Physical Activity to reduce Obesity in Elementary School Children

Amanda N. Szabo-Reed, Ph.D.
Assistant Research Professor
Internal Medicine
Center for Physical Activity and Weight Management
Cardiovascular Research Institute
The University of Kansas Medical Center
Prevalence of Overweight and Obesity in Youth Aged 2-19, 2011-2012

% of Youth Population

- Overall
- 2-5y
- 6-11y
- 12-19y

- Overweight
- Obese

Ogden CL, et al. JAMA 2014 CDC, National Health and Nutrition Examination Survey
Childhood Obesity


Schools = Kids
Schools Provide Opportunities

- Children go to school
- Permanent facility/Perpetuity
- Administration can “demand” uniformity
- Educated workforce used to delivering curriculums and evaluating outcomes

- Have health mandated program but, lack expertise for design and implementation
- Extended contact with children
  - 8 hours/d
  - 5d/wk
  - 9 months/yr
Schools are Sedentary

• Bus ride can be > 60 min each way
• Recess and physical education has declined to levels that cannot provide adequate stimulus (energy expenditure) for fitness or to protect against fatness
• Motor time off task is discouraged and disciplined
• Traditional teaching paradigm- sit down and be quiet
Frequency of School PE is Low

<table>
<thead>
<tr>
<th></th>
<th>Elementary</th>
<th>Middle</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requires Daily PE</td>
<td>3.6%</td>
<td>3.4%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Requires PE at least 3 days per week</td>
<td>15.3%</td>
<td>8.5%</td>
<td>5.9%</td>
</tr>
</tbody>
</table>

Results from the School Health Policies and Practices Survey, 2014
Schools Present Challenges

Schools appear to be ideal intervention sites, but:

- Difficult to obtain permission
- Not tolerant of biological samples (i.e. blood)
- Not tolerant of infringement on classroom time
- Not tolerant of additional teacher time

- Frequently have poor facilities
- Rarely have “normal” 5day week
- PE and Recess time is limited
Physical Activity Across the Curriculum (PAAC)

A 3-year, randomized controlled trial of physical activity and academic achievement for elementary school children in grades 2 & 3

Major Aims of PAAC

• Increase physical activity by using classroom teachers to teach existing lessons incorporating physical activity

• Primary aim-
  ➢ Diminish increases in BMI

• Secondary aims-
  ➢ Determine association between physically active lessons and academic achievement
  ➢ Characterize metabolic syndrome
Design

• Cluster randomized, controlled trial N=22 schools
• 3 year intervention
• Grades 2&3
• Target 90 minutes of moderate to vigorous physical activity/wk
• Use classroom teachers to deliver existing academic lessons using physical activity
Socioecological system of PAAC

Intervention Targets: Decrease BMI of 2nd and 3rd grade students

Use classroom teachers to deliver existing academic lessons using physical activity

Include the thoughts of Principles, School Administrators and Teachers in the design of PAAC
The PAAC Program

• A classroom-based approach to reduce sedentary behavior while maintaining the focus on academics

• NO DECREASE in academic instruction time

• PAAC is a technique to deliver existing academic instruction through movement
Conceptual Framework

- Minimal intervention
- Enhances learning
- No additional teacher preparation time
- No additional cost
- Easily perpetuated and replicated
- Desirable for both teacher and student (i.e., FUN)
- Students “must” participate in classroom lessons
The PAAC Program

- Integrate 10 minute periods of physical activity within academic lessons for a total of 100 min/wk
  - Language arts
  - Math
  - Science
  - History
Results
Average Days/wk School in Session vs Average Days/wk PAAC was Performed

Study Year

Days/Week

Ave days/wk in school

Ave days/wk PAAC
BMI Change Across 3 Years for PAAC Schools Receiving 75+ min of PA or < 75 min PA

9 schools 75+ min
5 school <75 min

P=0.0003

1.8±0.1

2.4±0.2
Academic Achievement- Individual Categories

Score

PAAC

CON

Donner Adjusted t for Each Category $p \leq 0.01$
Feedback from School Community

• 63% of teachers reported no barriers to incorporating physical activity into the classroom curriculum

• 26% reported time constraints caused by standardized testing, field trips, and substitute teachers as barriers to incorporating PAAC lessons

• <1% indicated the need for additional help from PAAC staff

Gibson et al. 2008
How was PAAC implemented?

Table 4: Ratings for Selected Characteristics of PAAC/Take 10® Lessons. Reported by Teachers (N = 75)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Not at all</th>
<th>At least once per week</th>
<th>2 or more times per week</th>
<th>On most days</th>
<th>Everyday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased PA* by incorporating it into lesson plans</td>
<td>1.3</td>
<td>9.3</td>
<td>13.3</td>
<td>54.7</td>
<td>21.3</td>
</tr>
<tr>
<td>Observed children enjoying classroom activities that incorporated PA</td>
<td>0.0</td>
<td>4.0</td>
<td>13.3</td>
<td>50.7</td>
<td>32.0</td>
</tr>
<tr>
<td>Used PA as part of the lesson plan to break the monotony of certain subjects</td>
<td>1.3</td>
<td>5.3</td>
<td>18.7</td>
<td>48.0</td>
<td>26.7</td>
</tr>
<tr>
<td>Employed physically active lessons to address various learning styles</td>
<td>6.7</td>
<td>13.3</td>
<td>21.3</td>
<td>42.7</td>
<td>16.0</td>
</tr>
<tr>
<td>Enjoyed becoming physically active through implementing movement into your lesson plans</td>
<td>4.0</td>
<td>10.7</td>
<td>17.3</td>
<td>44.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Enhanced your own sense of well-being on days that you incorporated PA into the curriculum</td>
<td>9.3</td>
<td>13.3</td>
<td>16.0</td>
<td>40.0</td>
<td>21.3</td>
</tr>
<tr>
<td>Used the notebook as a resource for active lessons</td>
<td>30.7</td>
<td>37.3</td>
<td>16.0</td>
<td>14.7</td>
<td>1.3</td>
</tr>
</tbody>
</table>

*PA = physical activity

Gibson et al. 2008
9-Months Post Intervention Teacher Survey
Summary of PAAC findings

• Physical activity can successfully be delivered through traditional academic lessons
• Those children that do 75 minutes or more of physical activity or more see less of an increase in BMI
• Children receiving PAAC lessons had greater academic achievement improvements than those in Control
• Sustainability post intervention is an issue.
How Does Physical Activity Influence Academic Achievement?

- Brain function (Plausible biological model?)
- Attendance at school
- Attention-to-task
- Body fatness
- Physical fitness
- Physical activity
- Parent characteristics, SES
- Other?
A 3-year, randomized controlled trial of physical activity and academic achievement for elementary school children

Donnelly et al., Physical activity and academic achievement across the curriculum (A + PAAC): rationale and design of a 3-year, cluster-randomized trial
A+PAAC Design- Emphasis on Academic Achievement

• Adequately powered, cluster randomized trial
• 17 elementary schools, (9 intervention, 8 control)
• Children from 2nd & 3rd grades followed 3 yrs. to 4th and 5th grades (682 children total)
• 20 minutes of A+PAAC lessons/day

Donnelly et al. 2013
DK85317, Donnelly PI
Results
Average Days/wk School in Session vs Average Days/wk A+PAAC was Performed

Donnelly et al., Preventative Medicine, 2017
Teacher Reported A+PAAC minutes/wk across 3 years

Donnelly et al., Preventative Medicine, 2017
–Increases in fitness are associated with better inhibitory control and the facilitation of attention.

Scudder et al., Preventative Medicine, 2017
– Increases in fitness are associated with improvements in working memory performance, in particular when challenge is increased.
Time-on-task

• MVPA time across the intervention was associated with improvements in on-task behavior both before and after the physical activity break

• Increased MVPA time was associated with improvements in academic achievement scores for math and spelling
**Time-on-task**

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<th>Reading</th>
<th>Spelling</th>
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<tr>
<td>Intercept</td>
<td>99.87</td>
<td>91.33</td>
<td>98.16</td>
</tr>
<tr>
<td>β(MVPA)</td>
<td>1.93</td>
<td>3.49</td>
<td>1.01</td>
</tr>
<tr>
<td>p</td>
<td>0.034</td>
<td>0.424</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Summary

- Classroom physical activity is associated with improvements in:
  - BMI/Weight status
  - Attention
  - Working memory
  - Academic achievement

- The question is, How do we get teachers and students to do classroom physical activity?
Socioecological system for future PAAC Programs

- **Intervention Targets**: Decrease BMI of 2nd and 3rd grade students
- **Use technology to deliver existing physical activity?**
- **Is a school policy change needed in order to achieve PA goals?**
- **Include the thoughts of Principles, School Administrators and Teachers in the design of future PA programs**
Thank you!

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