**Mark, Set, Go! School-Based Nutrition and Physical Activity Program: A Five-Year Evaluation**

FADYA EL RAYESS, MD, MPH; MEEKA GANDHI, BA; HARAN MENNILLO

**ABSTRACT**

*Mark, Set Go!* is a school-based intervention addressing pediatric obesity in an urban, underserved community. This study evaluates its impact on participants’ knowledge, attitudes and behavior related to nutrition, physical activity and screen time.

**METHOD:** Participants, 954 fifth- and sixth-grade public school students, received a 9-week classroom-based intervention led by high school peer educators. A matched design analyzed paired data from pre/post intervention knowledge, attitude and behavior surveys, heights, weights and 24 hour pedometer recordings.

**RESULTS:** 787 students (82.4%) completed both a pre- and post-test. Participants demonstrated improvement in knowledge, self-reported screen time, daily exercise and sweetened beverage consumption. Changes were greater for girls. A statistically significant decrease in BMI was noted overall, for boys and for overweight students, among the 443 participants (46%) with paired BMI data.

**CONCLUSIONS:** This school-based peer educator led intervention was effective in improving participant knowledge and healthy behaviors.

**KEYWORDS:** Primary school, peer influence, health education, nutrition, physical activity

**INTRODUCTION**

In 2014, 33.4% of United States children ages 2–19 were overweight or obese, double the prevalence in 1970, with even higher rates in ethnic minorities. The prevalence among Rhode Island high school students rose from 23% in 2001 to 26.9% in 2013. Contributing factors include an increase in sedentary forms of entertainment such as videogames or television. Higher screen time is correlated with an increase in consumption of sweetened beverages and snack foods and a decrease in fruit and vegetable consumption which adds to the risk of becoming overweight.

A number of studies have demonstrated that school-based interventions can impact childhood overweight and obesity. Eat Well and Keep Moving targeted fourth- and fifth-graders and resulted in improved dietary intake and decreased television screen time. Planet Health deceased the rate of obesity among female participants. Other school-based interventions increased participant knowledge and consumption of fruits and vegetables. Peer educators have been used to increase youth knowledge about HIV/AIDS and sexually transmitted infections and to teach conflict resolution and peer mediation. A peer health educator model is grounded in Bandura’s social cognitive theory of health behavior which posits that individuals are influenced, and more likely to change their behavior, in response to the opinions and actions of their peers. Review of the literature at the time of program implementation did not reveal any studies that use peer educators to deliver a school-based nutrition and physical education intervention.

From 2006 to 2010, the *Mark, Set, Go!* Program, a school-based intervention to teach 5th and 6th graders about physical activity and nutrition, was delivered by peer educators to nearly 1000 students in Providence, RI. Our study evaluates the program’s impact on participants’ nutrition and physical activity knowledge and behaviors.

**METHODS**

**Participants and setting**

Our study population was a convenience sample of all 5th or 6th grade students (954 students) attending one of ten public elementary schools in Providence, RI. Peer educators were recruited from the MET High School, a Providence school with an experiential learning curriculum that places students in internships at various community sites.

**Procedure**

**Curriculum**

We developed the *Mark, Set Go!* curriculum, workbook and lesson plans in consultation with a pediatric nutritionist, based on previous interventions. Topics included energy, physical fitness, the food pyramid, fats, drinks and a Jeopardy review game. The program coordinator and 3 to 4 trained peer educators used an interactive small group format to teach each class. For example, during the ‘drinks’ lesson each small group under the direction of a peer educator calculated the amount of sugar in a 2-liter bottle of a sweetened beverage and then filled that bottle with the correct number of teaspoons of sugar. Next the group calculated the number of minutes they would need to exercise to ‘burn’ those calories.
Peers educator training
We held an orientation and weekly sessions to train peer educators. Topics covered included classroom management, effective small group teaching strategies and a review of material to be taught. Peer educators were trained by the Program Director (FE), program coordinators and consulting nutritionist.

School Enrollment
We invited schools to participate through phone contact followed by an in-person presentation to the school nurse and principal that included topics to be covered in the program, the nature of the study, data to be collected and the passive consent process. All students in 5th grade (8 schools) and 6th grade (2 schools) received the nine-week Mark, Set, Go! Program. Passive consent was obtained from parents for student participation in the evaluation of the study. We sent home information about the program and the study evaluating its effectiveness to parents who could exclude their children from the study by returning an opt-out passive consent form. This study was IRB approved. All students participated in the program; very few (six) opted out of the study.

Survey Tool
The survey tool, written at a 5th grade math and language comprehension level, contained 15 knowledge questions and 11 previously validated questions from the Health Behaviors in School Age Children Survey that assessed self-reported daily consumption of fruits, vegetables, fast food, TV screen time and physical activity. We administered the survey and measured pre/post height, weight and 24-hour pedometer readings during the first and last week of the program. Each student was assigned a unique identifier which allowed us to match pre/post results.

Data analysis
We pooled data from ten consecutive semesters using a matched design to pair each student’s pre- and post-test. Only data from students who completed both a pre- and post-test was included. We used the Wilcoxon-Rank Sum Test to analyze BMI, pedometer and self-reported physical activity and McNemar’s test to analyze the knowledge and behavioral-based questions at the alpha= 0.05 level of significance, (SAS version 9.2). We conducted subgroup analysis by gender and BMI above and below the 85% for age, using pre-intervention BMI.

RESULTS
Demographic characteristics
The program was delivered to 960 students with 954 participating in the study. Matched pre/post survey and anthropometric data was available for 787 (82.4%) of the participants. Characteristics of study participants are shown in Table 1. Mean age of participants was 10.4; 46.3% were male and 53.8% female. 36.2% of the students had a BMI >85% for age with significantly more males (40.1%) than females (32.9%) falling into this overweight category. However, these data should be interpreted with caution as we did not have heights and weights for 25% of the participants. 66.3% identified as Hispanic, 15.8% as Black or African American, 9.3% as white, 7.5% as Asian and 1.1% as other.

Knowledge
Fifteen questions tested participants’ knowledge of nutrition, physical activity facts, and age appropriate recommendations [Figure 1]. Questions generated from the curriculum tested students’ knowledge of recommendations for exercise,
types of exercise, screen time, fruits and vegetable consumption and food groups. The number of students answering correctly improved in 13 of 15 questions, with statistically significant improvements in 11 questions.

**Behavior**

We used questions from the previously validated 2005–06 Behavior in School Aged Children Survey to assess behaviors. Questions asked about daily exercise, screen time, frequency of consumption of fruits and vegetables, sweetened beverages, breakfast and fast food meals. We also collected pre/post pedometer and BMI.

**Physical activity**

Students were asked to report the number of days they worked out for at least 60 minutes in the last 7 days. The mean number of days per week increased overall from 4.17 pre-intervention to 4.37 post-intervention (SD 2.52, p<0.03). The change was greater for girls, who reported an increase from 3.97 days per week to 4.32 (SD 2.62, p<0.008). Paired pre/post 24-hour pedometer data, collected for 232 (24%) of participants, demonstrated only modest improvement. To assess for likelihood to exercise/play outside the home, participants were asked if they are allowed to play outside and if they feel safe playing outside. While 92.3% reported being allowed to play outside, only 85.2% reported feeling safe playing outside.

**BMI**

We were able to collect both a pre- and post-intervention height and weight for 443 (46%) of participants. Mean BMI dropped for these participants from 21.13 to 20.82 (SD 2.42, p=0.01); and for male participants from 21.46 to 20.85 (SD 2.75, p=0.0088). Overweight participants dropped from a mean BMI of 25.09 to 24.33 (SD 2.4, p<0.0001).

**Screen time/sedentary time**

We assessed interactive (computer/video game playing) and sedentary (television watching) screen time. We analyzed the results in terms of percent of participants meeting the recommendation of less than or equal to 2 hours of screen time on weekdays. The percent of participants meeting this goal increased from 73.6% to 77.4% (p=0.039; CI 0.199-0.3491); with girls increasing from 79.0% to 84.2% (p=0.0263; CI 0.1233-0.3474). All categories saw an increase in the number of participants reporting a TV screen time of no more than two hours on weekdays. Noteworthy is the dramatic increase in girls meeting this recommendation, from 60.1% to 71.4% (p <0.0001; CI 0.1522-0.3373).

**Eating habits**

We used questions from the HBSA survey to assess self-reported dietary intake. There was no significant change in the mean fruit and vegetable consumption pre/post intervention.

### Table 2. Changes in Physical Activity & BMI

<table>
<thead>
<tr>
<th>Q6. In last 7 days, number of days physically active for a total of at least 60 minutes (mean)</th>
<th>N</th>
<th>Pre</th>
<th>Post</th>
<th>Absolute Difference</th>
<th>Std deviation</th>
<th>Std Error</th>
<th>p-value students t</th>
<th>signed rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>780</td>
<td>4.17</td>
<td>4.37</td>
<td>0.20</td>
<td>2.52</td>
<td>0.09</td>
<td>0.0347</td>
<td>0.05</td>
</tr>
<tr>
<td>Male</td>
<td>362</td>
<td>4.40</td>
<td>4.44</td>
<td>0.04</td>
<td>2.40</td>
<td>0.13</td>
<td>0.8609</td>
<td>0.935</td>
</tr>
<tr>
<td>Female</td>
<td>417</td>
<td>3.97</td>
<td>4.32</td>
<td>0.35</td>
<td>2.62</td>
<td>0.13</td>
<td>0.0087</td>
<td>0.108</td>
</tr>
<tr>
<td>BMI &gt;= 85%</td>
<td>284</td>
<td>4.25</td>
<td>4.4</td>
<td>0.15</td>
<td>2.57</td>
<td>0.15</td>
<td>0.3215</td>
<td>0.4241</td>
</tr>
<tr>
<td>BMI &lt; 85%</td>
<td>294</td>
<td>3.91</td>
<td>4.35</td>
<td>0.44</td>
<td>2.56</td>
<td>0.15</td>
<td>0.0067</td>
<td>0.0079</td>
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</table>

<table>
<thead>
<tr>
<th>Pre and Post Pedometer readings (mean steps)</th>
<th>Overall</th>
<th>231</th>
<th>8995</th>
<th>9873</th>
<th>878</th>
<th>7369</th>
<th>484</th>
<th>0.6488</th>
<th>0.8765</th>
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<tbody>
<tr>
<td>Male</td>
<td>114</td>
<td>9534</td>
<td>10939</td>
<td>1405</td>
<td>8213</td>
<td>769</td>
<td>0.8713</td>
<td>0.7618</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>117</td>
<td>8468</td>
<td>8877</td>
<td>408</td>
<td>6406</td>
<td>592</td>
<td>0.4789</td>
<td>0.5052</td>
<td></td>
</tr>
<tr>
<td>BMI &gt;= 85%</td>
<td>109</td>
<td>8306</td>
<td>9447</td>
<td>1141</td>
<td>7747</td>
<td>742</td>
<td>0.5148</td>
<td>0.6087</td>
<td></td>
</tr>
<tr>
<td>BMI &lt; 85%</td>
<td>111</td>
<td>9743</td>
<td>10439</td>
<td>695</td>
<td>7053</td>
<td>669</td>
<td>0.9132</td>
<td>0.6481</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre and Post BMI (mean)</th>
<th>Overall</th>
<th>443</th>
<th>21.13</th>
<th>20.82</th>
<th>0.31</th>
<th>2.42</th>
<th>0.12</th>
<th>0.0183</th>
<th>0.0202</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>206</td>
<td>21.46</td>
<td>20.85</td>
<td>0.61</td>
<td>2.75</td>
<td>0.19</td>
<td>0.0088</td>
<td>0.0134</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>236</td>
<td>20.80</td>
<td>20.78</td>
<td>0.02</td>
<td>2.05</td>
<td>0.13</td>
<td>0.7436</td>
<td>0.4749</td>
<td></td>
</tr>
<tr>
<td>BMI &gt;= 85%</td>
<td>213</td>
<td>25.09</td>
<td>24.33</td>
<td>0.76</td>
<td>2.40</td>
<td>0.16</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>BMI &lt; 85%</td>
<td>227</td>
<td>17.26</td>
<td>17.46</td>
<td>0.20</td>
<td>2.34</td>
<td>0.16</td>
<td>0.2231</td>
<td>0.2655</td>
<td></td>
</tr>
</tbody>
</table>

1 Wilcoxon-Rank Sum Test
2 Pre-participation BMI was used to classify participants into BMI <85% and BMI >=85%
3 Only 443 participants had both a pre and post BMI
Sweetened beverages

The percent of students reporting drinking Coke or other soft drinks daily decreased from 37.9% to 31.0% (p=0.0005; CI 0.2415–0.3780). There was no significant change for boys but a substantial drop for girls from 41.1% to 29.3% (p <0.0001; CI 0.2259-0.4066). All groups had a significant drop in the daily consumption of juice. The largest change was for overweight students from 70.2% to 55.4% (p <0.0001; CI 0.1275–0.3458).

Breakfast and fast-food consumption

We did not find a change in breakfast consumption pre/post overall, by gender or by weight. Mean breakfast consumption was 3.9/5 weekdays. The percent reporting eating fast food one or more times a week decreased from 43.3% pre- to 37.3% post-intervention.

DISCUSSION

This classroom-based intervention delivered by trained peer educators was effective in increasing participant knowledge and self-reported exercise behaviors while at the same time decreasing BMI, self-reported screen time and sweetened beverage consumption. Previous studies have demonstrated similar findings but did not use peer educators to deliver the curriculum.7-13

Our study population, a subset of children attending schools serving families with low socioeconomic backgrounds in Providence, had much higher rates of pediatric obesity than the US HBSA sample from the 2005-06 survey. 40.5% of girls and 51.4% of boys in our sample had a BMI over the 85%tile for age as compared to 25% of girls and 33% of boys in the US sample. Our study population also had higher rates of baseline daily fruit consumption, 58.5% of boys and 63.1% of girls as compared to 49%
and 44% respectively for the US sample. Daily soft-drink consumption was similar for boys, 34.3% as compared to 35% of boys in the US sample, but much higher for girls, 41.1% as compared to 29% of girls in US sample. We delivered the Mark, Set, Go! Program in a real-world setting. Participating students attended schools in areas designated as food deserts, where affordable grocery stores are inaccessible by public transportation. Often the only source of groceries is a corner store, filled with processed foods and pre-packaged snacks. As a result, participants may have had limited access to fruit and vegetables.

Our study had several limitations. We collected pre/post surveys and anthropometric data on the first and last day of the program. If students were not present we did not capture their responses or measure them. Consequently, only 46% of participants had paired BMIs and only 24% had matched pedometer readings. The staffing of our program also changed over the course of the five years. While our curriculum remained constant, we had three program coordinators. Our peer educators, recruited from a local high school with an internship-based curriculum, also changed each year. There was also variation in the number of years each school participated in the intervention. Some participated for several years in a row and others only for one semester. In analyzing our data, we did not control for these differences. Instead we pooled data from all five years, matching pre/post data for each student, and looked for change at the individual level. Another limitation is that we did not have controls and consequently could not account for the impact of other nutrition and physical activity education.

CONCLUSION

Despite the limitations, this study demonstrates the potential effectiveness of using peer educators to deliver nutrition and physical activity education. The program had a positive impact on BMI, overall health knowledge and self-reported behaviors, including a decrease in screen time and sweetened beverage intake. Future studies with more staffing consistency are needed in order to control for variability in instruction. Additional research that takes into consideration language barriers and cultural background would be helpful as would studies that help further analyze variation in how children of different genders interact with and respond to nutrition education.

References


18. Study #06-08 Mark, Set, Go! Pilot Study Approval by the Committee on the Use of Human Subjects in Research, Memorial Hospital of Rhode Island, Feb 22, 2006.


Acknowledgments

Data analysis was completed by Haran Mannillo. Program design and implementation was carried out by the Mark, Set, Go! Team: Shayla Graham-Brock, MD; Eboni Smith, MD; Sophy Hernandez, MD; Jennifer Chavez, MS; Barbara B. Robinson, MPH, RD, CNSD and Peer Educators: Michael Pete, Deirdre Jones, Odysee Smith, and Abraham Mangana.

Presentations

The results were presented as a poster at the Rhode Island Academy of Family Practice Annual Conference in March of 2014 and as a distinguished paper, Society of Teachers of Family Medicine, National Conference, May 5, 2014.

Authors

Fadya El Rayess, MD, MPH, is Assistant Professor (Clinical) Department of Family Medicine, the Warren Alpert Medical School of Brown University.

Meeka Gandhi, BA, is a fourth-year medical student at the Warren Alpert Medical School of Brown University.

Haran Mennillo is a student at the University of Rhode Island and entering student, 2017, the Warren Alpert Medical School of Brown University.

Disclosures

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Correspondence

Fadya El Rayess, MD
111 Brewster Street
Pawtucket, RI 02860
Fadya_El_Rayess@brown.edu