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# Combating Disparities in Leisure Time Physical Activity in Underserved Children through Community-Academic Partnerships and a Comprehensive School-Based Program

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## Abstract

Engaging in regular physical activity is widely accepted as an effective preventative measure for a variety of obesity-related chronic diseases including diabetes, metabolic syndrome and cardiovascular disease. Disparities exist where racial/ethnic minority and low-income children do not meet these recommendations. Rather, they are spending the majority of their leisure time engaging in sedentary activities (e.g. using the computer, playing video games or watching television). The school years are known to be a key stage in the life course for shaping attitudes and behaviors. While school-aged children are ultimately dependent upon their parents, they also look to schools for education regarding physical activity. Therefore, schools, through the provision of culturally and developmentally appropriate healthy lifestyle programs, have the power to decrease sedentary behaviors, especially for underserved children where disparities in obesity-related outcomes exist. Through a partnership with a university and several community schools, the present randomized controlled trial study utilized a community-based participatory research approach to evaluate the impact of environmental changes and a culturally sensitive, school-based, family-centered lifestyle program, called Kids N Fitness©, on body mass index and leisure time physical activity, including: TV viewing and computer game playing, among underserved children ages 7-12 (N = 251) in Los Angeles County.

**Results:** Children who participated in the KNF© program had significant decreases in body mass index z-scores (p=0.04) and TV viewing (p = 0.03) from baseline to the 12 month follow-up.

**Conclusions:** The present study shows the value of utilizing community-academic partnerships and a culturally sensitive, multi-component, collaborative intervention to decrease disparities in leisure time physical activity behaviors among racial/ethnic and low-income children.

## Introduction

Engaging in regular physical activity is widely accepted as an effective preventative measure for a variety of obesity-related chronic diseases including diabetes, metabolic syndrome and cardiovascular disease. However, many underserved children do not meet these recommendations. Rather, they are spending the majority of their leisure time engaging in sedentary activities (e.g. playing video games or watching television [TV]). In the United States [1] and Canada [2] children and youth spend an average of 6 to 8 hours a day being sedentary. Data from such studies also suggest that the greatest decrease in physical activities occurs during early to late adolescence, a critical period of child growth and development. This decrease correlates with the increasing number of children who are overweight (Body Mass Index [BMI] > 84th - 94th percentile) or obese (BMI > 95th percentile) [3]; where globally, in 2010, approximately 42 million children under the age of five were overweight [4], and in the United States, the percentage of overweight school-aged children (aged 5-14 years) has doubled in the last 30 years, from 15% to 32% [5]. Of concern are the disproportionate rates of childhood obesity among racial/ethnic minority groups, particularly Black/African-American, Hispanic/Latinos, boys, and those from a lower Socio Economic Status (SES) [6-8]. For both children and adolescents, physical activity includes physical education, recreation, games, sports, or planned exercise, in the context of school, family, and community activities. Regular physical activity improves muscular strength, builds healthy bones and muscles, increases endurance, reduces the risk for developing chronic disease risk factors, improves self-esteem, and reduces stress and anxiety [9]. Beyond these known health effects, physical activity may also have beneficial influences on academic performance [10].

## The importance of collaborations in tackling childhood obesity

Children and youth have very little control over their physical activity options and food choices, particularly in the obesogenic environment of low SES communities. Schools serve as an excellent venue to provide students with the opportunity for daily physical activity and to teach the importance of regular physical activity in order to build skills that support active lifestyles [11-13]. Schools have access to school nurses who can provide screening, counseling and continuum of care [11-13]. In contrast to clinical programs, school programs can be delivered at little or no cost to families and can reach low-income urban children who otherwise might not receive treatment. Consequently, community-university collaborations targeting obesity prevention are increasingly being pursued, as they have the potential to bridge resources and to reach a greater number of individuals than either partner could accomplish alone. Community-

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Based Participatory Research (CBPR) has been recommended as an effective way to bring collaborative stakeholders from the university and the community together and create partnerships to prevent health disparities in childhood obesity.

School-based obesity prevention programs are most effective if they follow a coordinated, comprehensive program for school health. The comprehensive health program model for schools [14] consists of eight interacting components: school-health services; school counseling and psychology programs; school-health environment; school health instruction (e.g. curriculum); school physical education; school food service; school-site health promotion programs for faculty and staff; and integrated and linked community and school health-promotion efforts. This model lends itself well to obesity prevention efforts in the school and has been adopted by the Centers for Disease Control as a critical program model for all schools [15].

Physical activity in children generally consists of activities done during leisure time, physical education at school, riding their bikes or scooters, and activity related to everyday life tasks, such as eating or taking a bath. Such activity has been termed Leisure-Time Physical Activity (LTPA) [16]. Watching TV, computer use and playing video-games, are also components of leisure time and have been considered to be a good indicator of sedentary behavior [16]. Television watching has been cross-sectionally related to childhood adiposity in several epidemiological studies [17,18]. Television, along with other sedentary behaviors, may contribute to obesity by competing with more physically active behaviors [19]. Increasing leisure time activities such as mild, moderate or physical activity, and reducing sedentary behaviors, such as TV viewing and computer and/or video game use is a recommended goal in childhood obesity prevention and treatment [19, 20]. Despite this recommendation, there is a relative paucity of published studies that assess the impact that comprehensive school-based obesity prevention programs have on LTPA, especially among urban, low-income, overweight children.

Given this background, the present study among high risk, inner-city, early elementary school children was done to evaluate the impact of a coordinated comprehensive school health program that was culturally and linguistically responsive, family-centered, and lifestyle focused, on weight loss and LTPA. It was hypothesized that those participating in the intervention would have increased in vigorous daily physical activity, decreased TV viewing, and sustained weight loss, as indicated by lower BMI z-scores, between baseline and the 12-month follow-up.

## Materials and Methods

### Participants

Students (N = 251) were English or Spanish-speaking, had a BMI between the 85th and 94th percentile, were between 8-12 years of age and had no physical limitations that prevented regular exercise. Children and their parents assented/consented to participate in line with institutional review board requirements (assents/consent forms were translated into Spanish for Spanish-speaking parents).

### Procedures

The study was a parallel-group, cluster, randomized control trial. Between January 2008 and September 2010, students were recruited from five underserved elementary schools in Los Angeles, CA. Between January and April 2008, letters were sent to all elementary schools in the Downtown Los Angeles area. Schools were similar in ethnicity, gender breakdown, and SES (as measured by percent use of the free/reduced meal program), whereas all schools had a student population of at least 50% utilizing the free/reduced cost meals program (Table 1). The first five schools that responded to the letter and signed a Memorandum of Understanding (MOU) created by the CAB were enrolled in the study. The study design included repeated measures at the individual student level, where questionnaire data and anthropometric measures were collected by trained research staff at the school sites at baseline (pre-intervention), at the completion of the intervention phase (4 months), and at 12 months post-intervention. Students were compensated for their time with small tokens (stickers and/or a small toy). Parents were compensated for their time with a small token ($10 grocery store gift card).

A community-based participatory research conceptual framework was used. This framework, created by Jones and colleagues, was called Community-Academic Partnered Participatory Research (CPPR) [21,22]. CPPR emphasizes equal partnership for community and academic partners, while building capacity for partnered planning and implementation of research-based programs. A collaborative partnership between the University of California, Los Angeles, and Los Angeles-based underserved communities was established over an eight-year period, and subsequently, a research study, Kids Health Research Study, was developed. In accordance with the CPPR framework, a Community Advisory Board (CAB), composed of 14 active community stakeholders (including academicians, school administrators, teachers and parents, and parent association members), was formed and met quarterly to advise the researchers on all phases of the research study design, recruitment, retention, and dissemination of information [22,23]. The study was approved by the University of California Los Angeles Institutional Review Board, the ethical and research governing body.

Once enrolled, schools were randomly assigned to either the Kids N Fitness© intervention group (KNF©) (2 schools) or to the General Education (GE) group (3 schools) utilizing urn randomization [24]

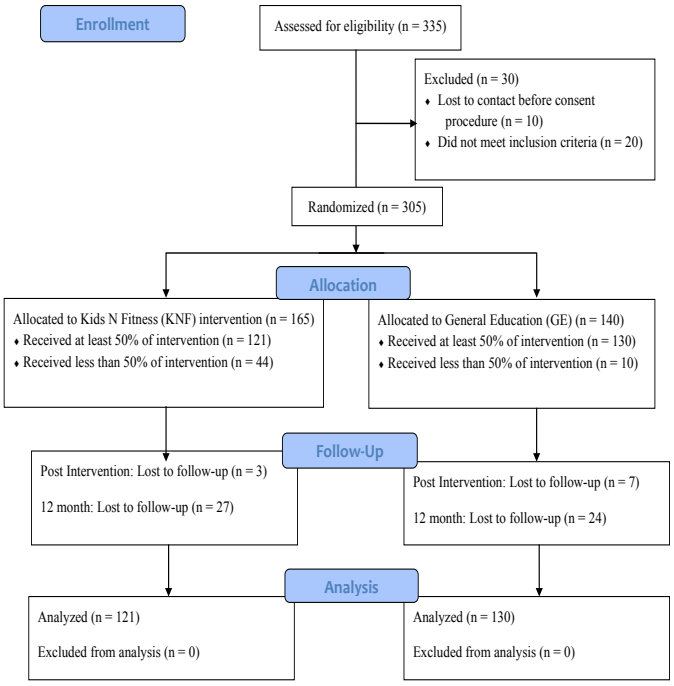


**Table 1:** CONSORT Table - Flow diagram of recruitment and attendance.

to ensure balancing of groups, the urn randomization was based on baseline characteristics including gender, race and SES. The general education group participated in the standard physical activity program given by their respective schools and did not receive any physical or nutritional education. The KNF© intervention group had two components, a family-centered educational lifestyle program plus environmental interventions at the school site. The intervention components were developed by the study team, which included a nutritionist, an advanced practice nurse, registered nurses, an exercise physiologist, a psychologist, and trained community health workers from the local schools. Once developed, it was reviewed by the CAB and pre-tested with 25 youth, who also provided cultural and linguistic modifications.

### Intervention fidelity

Once approved by the CAB, research team members were trained on all aspects of the intervention. To ensure fidelity of the intervention, team members were trained to implement protocols through full-day in-person training. They used a checklist of the course contents to ensure that protocols were consistently followed. They also rated how well the material was covered. The checklist was used during classroom observations. If research team members were not following the protocol they were given assistance and, if necessary, retrained (<10% of classes).

### The Kids N Fitness (KNF©) program

KNF© is a 6-week after-school program for parents and their children, with weekly 90-minute sessions conducted by a registered nurse, trained community health workers, and a physical education specialist. Sessions consisted of three components: physical activity, nutrition education/behavior modification, and family involvement through parental education classes on physical activity and nutrition and a parent support group where parents discussed challenges and facilitators of diet and exercise modification. The major focus of the culturally and developmentally appropriate physical activity education component was on reducing sedentary behaviors that may compete with physical activity, including TV viewing, and computer and video game use. All sessions and materials were in both English and Spanish. Students and parents were compensated for their time after each session that they attended with 1 small token per session.

### Environmental activities: school and community involvement

Environmental interventions at the school/community-level included (1) establishing partnerships with local community clinics who provided on-site health and mental health services for the children; (2) a School Health Advisory Council (Advisory Council) made up of representatives from the University, school administrators and staff, parents and community partners that created and promoted School Wellness Policies involving physical activity and dietary changes; (3) staff professional development seminars taught by research team members on nutrition and activity; and (4) home-level activities that included parental outreach via bi-monthly educational newsletters created by the Advisory Council that were mailed to parents homes.

## Measurements and Instruments

### Demographics

Parents/Guardians completed a demographic form utilizing questions from the 2006 Behavioral Risk Factor Surveillance System Questionnaire (BRFSS), which included race/ethnicity, marital status, education level, income level, health status, child diagnosed by an MD with asthma, and child still with asthma. Students completed the demographic section of the Child and Adolescent Trial for Cardiovascular Health (CATCH) and the School Physical Activity and Nutrition (SPAN) Student Questionnaire, which included questions on date of birth, age, gender, primary language spoken, and race/ethnicity (Table 2). Questionnaires were in both English and Spanish.

### Body composition

Subjects' weight measurements were obtained to the nearest 0.1 kg using a Detecto electronic weight scale that was calibrated daily. Heights were measured in 0.1 cm increments using a Harpenden stadiometer. BMI values ($kg/m^2$) and associated z-scores were calculated using Epi Info software developed by the CDC [3].

### Anthropometric measures

Resting blood pressure was obtained via the LifeSource UA-100 Aneroid sphygmomanometer, which was calibrated prior to measurements (utilizing appropriate pediatric or adult-sized cuff). To measure waist circumference, a cloth tape measure was placed around the abdomen horizontally at the midpoint between the highest point of the iliac crest and the lowest part of the costal margin in the mid-axillary line. Measurements were performed three times and averaged for analyses.

### Physical activity behaviors

Physical activity in children generally consists of activities done during leisure time, physical education at school, getting to and from school, and activity related to everyday life tasks. Of all of these variables, leisure-time physical activity (LTPA) exhibits the largest variations among the different age and sex groups studied [16]. Consequently, in the present study LTPA was chosen as an overall indicator, and LTPA behaviors were assessed using the CATCH SPAN Questionnaire, utilizing 5 items in the areas of daily vigorous physical activity, daily mild to moderate physical activity, TV use, computer use, and video game use (Table 3). Acceptable reliability and validity of the instruments was determined during testing in a diverse sample of 96 elementary schools [25]. Internal consistency for activity behavior questions was $\alpha = 0.85$.

### Data analysis

Baseline characteristics were compared using t-tests for continuous variables and chi-square tests for categorical variables. Data were analyzed under the intent-to-treat principle whereby all randomized subjects were analyzed in the group to which they were randomized [26]. The intent-to-treat analysis was performed on all 305 randomized subjects. This included 30 children who were randomized and participated in the intervention but were lost to follow-up. For the primary analysis, a mixed model of repeated measures analysis (adjusted for baseline scores, child's race, and parental marital status) was used to evaluate changes in outcomes over time and to compare these changes between KNF and GE groups. This model provides unbiased estimates of time and treatment differences in outcomes, assuming missing data are Missing At Random (MAR) [27], i.e., given the observed outcomes and covariates, missing data are not dependent on unobserved values [28]. Predicted least square means was used to calculate changes from baseline to 4 months and 12 months in each outcome of interest over time across both groups and by groups. A p-value of $< 0.05$ was deemed significant. All analyses were performed in SAS V9.1 [29]. A power analysis showed that for assessing program differences in change over time for student-level outcomes, the sample

size of approximately 130 students will allow detection of moderate effects (approximately d = 0.65-0.75) in repeated measures analyses, accounting for cluster randomization [30].

## Results

### Demographics

Of the 305 students initially enrolled in the KNF© program, 251 students (82%) attended at least half of the sessions and therefore constituted the study cohort. There were 121 students assessed at baseline in the KNF© group and 130 in the GE group. Both groups were similar in that there were more girls, more students from the 4th grade, and more parents with an elementary school education. The parents had an annual income at or below the federal poverty level of 0-$15K/year (Table 2).

Thirty students (25%) were lost to follow-up at 12 months in the KNF© group, compared to 31 students (23%) in the GE group (p = 0.75). Students who were lost to follow-up, compared to those who completed the study, were more likely to be older (50.1% vs. 42.3%), Spanish-speakers (70% vs. 61%) (p = 0.028) and had higher TV-viewing behaviors (39% vs. 22%) (p = 0.015)

### Anthropometric outcomes

There were no significant baseline anthropometric group differences between the KNF© and GE Groups (Table 3). However, there was a significant decrease between the KNF© and GE groups from baseline to 4 months and the effect was sustained at 12 months for BMI, KNF group difference of – 2.80 ($p$ = 0.05) and BMI z-score difference of -0.19 ($p$ = 0.04).

| | KNF Group ($n$ = 121) | GE Group ($n$ = 130) | $p$-value[a] |
|---|---|---|---|
| Age, mean (SD) | 9.2 (1.6) | 9.3 (1.1) | 0.12 |
| Grade, Mean (SD) [a] | 4.2 (1.2) | 4.4 (1.5) | 0.02 |
| Gender [a] | | | 0.04 |
| Male, N (%) | 51 (42) | 50 (41) | |
| Female, N (%) | 70 (58) | 80 (59) | 0.01 |
| Primary Spanish Speaking, N (%) | 70 (53) | 73 (52) | |
| Diagnosed with Asthma, N (%) | 15 (12.4) | 16 (12.3) | |
| Child Race/Ethnicity, N (%)[b] | | | 0.32 |
| Black or African American | 5 (3) | 5 (3) | 0.01 |
| Hispanic/Latino | 116 (97) | 120 (99) | |
| Mexican/Mexican American | 115 (95) | 120 (99) | 0.33 |
| Caregiver Gender - Female | 70 (58) | 72 (55) | 0.02 |
| Caregiver Education, N (%)[c] | | | |
| 1-8th grade | 36 (44) | 30 (45) | |
| 9-11th grade | 16 (22) | 9 (19) | |
| Grade 12 or GED | 24 (32) | 28 (34) | |
| College 1-4 years | 4 (2) | 3 (2) | |
| Caregiver Marital Status, N (%)[d] | | | 0.03 |
| Single Parent Household e | 27 (39) | 30 (43) | |
| Married | 43 (61) | 40 (57) | |
| Caregiver Income, N (%)[c] | | | 0.01 |
| 0-$15K | 45 (56) | 43 (61) | |
| $15K-$25K | 35 (44) | 27 (39) | |

[a]P <.05 by from t test (age and grade) or $\chi^2$ (all others)
[b]Racial/Ethnicity Categories Taken from include Coordinated Approach To Child Health (CATCH) School Physical Activity and Nutrition (SPAN) Student Questionnaire, include American Indian or Alaska Native, Asian, Black or African American, Latino or Hispanic [if Latino/Hispanic are they Mexican or Mexican-American], Native Hawaiian or Other Pacific Islander, White, non-Hispanic, non-Latino and Other). KNF Group: Other -5 (4%);
[c]Caregiver (e.g., parent/guardian) KNF group N = 80; GE Group N = 70
[d]Single Parent household = Divorced, Separated, Member of Unmarried Couple; KNF Group Missing = 10.

**Table 2:** Baseline (Pre-Intervention) Demographic Characteristics by Group.

### Leisure-Time Physical Activities (LTPA)

At baseline, there were significant group differences for vigorous daily physical activity ($p$ = 0.05) and mild-moderate physical activity ($p$ = 0.05) (Table 4). The multivariate analysis revealed that there was

| | KNF Group Pre-Intervention (N = 121) | GE Group Pre-Intervention (N = 130) | $p$-value[b] |
|---|---|---|---|
| | Mean (SD) | Mean (SD) | |
| Anthropometric measures | | | |
| BMI (kg/m²) a | 21.89 (6.26) | 21.25 (6.68) | 0.02 |
| BMI Z-score a | .98 (.50) | 1.00 (.78) | 0.01 |
| Waist Circumference | 26.91 (4.16) | 26.82 (3.91) | 0.89 |
| Leisure Time Physical Activity | | | |
| Vigorous daily PA[c,d] | 1.51 (.50) | 1.55 (.69) | 0.01 |
| Mild-Moderate PA[c,e] | 1.32 (.47) | 1.38 (.40) | 0.01 |
| TV Viewing f | 1.32 (.47) | 1.35 (.38) | 0.04 |
| Computer Use g | 1.21(.41) | 1.18 (.49) | 0.03 |
| Video Game Use[h] | 1.02 (.33) | 1.05 (.39) | 0.98 |

[a]BMI- Body Mass Index
[b]P <.05 by t test
[c]PA = Physical Activity
[d]Daily Vigorous Physical Activity- "On how many of the past 7 days did you exercise or take part in physical activity that made your heart beat fast and made you breathe hard for at least 20 minutes?" (For example: basketball, soccer, running or jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities)." (Source: CATCH SPAN)
[e]Daily Mild-Moderate Physical Activity- "On how many of the past 7 days did you do any exercise that did not make your heart beat fast and did not make you breathe hard for at least 30 minutes?" (For example: fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors.) (Source: CATCH SPAN)
[f] T.V. Viewing- "Yesterday, how many hours did you watch TV or video movies away from school?" (Source: CATCH SPAN)
[g]Computer Use-"How many hours per day do you usually spend on the computer away from school?" (Time on the computer includes time spent surfing the Internet and instant messaging). (Source: CATCH SPAN)
[h]Video Game Use- "How many hours per day do you usually spend playing video games like Nintendo®, Sega®, PlayStation®, Xbox®, GameBoy® or arcade games away from school?" (Source: CATCH SPAN)

**Table 3:** Baseline Outcome Data between KNF Intervention and GE Groups.

| | KNF GROUP | GE GROUP | |
|---|---|---|---|
| | 12-Month Follow-up | 12-Month Follow-Up (N = 99) | $p$-value[b] |
| Anthropometric Measures | | | |
| BMI (kg/m²)[a] | -2.80 (-4.31, -1.25) | 1.23 (-4.12, 3.41) | 0.05 |
| BMI Z-score[a] | -0.19 (-0.38, 1.01) | 0.58 (-1.08, 1.09) | 0.04 |
| Waist Circumference | -0.03(-1.21, 1.02 ) | 0.94 (0.30, 1.51) | 0.09 |
| Blood Pressure | 0.02 (0.01-1.12) | 0.10 (0.09-2.12) | 0.58 |
| Leisure Time Physical Activity | | | |
| Vigorous Daily PA[c] | 2.52 (1.98, 9.18) | 0.10 (-0.40, 0.70) | 0.02 |
| Mild-Moderate Daily PA[c] | 1.50 (-0.01, 1.21) | 0.80 (-0.49, 0.52) | 0.03 |
| TV Viewing Computer | -1.90 (-3.10, -0.60) | 0.05 (-1.57, 1.80) | 0.02 |
| Use Video | -0.50 (-0.31, 2.11) | 0.14 (-0.21, 1.21) | 0.03 |
| Game Use | -0.07 (-1.09, 1.30) | 0.10 (-0.44, 0.75) | 0.21 |

[a]BMI- Body Mass Index
[b]P <.05 by t test; sustained significance at the 12-month follow-up visit
[c]PA = Physical Activity

**Table 4:** Mixed Model Analysis of Outcomes between KNF and GE Groups by Gender: Changes from Baseline (95% CI).

a significant increase from baseline to 4 months and the effect was sustained at 12 months for vigorous daily physical activity, an increase of 2.52 ($p = 0.02$) and a mild-moderate increase of 1.50 ($p = 0.03$) for daily physical activity. There was a significant decrease from baseline to 4 months and the effect was sustained at 12 months for computer use, decrease of -0.50 ($p = 0.03$) and TV viewing, a decrease of -1.90 ($p = 0.02$), but not for video game use ($p = 0.21$). As compared to English speakers, Spanish-speaking students had significant increases in vigorous daily physical activity ($p = 0.02$), but not mild-moderate daily physical activity ($p = 0.25$) (Results not shown). Children with asthma had significant decreases in vigorous ($p = 0.05$) and mild-moderate daily physical activity ($p = 0.05$) from baseline to 4 months and the effect was sustained at 12 months (Results not shown).

## Discussion

This study adds to the evidence that community-university partnerships, which provide a comprehensive, culturally and linguistically school-based obesity prevention program, can be effective in addressing leisure time physical activity by improving health and fitness and decreasing sedentary behaviors among high-risk, low-income, young children. This study is unique in that it is one of few studies in this population that showed sustained improvements over a 12-month period of time. All intervention participants fulfilled the hypothesis of sustaining substantial weight loss, as indicated by BMI z-scores, increasing vigorous daily activity, and decreasing TV-viewing time. Additionally, intervention participants achieved sustained increases in mild-moderate daily physical activities and decreases in computer time. These results are partially shared in the literature [18,31-33]. School-based intervention studies with young children in grades 2-4 show similar post intervention results of children in the intervention group with statistically significant relative decreases in BMI and decreases in TV viewing [18,31]; however, the studies show no changes in moderate-vigorous physical activity [18,32].

Differences between the current study and the literature may be due to differences in the study population (e.g., racial/ethnic or gender differences). For example, some studies focused only on African-Americans or only on girls [31]. The differences may also be related to varying intervention components. Some studies focused on an intervention that utilized a promotora or community-health worker only model [33]. Other studies focused their intervention on one specific form of activity, such as dance [31] or TV-viewing reduction or video game reduction [18]; others used a combination of 2-3 activities [34,35]. One study included multiple components, including the environmental activity of a school-based committee, to assist with recommendations for improvements in nutrition and physical activity [36]. However, the current study utilized several key components in their education including mild, moderate and vigorous physical activity, nutrition education for parents and children, and environmental activities that focused on educating school administrators, faculty, and parents and creating policy changes to meet the desired outcomes. Another unique distinction from previous studies was the use of community-academic partnerships through the CAB to help lead and tie-in each segment of the activities. Thus, the CAB became the catalyst and the tie that bound the community-academic partnership [37] and all activities related to the Kids Health Research Study.

It is now known that children and adolescents have health-enhancing effects from continuous forms of vigorous physical activity that the CATCH questionnaire was designed to assess [38]. Thus, physical activity guidelines that have changed to the current recommendations are for young people to accumulate 60 minutes of at least moderate intensity activity on most days of the week [39]. This current study showed that through a community-university partnership that supported the comprehensive school-based obesity prevention program outlined in the study, these recommended goals can be achieved.

There are some limitations that should be taken into account in the interpretation of the data. First, the sample population was predominately Latino, therefore the generalizability to other racial/ethnic and regional groups may be limited, and future studies should be done in various groups to assess changes in BMI z-scores and activity behaviors. A major limitation of the study was the attendance and retention of participants, especially at the 12-month follow-up period. Poor retention is a common phenomenon in many healthy-living programs in both children and adults, especially among racial/ethnic minority populations [40]. There are several possible reasons for this low retention in attendance. The schools involved were in the inner-city with low test scores in reading and math and high absenteeism. Students routinely were pulled from after school programs to attend tutorial reading and math classes in order to improve mastery test scores. In addition, coming from low SES schools, students and parents were not given monetary incentives, and parents who needed to work had to rush home from work to participate in the after school program, making it difficult for them to attend. The programs were funded through research grants, and while incentives were provided based on recommendations of the CAB, which included healthy snacks and a full dinner with each session, as well as educational and physical activity equipment, perhaps schools and their community partners could come up with additional incentives that might encourage more participation.

## Conclusion

The literature recommends that population-based interventions directed towards childhood obesity prevention should target physical activity and nutrition behaviors, as well as reduction in TV viewing. The current study concurs with this recommendation and shows that a comprehensive, culturally and linguistically appropriate school-based intervention, which includes physical activity and nutrition education, can not only increase mild-vigorous physical activity and decrease TV viewing, but can also decrease computer time use. More intervention studies among low-income, racial/ethnic populations need to be conducted to address these issues, as well as the issue of reducing time associated with video game playing.

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