Promoting Physical Activity and Fruit and Vegetable Consumption Through a Community-School Partnership: The Effects of Marathon Kids® on Low-Income Elementary School Children in Texas

Andrew E. Springer, Steven H. Kelder, Nalini Ranjit, Heather Hochberg-Garrett, Sherman Crow, and Joanne Delk

Background: Marathon Kids® (MK) is a community and school-based program that promotes running, walking, and healthy eating in elementary school children. This study assessed the impact of MK on self-reported physical activity (PA), fruit and vegetable consumption (FVC), and related psycho-social factors in a sample of low-income, 4th- and 5th-grade students in Texas (n = 511). Intervention strategies included structured school running time, behavioral tracking, celebratory events, and rewards. Methods: A quasi-experimental design with 5 intervention (MK) and 3 comparison schools was employed. Students were assessed at baseline in the fall and at 3 time points during 2008 to 09. Mixed-effect regression methods were used to model pooled means, adjusting for baseline and sociodemographic variables. Results: MK students reported a higher mean time of running in past 7 days compared with non-MK students (mean = 4.38 vs. 3.83, respectively. P = .002), with a standardized effect size of 0.16. Mean times of FVC (P = .008), athletic identity self-concept (P < .001), PA outcome expectations (P = .007), and PA and FVC self-efficacy (P < .001 and P = .02, respectively) were also higher in MK students. Fewer differences in social support were observed. Conclusion: Findings provide further evidence on the importance of community and school partnerships for promoting PA and healthy eating in children.

Keywords: goal setting, Hispanic

Despite the numerous health benefits associated with regular physical activity (PA) and fruit and vegetable consumption (FVC), local and national estimates indicate a large percentage of U.S. children are not meeting national health recommendations for these behaviors. Findings from a national study of children's physical activity based on accelerometry indicate that only 42% of U.S. children ages 6 to 11 years were found to engage in 60 minutes or more of moderate-to-vigorous PA on 5 or more days per week. At the high school level, the percentage of students meeting national recommendations decreases to just over one-third (34.7%). With regard to FVC, roughly three-quarters (74.1%) of children between the ages of 6 to 11 years do not meet U.S. Department of Agriculture MyPyramid recommendations on fruit consumption (approximately 1.5 cups per day contingent upon gender, age, and activity level) and 83.8% do not meet guidelines for vegetable consumption of between 1.5 and 2.5 cups per day—findings comparable for U.S. high school students.

Children from economically disadvantaged backgrounds in the U.S. are an important priority group for efforts to enhance PA and healthy eating opportunities given their higher rates of obesity, lower access to supportive PA environments and lower engagement in PA participation. Programs with evidence of effectiveness are specifically needed for schools that serve economically disadvantaged children.

Partnerships between schools and community organizations hold the potential to provide complementary actions to support children’s engagement in PA and other healthy behaviors while maximizing resources and impact on children’s health behaviors. van Sluijs and colleagues found strong evidence for the impact of school-based interventions plus community or family components on adolescent physical activity, yet evidence for children was deemed “inconclusive” based on a review of 14 studies. In a separate review by Salmon and colleagues, of 4 school and family/community interventions targeting elementary school children, 3 were found to have no significant impact on physical activity, and 1 was found
to have a small but questionable impact on children’s physical activity. Although schools have been found to be effective vehicles for promoting children’s fruit and vegetable consumption via strategies that include FV provision, classroom-based curriculum, teacher involvement, school food service involvement, and parent and community involvement, interventions that specifically target children from lower socioeconomic status groups have shown limited effect on FVC. Further research is needed to identify effective models of school and community partnerships for promoting physical activity and fruit and vegetable intake in children from economically disadvantaged backgrounds.

Marathon Kids® (MK) is a community-based organization that builds partnerships with schools, community leaders and the private sector to promote running and walking and FVC in children in grades K through 5 and their families. This study assessed the impact of participation in the Marathon Kids program on PA engagement, FVC, and related psycho-social factors in a sample of low-income, 4th and 5th public elementary school children from 2 metropolitan areas of Texas.

**Methods**

**Program Description**

Founded in 1996 in Austin, Texas, Marathon Kids operates in 7 cities throughout the United States (Austin, Dallas, Houston, Harlingen, Los Angeles, Baltimore, and Chicago), with a pilot project launched in 2008 with the Navajo Nation in Window Rock, Arizona. The core program activities center on a ~6-month walking/running and FVC program for elementary school children and their families. During the program, students track the number of miles they walk or run along with the number of fruits and vegetables they eat by coloring in their MK Mileage Log and MK Fuel Log for each quarter mile run/walked and each fruit/vegetable consumed, respectively. Successful completion of MK is based on walking or running 26.2 miles over a ~6-month period and eating fruit or vegetables 5 times a day for 26 days for 1 month. Students can perform these activities at school, home, and community. In many schools, structured time is provided during recess, PE class, or other periods of the school day for students to walk or run, and teachers often assist students with the tracking of their miles and FVC. A key feature of MK is the celebration of child and family PA and healthy eating through highly publicized Kick-Off and Final Mile Run events, which book-end the 6-month program. These events are often held at well-known public venues, such as university or city football stadiums. Local and national celebrities such as mayors, entertainers, and professional athletes often host the book-end events. Students who complete the program receive a finisher t-shirt, and those who attend the Final Mile Run also receive a medal. MK is primarily implemented by PE and classroom teachers, parents and community volunteers. A distinguishing feature of the nonprofit MK is that the program is offered at no financial cost to schools or program participants. Partnerships established with local and national businesses as

![Figure 1 — Logic model of Marathon Kids program.](image_url)
well as private foundations support all costs associated with the program. Figure 1 presents a logic model of the core program inputs, process objectives, and outcome objectives of the MK program.

Sallis and colleagues’ (2006)22 Ecological Model for Active Living posits that 4 key environments shape PA behavior: the information environment, the social/cultural environment, the policy environment, and the natural/built environment. MK targets aspects of 3 of these environments. Under the information environment, MK increases awareness about the program and importance of activity and healthy eating via presentations to school districts and PE teachers, easily recognizable logo and bumper stickers, community signage such as advertising on buses, MK t-shirts, parent and teacher information packets, and widely publicized book-end events. Within the social cultural environment, MK fosters social support for the key target health behaviors via promoting teacher and parent encouragement as well as instrumental support for filling out the MK logs. In some schools, instrumental support is also provided via transportation to MK events as well as incorporation of MK goals into afterschool programs. MK also fosters social reinforcement for walking/running and FVC via the Kick-Off and Final-Mile Run events, which include social reinforcement from public role models; promotion of school gardens; and social recognition of completion of program goals via final mile medal awards and finisher t-shirts. Lastly, MK targets the policy environment through promoting scheduled time for walking/running during PE class and other times of the school day.

We hypothesized that participation in the MK program would positively impact key intrapersonal and interpersonal factors of children that have been found to be related to PA and healthy eating, specifically children’s athletic identity self-concept,23–26 social support for PA and healthy eating,2 perceptions about the benefits of PA participation (“positive outcome expectations”),27,28 and self-efficacy for PA29–31 and FVC.32–34

Recruitment of Marathon Kids. Schools and school districts are invited to participate in MK via presentations to PE teachers and school district personnel provided at the beginning of the school year. Once a school decides to participate, information packets are sent to schools to enroll students in the program, and schools send a description of the program to parents.

Evaluation
Study Design and Sample. In January 2008, The University of Texas School of Public Health-Austin was subcontracted by MK, with funding from the Michael & Susan Dell Foundation, to evaluate MK in 15 public elementary schools in Texas, of which 8 were classified as “low income.” The current paper reports on our findings from a quasi-experimental study of the 8 low-income public elementary schools. A nonequivalent control group, pretset/posttest evaluation design with multiple measurement periods was used to evaluate the effect of MK on children’s PA, FVC, and related psychosocial factors.

The evaluation sample comprised 4th- and 5th-grade students attending school in a school district in the Houston area and a school district in the Austin area of Texas. Of the 8 low-income elementary schools, 6 schools were located in Houston (3 intervention and 3 comparison schools) and 2 intervention schools were located in the Austin area. In selecting the sample, we obtained a list of all participating schools for school districts in the Houston and Austin areas from MK staff and categorized the list by school composition of economically disadvantaged students as per data from the Texas Education Agency. We then identified schools in these school districts that were not participating in MK for the 2008–09 school year and had not participated in the year before the study. Because all schools in the northern Austin school district indicated participation in MK for the 2008–09 school year, we were limited to comparison schools located in the Houston area. Schools were considered ‘low-income’ if they had ≥60% school composition of economically disadvantaged students based on criteria for classifying schools as low-income provided by the funding agency.

Study Measures. Tables 1 and 2 present the principal study constructs and measures. Physical activity, diet, and related psycho-social factors were assessed via a self-administered questionnaire entitled “The Active Kids Project” (AKP) questionnaire. The AKP includes items on PA engagement; FVC; and psycho-social factors such as students’ athletic identity self-concept, social support for PA and FVC, outcome expectations related to PA, and self-efficacy. Physical activity measures were based on the Physical Activity Questionnaire for Older Children (PAC-Q), a 7-day recall measure designed to assess general PA levels in children in grades 4 and higher. The PAQ-C has been found to have good internal consistency and test-retest reliability in children,35–37 and has been related to the Caltrac accelerometer (r = −.39) and step test of fitness (r = .28).38 Seven-day recall measures have also been found to have adequate reliability and validity for 5th, 8th and 11th grade children in the United States.39 We focused specifically on 2 7-day items on running and walking, given that running and walking were the primary targets of the MK program. In addition, we created a composite variable of other leisure-time PA (bicycling, skateboarding, and rollerskating/rollerblading) to assess the potential secondary impact of MK on related individually-oriented PA.

Three items assessing FVC were adapted from the School Physical Activity and Nutrition (SPAN) survey, which has been tested for validity and reliability.39–41 The SPAN survey items have been found to have an acceptable level of reproducibility in 4th-grade students, with Kappa statistics for fruit and vegetable items ranging from 0.60 to 0.65.41 We modified the items from their previous day time frame to a “usually” time frame to capture a broader habitual pattern of children’s FVC. In addition, we included 4 items to assess FVC at home and at school.
Table 1  Description of Principal Study Constructs and Measures; Marathon Kids Evaluation Project—Low-Income School Study, 2008–09

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measure/questionnaire item</th>
<th>Reliability/validity (source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous 7 days:</td>
<td>“Physical activity outside of school PE (on your own, with friend, team, etc.).”</td>
<td>Adapted from the Physical Activity Questionnaire for Older Children (PAQ-C).35 One-week test-retest reliability for the composite PAQ-C scale ranges from .74 to .82, with correlations with other 7-day recall ($r = .46$); Caltrac accelerometer ($r = .39$), and a step test of fitness ($r = .28$).35</td>
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<tr>
<td>Running</td>
<td>“Have you done any of the following activities in the past 7 days?”</td>
<td>Adapted from “yesterday” fruit &amp; vegetable items from SPAN questionnaire, with test-retest Kappa = .60 for fruit and .65 for vegetable based on a sample of 4th-grade students in Texas.41</td>
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<tr>
<td>Walking</td>
<td>Running or jogging for exercise; walking for exercise; bicycling; skateboarding</td>
<td>Developed for this study.</td>
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<tr>
<td>Other leisure-time PA</td>
<td>Rollerskating/rollerblading” (Response options: No, 0 times, 1–2 times, 3–4 times, 5–6 times, 7 or more times.)</td>
<td>Taken from Anderson &amp; Coleman (2008) Athletic Identity Questionnaire-Child. Based on study of 9 and 10 year olds, AIQ-Child factors were found to be positively related to PA ($r = .51$ to .68) and fitness ($r = .15$ to .41) and negatively related to TV/computer use ($r = -.28$ to -.03) and adiposity ($r = .32$ to .04).25</td>
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<td>Fruit and vegetable</td>
<td>“How many times a day do you usually eat fruit? Do not count fruit juice.” (Response options: I don’t usually eat any fruit; I usually eat fruit 1 time a day; 2 times a day; 3 times a day; 4 times a day; 5 or more times a day.)</td>
<td>Adapted from “yesterday” fruit &amp; vegetable items from SPAN questionnaire, with test-retest Kappa = .60 for fruit and .65 for vegetable based on a sample of 4th-grade students in Texas.41</td>
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<td>consumption</td>
<td>“How many times a day do you usually eat vegetables? Vegetables are cooked and uncooked vegetables; beans; salads; and boiled, baked and mashed potatoes. Do not count french fries or chips.” (Response options: I don’t usually eat any vegetables; I usually eat vegetables 1 time a day; 2 times a day; 3 times a day; 4 times a day; 5 or more).</td>
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<td></td>
<td>“I eat [fruit/vegetables] during school lunch.” (2 items; Response: always, most of the time, some of the time, never.)</td>
<td>Developed for this study.</td>
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<td>Athletic identity</td>
<td>“Please answer the following questions according to how true each sentence is for you. Choose only 1 answer for each question.” (Response options: Definitely No; Somewhat No; Neither; Somewhat Yes, Definitely Yes.)</td>
<td>Taken from Anderson &amp; Coleman (2008) Athletic Identity Questionnaire-Child. Based on study of 9 and 10 year olds, AIQ-Child factors were found to be positively related to PA ($r = .51$ to .68) and fitness ($r = .15$ to .41) and negatively related to TV/computer use ($r = -.28$ to -.03) and adiposity ($r = .32$ to .04).25</td>
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<td></td>
<td>Appearance: “I think I look like a person who exercises,”</td>
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<td></td>
<td>“My body looks in shape.” “I look like a person who is physically fit.”</td>
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<td></td>
<td>“It is obvious to other that I am out of shape.” (reverse coded).</td>
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<td></td>
<td>“I look healthy—not overweight or underweight.”</td>
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<td></td>
<td>Competence: “I can do many types of physical activities.”</td>
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<td></td>
<td>“I can do most physical activities if I work hard and practice.”</td>
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<td></td>
<td>“I know I can do most physical activities, sports and exercise.”</td>
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<td></td>
<td>“I am good at any sport or physical activity I try.”</td>
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<td></td>
<td>“I am good in at least one type of physical activity.”</td>
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<td></td>
<td>“I know I can get better at sports, exercise, or physical activities with practice.”</td>
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<td></td>
<td>Importance: “After I am sick or hurt, I begin doing physical activity as soon as it is ok.”</td>
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<td></td>
<td>“I’d be very upset if something stopped me from doing a sport or exercise I wanted to do.”</td>
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<td></td>
<td>“I don’t let things stop me from doing sports or physical activities.”</td>
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<td></td>
<td>“I’d rather spend time playing sports or being active than sitting around watching TV.” “I love to play active sports.”</td>
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<tr>
<td></td>
<td>“I try really hard when I play sports or exercise.” “I really like to be physically active,”</td>
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</table>
Table 2  Description of Principal Study Constructs and Measures; Marathon Kids Evaluation Project—Low-Income School Study, 2008–09

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measure/questionnaire item</th>
<th>Reliability/validity (source)</th>
</tr>
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</table>
| Social support                    | “For each of the next questions, think about your [parents/family, friends, teachers] and how often they do or say these things. Choose only 1 answer for each question. I have [parents/family, friends, teachers] who  
... want me to be physically active. 
... exercise with me. 
... encourage me to do sports or exercise. 
... watch me when I exercise or play sports and give me feedback on what I’m doing. 
... spend time teaching me how to play a sport or do a physical activity. 
... are proud of me when I exercise. 
... are willing to help me in every way when it comes to sports or exercise. 
... want me to eat fruit and vegetables. 
... give me fruit and vegetables to eat.”  
(Response options for each statement: Never, Almost Never, Sometimes, Almost Always, Always). | Taken from Anderson & Coleman (2008) Athletic Identity Questionnaire-Child. Based on study of 9 & 10 year olds, PA social support (“encouragement” construct from AIQ) was found be positively correlated with PA ($r = .67$), fitness ($r = .15$), and negatively correlated with TV/computer use ($r = -.19$). For this study, we specifically created items related to fruit and vegetable consumption social support. |
| Physical activity self-efficacy   | How sure are you that you can  
... run, jump, or play during recess? 
... be active every day? 
... play outside for 30 minutes every day? 
... keep moving for most of the time in PE class? | Based on Hoelscher et al. CDC-funded SIP 15 Project (not published). Internal consistency of 4 item scale: $\alpha = .58$.                                                                                                                |
| Fruit & vegetable self-efficacy   | How sure are you that you can  
... ask your parents for fresh fruit for a snack? 
... ask your parents for vegetables at dinner? 
... eat 5 fruits or vegetables every day?  
(Response options: Not sure, A little sure, Very sure.) | Based on Hoelscher et al. CDC-funded SIP 15 Project (not published). Internal consistency of 3 item scale: $\alpha = .70$.                                                                                                                |
| Physical activity outcome expectations | “Doing physical activity will  
... be fun. 
... make me sweat too much. (reverse coded) 
... be no fun because I get picked last for teams. (reverse coded) 
... make me stronger. 
... keep me from gaining too much weight. 
... make others tease me. (reverse coded) 
... make me look better.”  
(Response options: True for me; Sort of true for me; Not true for me.) | Adapted from positive and negative outcome expectancies constructs from Girls health Enrichment Multisite Study (GEMS), which found internal consistency of $\alpha = .72$ for Positive Outcome Expectancy, and $\alpha = .68$ for Negative Outcome Expectancy. The test-retest reliability of both scales was fair ($r = .22$ and $r = .38$, respectively.) |

Athletic identity and social support measures were taken directly from the Athletic Identity Questionnaire \(^{25}\) (Tables 1 & 2). Athletic identity comprises 4 dimensions: athletic appearance (5 items; eg, “I think I look like a person who exercises”), PA competence (6 items; eg, “I can do many types of physical activities”), PA importance (8 items; eg, “I don’t let things stop me from doing physical activities”), and encouragement. For this study, the encouragement dimension was analyzed separately under the construct of social support. Social support items assessed support for PA and healthy eating from parents and family (9 items), friends (5 items), and teachers (9 items) and included aspects of encouragement/emotional support, instrumental support, and modeling/observational support. The athletic identity and social support measures have been found to have evidence of factorial and construct validity in children of the same age range as this study. \(^{25}\) For the current study, we developed a composite variable for the global athletic identity construct, which was based on summing up the scores for the 3 subscales. Based on a total of 19 items, global athletic identity scores ranged from 19 (lowest) to 95 (highest). Similarly, we developed a composite variable for athletic appearance (5 items, with scores ranging from 5 to 25); PA competence (6 items, with scores ranging from 6 to 30); and PA importance (8 items, with scores ranging from 8 to 40).

Lastly, we measured outcome expectations for physical activity and PA self-efficacy and FVC self-efficacy. Outcome expectations for PA was measured with a 7-item scale adapted from the GEMS study. \(^{42}\) Students were asked to rate on a 3-point scale how much they identify with statements such as: “Doing physical activity will be fun” and “Doing physical activity will make me stronger.” PA self-efficacy (4 items) and FVC self-efficacy (3 items) were measured using a scale developed and being used by Hoelscher et al for the CDC-funded SIP 15 Project (personal communication, Dr. Deanna Hoelscher, April 11, 2010; Table 2).

**Descriptive Measures.** Student BMI-for-age and sex was assessed via physical measures of height and weight following standard protocols described previously. \(^{40}\) BMI was calculated using the standard formula, and BMI percentiles were calculated using the CDC 2000 growth charts. \(^{43,44}\) Family affluence was included as an indicator of socioeconomic status and was assessed using the WHO Health Behavior in School-Aged Children Family Affluence Scale (FAS). \(^{45}\) The FAS has been found to have better criterion validity and to be less affected by nonresponse bias than measures of socioeconomic status that rely on parental education or income. \(^{45}\) Age, gender, parent language use, and ethnicity were also assessed by self-report.

Lastly, we included a range of process measures of MK for students, parents, and school staff. For this study, we report on process measures related to student participation and satisfaction with the program, which were assessed via the *Active Kids Project: Marathon Kids* questionnaire, a 2-page self-administered survey that was implemented in April-May.

**Data Collection**

All 4th- and 5th-grade students from the 8 low-income study schools were invited to participate in the Active Kids Project (AKP) study via a written and oral invitation. All data collectors underwent training and a certification process on the data collection protocols. The AKP student questionnaire was administered to the same group of 4th- and 5th-grade students at 4 time points over the course of the 2008–09 school year. Children were assessed in October/November 2008 (baseline), in December 2008 and February 2009 (interim measures), and in April/May 2009 (posttest). Student height and weight measurements were taken during October 2008 and in April/May 2009. The October 2008 baseline measure was administered before or within 4 weeks after the MK Kick-Off event, while the April/May 2009 posttest measure was administered approximately 2 months after the Final Mile Run event.

Participation in the study was voluntary and confidential. University and school district human subject approval and parental active consent were obtained as well as student assent. Parental active consent was obtained by sending a letter home to parents that provided a description of the study and informed consent for participation in the study; parents were asked to sign and return the informed consent form to their child’s respective teacher. A written student informed assent description was reviewed orally with students at the time of questionnaire administration. All study aims, measures and protocols were approved by the University of Texas School of Public Health Committee for the Protection of Human Subjects and school district review committees.

**Analysis**

Impact assessment was done by comparing students from 5 low-income schools participating in the MK program to students in the same grade levels from 3 low-income schools that did not participate in the MK program. While control schools were all located in Houston, 2 of the 5 intervention schools were located in Austin and the rest in Houston. Houston and Austin schools were combined for analysis to increase effective sample size. There were no significant differences between Houston and Austin students in MK schools with respect to sex, ethnicity, language used with parents, baseline age and BMI of students, and school-level SES, indicating that pooling these schools was an acceptable procedure. Repeated measures regression methods were used to model the mean and variance of each outcome across the 3 post-Kickoff measures (2 interim + 1 posttest) in the comparison and intervention groups, and the difference in mean between conditions. This pooling of subject-specific mean levels across posttest measurement occasions was done to obtain more reliable estimates, and was accomplished by modeling a student-level random intercept for outcomes. Analyses adjusted for baseline estimates for the
primary variables of interest as well as gender, ethnicity, and family affluence. Lastly, we examined the potential dose-relationship between engagement in different levels of Marathon Kids’ activities with increased engagement in physical activity and diet outcomes (see description below). All analyses were performed using the statistical software package SAS v9.1.

Results

Description of Sample

Of the total number of 4th- and 5th-grade students attending the 8 low-income study schools (n = 5 MK schools and n = 3 comparison schools), 51.3% of MK school students and 40.9% of comparison school students returned an active parental consent form indicating their willingness to participate in the study. These students represented the final sample of the study (n = 383 MK students and n = 128 non-MK students). Attrition across the 4 measurement periods was minimal (7%, 1%, and 1% in the intervention group, and 6%, 1%, and 0% in the comparison group) and nondifferential with regard to sociodemographic attributes at baseline. Percent missing values during the 3 post-Kickoff measurement periods for the activity and diet measures ranged from <1% to 9%; for the athletic identity measures, from 3% to 10%; and for the support, outcome expectations and self-efficacy measures, from 0% to 8%.

Table 3 presents demographic characteristics of student participants at baseline measurement. Approximately half of the students were girls, with a mean age of 10 years. The majority of students in both the MK and non-MK comparison conditions were Hispanic (78.6%...
and 76.6%, respectively; Table 3). While Hispanic composition was similar between the 2 samples, the comparison sample had a higher composition of African American students and lower composition of white students (Table 3). No significant differences between the 2 conditions were found by age, gender, language spoken with parents, 3 of the 4 SES indicators, or BMI status.

**Process Evaluation Findings**

The majority of students attending MK schools completed their Mileage Log (78.1%), and two-thirds reported completing their Fuel Log (Table 4). Although the majority of students indicated that the logs helped them run/walk or consume more FV, the percentage was higher for the Mileage Log (80.0% vs. 69.1%, respectively). Just over a quarter of participants indicated they attended the public Kick-Off and Final Mile Run events. The majority of students reported the highest level of satisfaction with the program (71.4%), and 4 out of 5 students indicated intentions to participate in MK the coming year (Table 5). No significant demographic differences were found for satisfaction with the program.

**Outcome Evaluation Findings**

**Running, Walking, and Other PA Outcomes.** Figure 2 presents the estimated mean time that children engaged in each of 3 PA activities (walking, running, leisure-time PA) over the course of the school year by intervention and comparison condition, adjusting for baseline estimates and sociodemographic variables listed above. Students who attended MK schools were found to engage in a higher mean number of times of running for the 3 pooled post-Kick Off event measurement periods compared with their peers in schools that did not participate in MK activities and the level of key outcomes, we conducted a global process measure as the sum of 4 binary indicators: 1) whether the student participated in the Kick-Off event, 2) whether the student participated in the Final Mile Run event, 3) whether the student completed a mileage log, and 4) whether the student completed an FV Fuel log. The resulting measure ranged from 0 to 4, with 4 implying the greatest adherence. Data for these indicators were obtained only from students in MK schools. Using repeated-measures models, we modeled the difference in mean outcome across level of process, adjusted for sex, ethnicity, and baseline family affluence. Process was modeled as a continuous variable. With the exception of consumption of fruit and vegetables at home, competence, and physical activity outcome expectations, all outcomes showed a significant positive trend at \( P < .05 \), indicating that higher levels of process were linearly related to improved levels of outcome. In most cases, the change in outcome level associated with unit change in process was small, but for key indicators of running, walking and consumption of fruit and vegetables, a unit increase in process level was associated with 4% to 8% increase in the outcome level.

**Dose-Relationship.** To examine if there was a dose-response relationship between the amount of engagement in MK activities and the level of key outcomes, we constructed a global process measure as the sum of 4 binary indicators: 1) whether the student participated in the Kick-Off event, 2) whether the student participated in the Final Mile Run event, 3) whether the student completed a mileage log, and 4) whether the student completed an FV Fuel log. The resulting measure ranged from 0 to 4, with 4 implying the greatest adherence. Data for these indicators were obtained only from students in MK schools. Using repeated-measures models, we modeled the difference in mean outcome across level of process, adjusted for sex, ethnicity, and baseline family affluence. Process was modeled as a continuous variable. With the exception of consumption of fruit and vegetables at home, competence, and physical activity outcome expectations, all outcomes showed a significant \( P \) for positive trend at \( P < .05 \), indicating that higher levels of process were linearly related to improved levels of outcome. In most cases, the change in outcome level associated with unit change in process was small, but for key indicators of running, walking and consumption of fruit and vegetables, a unit increase in process level was associated with 4% to 8% increase in the outcome level.

**Discussion**

This study evaluated the effect of Marathon Kids on physical activity and healthy eating outcomes in a sample of low-income elementary school children in Texas.
Table 4  Participation Indicators at Final Posttest by Demographic Characteristics of Student Sample From Selected Houston and Austin Area Low-Income Schools\textsuperscript{a,b} Participating in Marathon Kids; Marathon Kids Evaluation Project—Spring 2009

<table>
<thead>
<tr>
<th>MK sample (n)</th>
<th>Completed mileage log (%)</th>
<th>Completed fuel log (%)</th>
<th>Mileage log helped student walk/run more (%)</th>
<th>Fuel log helped student eat F&amp;V (%)</th>
<th>Attended kick-off event (%)</th>
<th>Attended final mile event (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sample</td>
<td>383</td>
<td>78.1</td>
<td>66.3</td>
<td>80.1</td>
<td>69.1</td>
<td>26.5</td>
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<td>Gender</td>
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<tr>
<td>Girls</td>
<td>190</td>
<td>76.9</td>
<td>70.0</td>
<td>79.9</td>
<td>72.7</td>
<td>23.4</td>
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<tr>
<td>Boys</td>
<td>193</td>
<td>79.3</td>
<td>62.6</td>
<td>80.2</td>
<td>65.5</td>
<td>29.7</td>
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<td>25</td>
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<td>62.5</td>
<td>66.7</td>
<td>55.0</td>
<td>30.0</td>
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<td>68.1</td>
<td>82.2</td>
<td>71.8</td>
<td>27.9</td>
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<td>White</td>
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<td>54.1</td>
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<td>57.5</td>
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<tr>
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<td>76.1</td>
<td>69.5</td>
<td>88.8***</td>
<td>76.2**</td>
<td>28.6</td>
</tr>
<tr>
<td>English</td>
<td>216</td>
<td>79.9</td>
<td>63.2</td>
<td>73.5***</td>
<td>63.1**</td>
<td>24.5</td>
</tr>
</tbody>
</table>

Abbreviations: African Amer., African American; F & V, Fruit & Vegetable; MK, Marathon Kids.
\textsuperscript{a}Low-income classified as >60% school composition of economically disadvantaged students based on Texas Education Agency data for 2008.
\textsuperscript{b}Includes 4th- and 5th-grade students from low-income schools participating in Marathon Kids in Houston (n = 3 schools) and Austin area (n = 2 schools).
### Table 5  Satisfaction With Marathon Kids by Demographic Characteristics\(^a\); Marathon Kids Evaluation Project—Spring 2009 (n = 5 Low Income Schools)

<table>
<thead>
<tr>
<th>How much do you like Marathon Kids?</th>
<th>Will you do MK next year?(^b)</th>
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<tr>
<td>A lot (%)</td>
<td>A little (%)</td>
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<tr>
<td>Total sample</td>
<td>71.4</td>
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<td>Boys</td>
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<td>Hispanic</td>
<td>73.0</td>
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<td>White</td>
<td>58.1</td>
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<tr>
<td>Other</td>
<td>62.5</td>
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<tr>
<td>Spanish</td>
<td>74.6</td>
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<tr>
<td>English</td>
<td>70.1</td>
</tr>
</tbody>
</table>

\* P < .05; \** P < .01; \*** P < .001.

Note. Significant differences based on Chi-Square tests.

\(^a\) n = 346 4th- and 5th-grade students from low-income (>65% economic disadvantage) schools in Houston (n = 3 schools) and north Austin (n = 2 schools).

\(^b\) Based on 4th-grade students only (n = 182) as majority of fifth graders will attend middle school the coming year where MK is not an option.

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**Figure 2** — Estimated mean times 4th- and 5th-grade children participated in physical activity in past 7 days as assessed over 3 measurement periods during school year, by participation in Marathon Kids (n = 511). Analyses adjusted for baseline scores, gender, ethnicity, and family affluence. † Other recreational activity is a composite variable based on the following activities: bicycling, skateboarding, rollerblading/roller-skating. * Statistically significant.

Comparing same-age children from schools that participated in MK with those that did not participate, we found that MK participants engaged in a higher mean times of running and FVC, expressed higher athletic identity self-concept, and indicated higher positive outcome expectations and PA and fruit and vegetable self-efficacy when measured at 3 time points over the school year. Although generally modest yet significant differences were noted for the primary outcome variables of interest, these initial findings nonetheless provide encouraging evidence on the role of community-school partnerships for enhancing running, FVC and selected psycho-social outcomes in lower income children.

Physical activity promotion programs that reach underserved children are needed given the current gender, ethnic, and SES disparities in U.S. children’s PA participation.\(^1,2\) While evidence on interventions for promoting PA in lower income children is limited,\(^3\) schools and communities have long been cited as important vehicles for promoting PA in young people.\(^1,2\) Partnerships among school personnel, students, families, community organizations and businesses have been recommended...
to develop, implement and evaluate PA programs for young people while at the same time make the best use of existing resources. Marathon Kids provides an example of a community organization that has been successful in bringing together a range of stakeholders to provide free PA and healthy eating activities to children from diverse ethnic and socioeconomic backgrounds. The high satisfaction for MK among our sample and generally high compliance with program activities underscore the program’s feasibility of implementation as well as appeal among economically disadvantaged children. Our findings of significant differences in running in children who attended schools with a MK partnership are consistent with results from the PLAY-ON study in Ontario, Canada that found that children in grades 5 to 8 were more likely to be moderately active if they attended a school with well-established community partnerships.

In addition to the positive effects of MK on PA and FVC outcomes, we found students who attended MK schools expressed a higher athletic identity self-concept,
greater positive outcome expectations related to PA, and higher PA and FVC self-efficacy. Athletic identity self-concept has been positively associated with PA in both children and adolescents. Outcome expectations and self-efficacy are key constructs for engagement in a given behavior posited by Social Cognitive Theory. Outcome expectations or perceptions of benefits of PA, self-efficacy, and FVC self-efficacy have been found to be positively associated with young people’s PA engagement and FVC, respectively. Our findings suggest that the impact of MK extends beyond PA and FVC to other psycho-social aspects related to healthy behavior.

A core strategy of MK is the use of a log to track and promote children’s accomplishments with PA and FVC, an approach that has roots in both self-monitoring and goal setting. Self-monitoring and goal setting are common strategies in the field of health behavior change and have been cited as recommended behavioral skills for helping young people establish and maintain regular involvement in PA. A recent systematic review of pedometer research found that 8 of 10 studies that used self-monitoring and goal setting resulted in increased PA in elementary and high school aged children. Self-monitoring and goal-setting have also been successfully applied to the reduction of sedentary behavior such as TV watching, where children assess, track, and set goals to reduce the number of hours they watch TV. Self-monitoring PA data from 5th and 6th grade children have been found to be correlated significantly with changes in VO_{2\text{max}} and HDL/LDL ratio 1 and 2 years later. As school-based curriculum-only strategies have generally not been found to be effective in increasing children’s PA, our findings suggest that tracking logs may provide a promising alternative or enhanced strategy for promoting PA and other positive health behavior via the school setting. Marathon Kids’ focus on social reinforcement of children’s PA and FVC via celebratory events, structured PA time during the school day, rewards, and the targeting of multiple social influences fall within national recommendations for PA promotion in the U.S., which include the provision of structured and unstructured PA time as well as the involvement of adults in providing encouragement and reinforcement for youth to be physically active.

While we observed differences in our student-reported process measures regarding specific aspects of social support, such as provision of MK logs and structured time for walking and running at school [data not shown], we did not observe significant differences in perceptions of social support with the exception of parental support for FVC. It is possible that teachers in both MK and non-MK schools were already providing support for these behaviors, and thus our general support measures were not sensitive enough to assess differences. Another potential explanation is that the lack of differences in social support may point to the need for further enhancement of MK strategies to specifically target the role of teachers and parents with regard to provision of social support for MK activities and goals. Enhanced communication from MK staff to school teachers and parents throughout the program cycle hold the potential to not only strengthen social support for MK program goals, but also increase the modest yet significant effects observed on PA and FVC. The Marathon Kids model may also be further enhanced by exploring strategies for increasing local school support for parent and student involvement in the celebratory Kick-Off and Final Mile Run events, in which just over a quarter of students were reported to attend. Future efforts should explore both barriers and facilitating factors for parental participation in Marathon Kids.

Limitations

Specific study limitations merit mention. First, this study was based on self-reported measures of PA in children, which are prone to social desirability bias and recall bias. While we cannot discount the possibility that differences were due to an overestimation of PA from students attending MK schools, 7-day self-reported PA recall measures have been found to have evidence of reliability in children and reliability and validity for 5th-, 8th-, and 11th-grade children in the United States. We also attempted to strengthen the study design through the assessment of our main outcomes at 4 time points over the school year, which provides greater stability of a given measure while also allowing for a better assessment of overall pattern of PA over time. A second limitation is inherent to our nonequivalent control group design. Because we were not able to randomly assign students or schools to intervention conditions, we cannot rule out a selection bias in which students or schools may be more inclined for PA before participating in MK. In addressing this threat to validity, we attempted to match schools to the extent possible on specific characteristics and adjusted for key sociodemographic and selection differences (eg, baseline measures) in the analyses.

Conclusion

Given the mixed findings on school-community partnerships on physical activity as well as limited evidence of effect of school-based interventions on physical activity and FVC in low-income children, further research is needed on effective models for engaging community organizations with schools for the promotion of children’s health. This study provides initial evidence of effectiveness of the role of a community-based organization (Marathon Kids) in enhancing children’s physical activity and FVC through coordinated school, family, and community-focused activities. Specific strengths of the Marathon Kids model include its simple yet straightforward approach for motivating children’s engagement in walking, running and FVC through a goal-setting and behavioral tracking activity - an activity that is easily incorporated into existing PE, recess and/or classroom curricula and that is rooted in behavioral science theory; the volunteer nature of the program, which is driven by volunteer efforts of teachers, parents and community leaders that facilitate and support the program at no
financial cost to program participants; highly visible recognition of the program via bumper stickers, Marathon Kids t-shirts, and community signage; and social reinforcement of the behavioral objectives via highly visible celebratory events as well as Final Mile Run reward medals and “Finisher” t-shirts.

Although the effect sizes of the program were generally small to moderate, these findings should be evaluated within the larger context of the study and the program. First, this study was carried out as an effectiveness study, under which conditions were neither optimal nor manipulated by the researchers. The program was evaluated ‘as is’ in its current form within a community/school setting. Second, the program’s simple model provides specific appeal and potential for widespread adoption and impact compared with more time- and resource-intensive programs. The high satisfaction of the program among students in this study suggests that the program is appealing to ethnically diverse and lower income children. Third, the program was found to have several additional positive effects on children’s athletic identity self-concept, PA outcome expectations, and PA and FVC self-efficacy. Lastly, the modest effect sizes for the program may translate into an important population-level effect when taking into account the current reach of the program, with over 152,000 students participating during the year of the study (personal communication, MK Executive Director, April 11, 2010). Given the limited scope of the current study on low-income children from 2 areas in Texas, further research is warranted to assess the effect of Marathon Kids on a broader sample of children from economically and geographically diverse backgrounds. While further enhancements to MK should be considered to increase the program’s effects—including possible enhancements to facilitate greater participation in the celebratory events, this study provides further evidence of the role of community-school partnerships in promoting PA and healthy eating in children.

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