of Physical Education, Recreation & Dance*, *84*(5), 25-34.

Michigan Department of Education [MDE], Michigan Department of Community Health, Governors Council on Physical Fitness, Health and Sports (2001). *The role of Michigan schools in promoting healthy weight*, a consensus paper (Lansing, MI, Michigan Department of Education).

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*, 215-219.

National Association for Sport and Physical Education. (2008). *Comprehensive school physical activity programs* [Position statement]. Reston, VA: Author.

Pate, R. R., Davis, M. G., Robinson, T. N., Stone, E. J., McKenzie, T. L., & Young, J. C. (2006). Promoting physical activity in children and youth a leadership role for schools: A scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Physical Activity Committee) in collaboration with the councils on Cardiovascular Disease in the Young and Cardiovascular Nursing. *Circulation, 114*, 1214-1224.

Pate, R. R., & O'Neill, J. R. (2009). After-school interventions to increase physical activity among youth. *British Journal of Sports Medicine, 43*(1), 14-18.

Portney, L.G., & Watkins, M.P. (2009). *Foundations of clinical research: Applications to practice* (3rd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Sallis, J.F., Alcaraz, J.E., McKenzie, T.L., Hovell, M.F., Kolody, B., & Nader, P.R. (1992). Parental behavior in relation to physical activity and fitness in 9-year-old children. *American Journal of Diseases of Children, 146*, 1383-1388.

Sallis, J. F., McKenzie, T. L., Alcaraz, J. E., Kolody, B., Faucette, N., & Hovell, M. F. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. Sports, Play and Active Recreation for Kids. *American Journal of Public Health, 87*, 1328-1334.

Sallis, J.F., McKenzie, T.L., Kolody, B., Lewis, M., Marshall, S., & Rosengard, P. (1999). Effects of health-related physical education on academic achievement: Project SPARK. *Research Quarterly for Exercise Sport*, *70*(2), 127-134.

Sallis, J.F., Owen, N., & Fisher. E.B. (2008). Ecological Models of Health Behavior. In Glanz, K., Rimer, B.K., & Viswanath, K. (Eds.). *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed., pp.465-485). San Francisco: Jossey-Bass.

Seefeldt, V., Malina, R.M., & Clark, M.A. (2002). Factors affecting levels of physical activity in adults. *Sports Medicine, 32*(3), 143-168.

Shape America. (2014). *Let's Move Active Schools*. Retrieved from http://www.shapeamerica.org/prodev/workshops/lmas/. Last access on October 6th, 2014.

Stokols, D. (1992). Establishing and maintaining healthy environments: toward a social ecology of health promotion. *American Psychologist, 47*(1), 6.

Strong, W.B., Malina, R.M., Blimkie, C.J.R., Daniels, S.R., Dishman, R.K., Gutin, B., . . . & Trudeau, F., (2005). Evidence based physical activity for school-age youth. *The Journal of Pediatrics, 146*(6), 732-737.

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise, 40*(1), 181-188.

United States Department of Health and Human Services [USDHHS]. (2008). *2008 physical activity guidelines for Americans.* Washington, DC: Author. Retrieved from http://www.health .gov/PAguidelines/pdf/paguide.pdf. Last access on: October 6th, 2014.

USDHHS. (2012). *Physical activity guidelines for Americans mid-course report: Strategies to increase physical activity among youth.* Washington, DC: Author. Retrieved from http://www.health.gov/paguidelines/midcourse/PAG_Mid-course_Report.pdf. Last access on October 6th, 2014.

U.S. White House Task Force on Childhood Obesity (2010). *Solving the problem of childhood obesity within a generation.* White House Task Force on Childhood Obesity Report to the President. Washington, DC: Executive Office of the President of the United States.

Figure 1. Social ecological framework as described by Sallis et al. (2008).

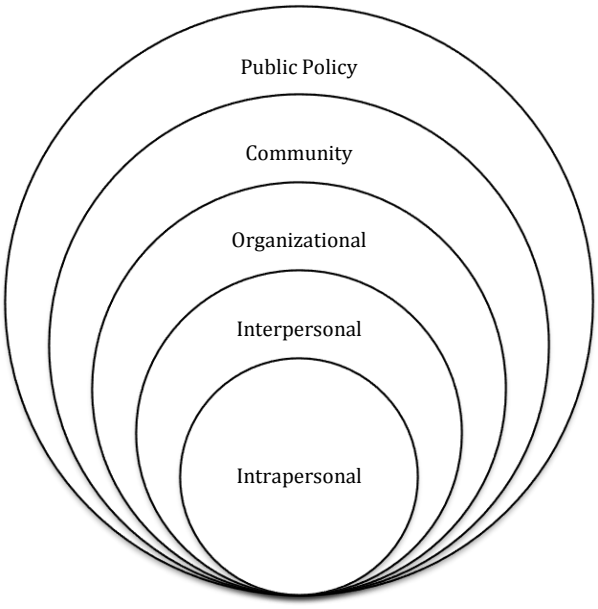

Table 1.

CSPAP and SEF alignment

CSPAP Component	SEF level of influence
Physical Education	Intrapersonal
PA during school	Intrapersonal, Organizational
PA before and after school	All levels
Staff involvement	Interpersonal, Organizational
Family & community engagement	All levels

Table 2. Average Number of Minutes During the School Day (Each School is Weighted Evenly)

	Pre Average		**Post Average**	
	Minutes	**Percent**	**Minutes**	**Percent**
Physical Education	15	4%	14	3%
Lunch and Recess	51	13%	60	13%
Classroom	302	76%	280	62%
Specials	28	7%	35	8%
Healthy Kids Club	0	0%	63	14%
Total	396	100%	452	100%

Table 3. RM-ANOVA results for students' MVPA within physical education, recess, classroom time, and specials.

	***F* -Value**	***P* level**	η^2	M_{pre} (*SD*)	M_{post} (*SD*)	**Percent of Minute Increase**	**Percent Change in Category**
Physical Education	(1,300) = 17.61	< .001	.06	1.10 (1.11)	1.70 (1.68)	54.5%	65.7%
Lunch & Recess	(1,300) = 21.68	< .001	.07	3.46 (4.51)	4.55 (4.38)	31.5%	11.7%
Classroom Time	(1,300) = 45.86	< .001	.13	2.70 (3.71)	4.27 (4.51)	58.1%	68.5%
Specials	(1,300) = 1.31	= .25	.01	.39 (.72)	.32 (.79)	--	--

Note. Percent of minute increase represents the increase in total MVPA minutes from pre to post. The Percent change in category represents the amount of time spent in MVPA as a percent of total category time from pre to post.

Table 4. RM-ANOVA results for students' SLPA within physical education, recess, classroom time, and specials.

	F **-Value**	***P*** **level**	η^2	M_{pre} **(SD)**	M_{post} **(SD)**	**Percent of Minute Change**	**Percent Change in Category**
Physical Education	(1,300) = 2.58	= .11	.01	13.98 (9.11)	12.88 (7.19)	--	--
Lunch & Recess	(1,300) = 55.78	< .001	.16	49.72 (11.64)	54.33 (10.97)	+ 9%	- 7%
Classroom Time	(1,300) = 87.50	< .001	.23	299.28 (37.59)	278.42 (22.99)	- 7%	+ .3%
Specials	(1,300) = 69.67	< .001	.19	27.96 (13.40)	34.81 (10.13)	+ 25%	+ .4%

Note. Percent of minute increase represents the increase in total SLPA minutes from pre to post. The Percent change in category represents the amount of time spent in SLPA as a percent of total category time from pre to post.