Health Empowers You: Impact of a School-Based Physical Activity Program in Elementary School Students, Georgia, 2015-2016

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BACKGROUND: Most youth in the United States do not meet the recommended 60 minutes of daily physical activity (PA). The school environment offers an opportunity to engage students in PA. The purpose of this study was to evaluate the impact of a comprehensive school-based physical activity program on student PA across student-level and school-level characteristics.

METHODS: PA levels from 3294 fourth grade students in 24 intervention schools and 7 control schools in metropolitan Atlanta, Georgia were measured during the 2015-2016 academic year. PA measures included daily steps in school, steps taken in physical education class (PE), and percent of PE class time spent in moderate-to-vigorous physical activity (MVPA). Intervention effectiveness was assessed using generalized estimating equations adjusting for sex and school-level socioeconomic status (SES).

RESULTS: After adjusting for sex and school-level SES, intervention students had significantly higher increases in average daily steps (p < .05), steps taken in PE (p < .01), and percent of PE class spent in MVPA (p < .01) than control students.

CONCLUSIONS: Our findings demonstrate the effectiveness of CSPAPs in increasing PA. Further research using randomized controlled trials of large-scale implementations, longer follow-up periods, and more diverse student sample is warranted.

Keywords: physical fitness and sport; child and adolescent health; public health.


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Regular physical activity in children is important for promoting health and fitness.1 Children who participate in regular physical activity typically have higher levels of cardiorespiratory fitness, stronger muscles and bones, lower body fatness, less prevalence of chronic diseases, and reduced symptoms of anxiety and depression.2 Additionally, children who are physically active are more likely to become active adults, and this may mitigate obesity risk later in life.3

The 2008 Physical Activity Guidelines for Americans, developed by the US Department of Health and Human Services, recommends that children and adolescents engage in at least 60 minutes or more physical activity daily, most of which should be moderate-to-vigorous intensity.1 In 2016, only 21.6% of US youth aged 6 to 19 years old met this recommendation on at least 5 days per week.4 Schools have been identified as the ideal setting for promotion and improving youth physical activity for reasons such as the length of time youth spend at school (8-9 hours a day and 5 days a week), over 95% of youth are enrolled in schools, and the fact that physical activity...
and physical education are core components of a complete American education. Additionally, there are a number of different physical activity opportunities available throughout a typical school day. Students can engage in physical activity before/after school, during recess and physical education classes, incorporated into classroom teaching and during breaks, and through programs outside of school such as sports and clubs. Interventions that target the whole school, incorporating grade level teachers, physical education teachers, and the administration are more successful at increasing student physical activity than interventions focused solely on the classroom environment.

The US Centers for Disease Control and Prevention (CDC) recommends that schools adopt a comprehensive school physical activity program (CSPAP) to increase school day physical activity. CSPAP is a multicomponent approach to providing sufficient physical activity opportunities throughout the school day to enable students to achieve 60 minutes of moderate-to-vigorous physical activity (MVPA) daily, as well as equip students with the knowledge and skills to be physically active throughout for a lifetime. A CSPAP represents coordination and synergy across 5 main components: quality physical education as the foundation, physical activity before and after school, physical activity during school, staff involvement, and family and community engagement.

A recent meta-analysis of 14 studies examining the effects of CSPAPs on youth total daily physical activity found only one study incorporated all 5 components of the CSPAP model; and study authors recommended further investigation of programs that have all 5 components of the CSPAP model. HealthM Powers, a nonprofit organization based in Atlanta, Georgia, has developed a program called “Health Empowers You!” which was designed based on the CSPAP model. External evaluation of “Health Empowers You!” has demonstrated improvements in school practices and policies such as the daily integration of physical activity into the classroom, as well as student-level outcomes such as improved fitness, health knowledge, health behaviors, and healthy weight status.

While “Health Empowers You!” has been previously evaluated for certain indicators, there has not been assessment of longitudinal objective physical activity measures such as daily steps or time spent in MVPA, as well as assessments of the impact of the intervention across sex, race/ethnicity, and school SES, have not been previously examined. The objectives of this study were to evaluate the effectiveness of “Health Empowers You!” on physical activity in a large sample of fourth grade students using objective measures of physical activity across sex, school SES, and race/ethnicity.

**METHODS**

**Intervention and Participants**

The “Health Empowers You!” intervention components are comprised of the following: establishment of a school health team, collection of student physical activity data, staff implementation trainings, resource access and availability, and technical assistance. Further details regarding the specifics of “Health Empowers You!” are described elsewhere.

HealthM Powers personnel operated directly with metropolitan Atlanta district health and physical education coordinators to facilitate the school recruitment process. Together, they contacted PE teachers within their respective districts and obtained a convenience sample of elementary schools. If a school agreed to participate, all fourth grade classrooms within the school participated in the intervention, however data was only collected if consent was obtained from the students’ parents. Intervention training began in October 2015 with 28 schools enrolled. Funding for control schools was secured past the intervention recruitment period. For this reason, data collection and measurement of control schools did not occur until January 2016. Seven control schools agreed to participate in the study. School staff were informed to continue with regularly scheduled activities to allow for normal physical activity behavior to be measured. For both intervention and control schools, HealthM Powers conducted brief in-person tutorials on data collection for both fourth grade and physical education teachers. Teachers received $200 compensation for their participation in the study.

The study population consisted of Georgia public elementary schools in 3 metropolitan Atlanta counties that offered fourth grade classes during the 2015-2016 academic year; the intervention schools were in 2 school districts and control schools were recruited from a separate third district. Among the 28 intervention schools and 7 control schools, 3396 students provided sufficient data for at least one physical activity outcome.

**Instrumentation and Procedure**

The intervention was evaluated through the collection of 2 different data sources: pedometers and Gopher FITstep Pros (GFSP). Pedometers (MyInertia, Pebble, Green Bay, WI) were used to measure daily steps. Pedometers provide accurate, objective measures of steps in both free-living and research settings. The GFSP and pedometer models were selected because they are considered accurate and appropriate for measuring physical activity in children. Teachers assisted students with the placement of the pedometer on their waist as they walked into class at the beginning of the school day, and removed the device as they left the classroom at the
end of the school day. Students were measured for one complete 5-day school week once a month for 5 consecutive months, resulting in 25 measures of daily steps measures for each student. A subsample of 111 students were given a GFSP to measure the number of steps taken during physical education class (“steps in PE”) and the amount of time spent engaging in MVPA during physical education class (“MVPA time”). Each GFSP was calibrated to a step per minute (SPM) threshold of 110. Once a student surpassed 110 SPM, the GFSP began recording MVPA time. If a student fell below the 110 SPM, the GFSP stopped recording. Steps in PE were measured continuously while the GFSP was worn. Upon entering physical education class, 4 students clipped the GFSP at waist level and participated in normal PE activities for the entirety of the class period. Once class ended, PE teachers retrieved the devices, downloaded the data, and stored the GFSPs. Students were measured once a month for 5 consecutive months, resulting in 5 measures of steps in PE and MVPA time for each student.

Classroom teachers provided rosters of participating students’ identification number, age, and sex, as well as the length of PE classes in minutes at their school to allow for calculation of the percent of PE class spent in MVPA. While sex and age data were available at the individual-level, the Georgia Department of Education (DOE) provided race/ethnicity and socioeconomic status (SES) data at the school-level. The primary indicators used were the number of students eligible for free and reduced-price lunch (FRL), which was used to estimate school SES, and number of students enrolled in fourth grade by race/ethnicity.

There are 3 primary outcomes of interest in this study: (1) average daily steps, (2) average steps in PE class, and (3) average percent of PE class time spent in MVPA. The intervention was the exposure variable of interest. Race/ethnicity was dichotomized using the percent of white students at a school (greater than or equal 25%), and SES was dichotomized using the percent of students eligible for FRL (greater than or equal to 50%).

Data Analysis

From an initial sample of 3396 students, 22 were excluded for missing sex information. Students missing step data for all 25 days were excluded, and students with less than 500 steps in a day or greater than 15,000 in a day were deemed implausible and were excluded (N = 80). The final analytic sample consisted of 3294 students with daily step data, 111 of which provided data on steps in PE and MVPA time.

Descriptive statistics regarding sex, race, and school-level SES were assessed. Significant differences between intervention and control group physical activity measures were assessed with 2 sample $t$ tests for all variables except sex, which was assessed using a chi-square test. Given that students were clustered within schools, multilevel generalized estimating equations (GEE) were used to model the 3 physical activity outcomes while accounting for this clustering as well as adjusting for sex, school-level race/ethnicity, and school-level SES. The models were assessed for confounding, interaction, and collinearity. Significance was established using a 2-tailed $\alpha = .05$ for all statistical tests. Analyses were conducted using Statistical Analysis Software (SAS), Version 9.4 (Cary, NC).

RESULTS

Intervention and control schools did not differ significantly by sex or percent of students that were white, however control schools had a significantly lower average proportion of students eligible for the FRL program than intervention schools (Table 1). Intervention students increased their average daily steps per week for each week, as well as had significantly higher average daily steps per week than control students had for each week other than Week 2. This is represented graphically in Figure 1. Intervention students had significant increases in both the average number of PE steps and the average percent of time in PE class spent in MVPA with each consecutive measurement (Table 1). Compared to control students, intervention students averaged 462 more steps in PE Class 4 and 715 more steps in PE Class 5 and these differences were statistically significant ($p < .05$). Additionally, the average percent of PE class spent in MVPA was significantly higher among intervention students during Class 3, Class 4, and Class 5 ($p < .05$). These trends are represented graphically in Figure 2.

The dichotomized variable for the percent of students that were white at a school was perfectly collinear with the dichotomized variable for the percent of students eligible for FRL. As a result, the race/ethnicity variable was removed from the GEE models. After adjusting for sex and school SES, the estimated weekly change in daily steps was 140.3 steps higher in intervention students than in control students (Table 2). The estimated baseline steps in PE class was 476.6 steps lower in intervention students; however, the estimated rate of PE step change for each class was 238.1 higher in intervention students than in control students. Similarly, the estimated baseline percent of PE class spent in MVPA was 7.6 percentage points lower in intervention students; however, the estimated difference in the rate of percent of PE class spent in MVPA change for each class was 4.6 percentage points higher in intervention students than in control students.
Table 1. Selected Characteristics and Physical Activity Results, Georgia, 2015-2016

<table>
<thead>
<tr>
<th>Variable</th>
<th>All (N = 3294)</th>
<th>Intervention (N = 2614)</th>
<th>Control (N = 680)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31 schools</td>
<td>24 schools</td>
<td>7 schools</td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1703 (51.7%)</td>
<td>1365 (52.2%)</td>
<td>338 (49.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>1591 (48.3%)</td>
<td>1249 (47.8%)</td>
<td>342 (50.3%)</td>
</tr>
<tr>
<td>Mean percent White, *% (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean percent FRL, †% (SD)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Physical activity results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average daily steps by week, mean (SD)</td>
<td>68.5% (28.8)</td>
<td>71.9% (26.4)</td>
<td>55.4% (33.7)</td>
</tr>
<tr>
<td></td>
<td>Week 1</td>
<td>3242 (695)</td>
<td>3266 (701)</td>
</tr>
<tr>
<td></td>
<td>Week 2</td>
<td>3285 (682)</td>
<td>3278 (669)</td>
</tr>
<tr>
<td></td>
<td>Week 3</td>
<td>3414 (586)</td>
<td>3549 (528)</td>
</tr>
<tr>
<td></td>
<td>Week 4</td>
<td>3529 (591)</td>
<td>3630 (571)</td>
</tr>
<tr>
<td></td>
<td>Week 5</td>
<td>3584 (601)</td>
<td>3699 (567)</td>
</tr>
<tr>
<td>Average steps in PE class, § mean (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>2250 (913)</td>
<td>2170 (1038)</td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td>2214 (712)</td>
<td>2250 (763)</td>
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<tr>
<td></td>
<td>Class 3</td>
<td>2434 (767)</td>
<td>2496 (808)</td>
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<tr>
<td></td>
<td>Class 4</td>
<td>2723 (853)</td>
<td>2840 (1043)</td>
</tr>
<tr>
<td></td>
<td>Class 5</td>
<td>3045 (950)</td>
<td>3225 (995)</td>
</tr>
<tr>
<td>Average percent of PE class in MVPA, ‡% (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>33.8% (13.4)</td>
<td>33.3% (15.1)</td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td>35.3% (11.1)</td>
<td>35.2% (12.7)</td>
</tr>
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<td></td>
<td>Class 3</td>
<td>37.7% (15.1)</td>
<td>39.3% (16.1)</td>
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<td></td>
<td>Class 4</td>
<td>41.5% (16.3)</td>
<td>43.3% (18.1)</td>
</tr>
<tr>
<td></td>
<td>Class 5</td>
<td>43.9% (20.4)</td>
<td>48.3% (21.7)</td>
</tr>
</tbody>
</table>

FRL, free and reduced price lunch; MVPA, moderate-to-vigorous physical activity; PE, physical education.
* Mean percent of fourth grade students that are white at each school.
† Mean percent of total school population that is eligible for the FRL program.
§ Indicates a statistically significant (p < .05) 2-sample t test or chi-square test comparing the difference between intervention and control measures.
‡ One hundred and eleven students provided sufficient data; 83 students in intervention schools and 28 students in control schools.

DISCUSSION

The purpose of this study was to examine the effect of “Health Empowers You!” on 3 physical activity measures in fourth grade students across metropolitan Atlanta, Georgia. The results of this nonrandomized controlled trial indicate that “Health Empowers You!” significantly increased average daily steps, steps in PE class, and MVPA time in PE class. While a previous study has examined the effect of CSPAP on school day step counts in children, this is the first study to examine efficacy of a CSPAP-modeled intervention in a large sample of elementary school-aged children throughout the school year using multiple measures of physical activity and a control group for comparison.

Compared with previous studies in elementary school-aged children with multicomponent physical activity intervention methods, the results of this study indicate that the “Health Empowers You!” intervention has a number of distinct features. First, the effect of the intervention increased physical activity levels for students regardless of sex or school-level SES. In the United States, boys ages 6-11 are more physical activity than girls ages 6-11. While this sex-based disparity in physical activity among youth is not new, recent findings have suggested that influences on physical activity from the school environment may be weaker on girls compared to boys. In addition, previous studies have found weaker effects of school-based physical activity programs in low SES schools compared to higher SES schools. Our results indicate that “Health Empowers You!” was effective in improving physical activity similarly across both sex and school-level SES.

There are at least 3 strengths of this analysis. First, data was collected from large number of schools and students, which enhances the generalizability of the results. Second, the comparison of intervention students to control students allows for stronger interpretation of physical activity outcomes attributable to the intervention. Lastly, physical activity data was collected from September to May, which allowed for examination of the effect of the intervention over the course of an academic year.

While the results of this study are promising for the effectiveness of the “Health Empowers You!” intervention, there are a number of limitations that should be noted. First, the control schools were added to the study later than intervention schools, resulting in differences in timing of data collection. Second, control schools were of significantly higher SES than intervention schools. While we were able to control for this difference at the school-level in the analysis, a more comparable control group would provide stronger interpretations of intervention effectiveness. Third, individual-level data on SES and ethnicity were not available for this study. However, validated proxies at the school-level were used and can inform future studies about likely trends in physical activity outcomes between schools of varying ethnicities and SES status. Fourth, our measures of race/ethnicity and SES where perfectly collinear, therefore ethnicity was dropped from all regression model analysis. Future school-based intervention studies should consider alternative forms of measuring race/ethnicity. Fifth, the subsample of student MVPA activity was relatively small, especially of control students. However, given that strong significant differences were observed between intervention and control student MVPA activity, a larger sample size would likely support our results. Lastly, while physical activity throughout the school day and physical activity were examined in this study, other areas of physical activity such as before and after school and during recess were not specifically examined in this study. For a fuller evaluation of the intervention’s effect on physical activity, a larger sample size would likely support our results.
Figure 1.  Mean Daily Steps by Week for Intervention and Control Students, Georgia, 2015-2016

Figure 2. (a) Average Steps in PE by Week*. (b) Average Percent of PE Spent in MVPA by Week*
activity, future research should measure all physical activity components of the CSPAP model.

Future research can further improve upon this analysis. First, a larger, diverse sample with a more comparable control group or a randomized controlled trial would allow for stronger interpretation of the outcome. Follow-up periods that extend beyond one school year would elucidate the long-term effectiveness and fidelity of the intervention. While cost is an obstacle in any study, a larger sample of MVPA steps and MVPA time measures would provide further insight into the effect of the intervention on this physical activity measure. Assessing the effect of this intervention on academic and social/behavioral outcomes would likely improve the receptiveness of schools to future intervention implementation. Future research in school-based physical activity interventions should focus on the specifics of the program that are effective in changing physical activity behaviors. The “Health Empowers You!” model is comprised of 5 components, but they were not individually assessed in this analysis. Determining the various parts of the intervention that are most effective may further improve the efficacy of future school-based physical activity programs. The implications of these findings suggest that the “Health Empowers You!” intervention is effective in increasing school-based physical activity. These results further suggest that whole school-based physical activity interventions based on the CSPAP model are effective in producing positive health and fitness benefits in children. Leaders in school curriculum and policy makers should consider the implementation of validated school-based physical activity programs.

**IMPLICATIONS FOR SCHOOL HEALTH**

Children who meet federal physical activity guidelines are typically healthier and have higher levels of fitness than children who do not. However, current data indicate the majority of youth in the US do not meet these guidelines. Due to the fact that most youth spend the majority of the weekday in school, all opportunities for students to be physically active through the school day should be explored. The CDC recommends that schools adopt a comprehensive school physical activity program, and they provide guidance documents and resources for schools and school districts to develop, implement, and evaluate these programs.20 The findings of this study further suggest that CSPAP-modeled interventions can be effective in increasing student physical activity levels, and these findings may assist academic leadership and policymakers as they aim to enact strategies to improve student physical activity and health.

**Human Subjects Approval Statement**

The study protocol was approved by each school district’s Institutional Review Board, and participants in this study provided assent and parents/guardians provided written informed consent to participate in the study.

**Conflict of Interest**

The authors have no conflict of interest to report. One of the authors, Christi Kay, is President of HealthMPowers, Inc.

**REFERENCES**