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Impact of a pilot pharmacy health-care professional out-of-school time physical activity and nutrition education program with exercise on fourth and fifth graders in a rural Texas community

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Abstract

Objectives: Childhood obesity continues to be a problem. Children in rural populations are more likely to be overweight or obese and a lack of resources in those areas may contribute to this problem. We aimed to assess the impact of a pilot pharmacy health-care professional out-of-school time vigorous physical activity and nutrition education program on fourth and fifth graders in a rural Texas community.

Methods: We conducted a prospective 12-week cohort study from August to November 2012. Thirty-three children, aged 8–11 years, in Bailey County, Texas, were enrolled in the study. Body mass index, body mass index percentile, blood pressure, waist circumference, and a diet preferences and activities knowledge survey were obtained at 0, 4, 8, and 12 weeks. Study participants completed a twice weekly physical activity and nutrition education program with exercise over weeks 1–4 with no intervention during weeks 5–12.

Results: Thirty-one (94%) of the 33 children, predominately Hispanic girls, completed the program. Body mass index (−0.30 (95% confidence interval, −0.44 to −0.17); P = <0.0001), body mass index percentile (−2.75 (95% confidence interval, −4.89 to −0.62); P = 0.0026), systolic blood pressure (−1.9 (95% confidence interval, −2.9 to −0.9); P = <0.0001), and waist circumference (−0.47 (95% confidence interval, −0.85 to −0.10); P = <0.0001) mean change decreased between baseline and week 12 with no intervention for 8 weeks. Positive survey results at 3 months indicated a decrease in fried/sweet foods; increase in exercise; decreases in video games and computer use; and a change in knowledge regarding the selection of the most healthy food group servings per day.

Conclusion: In this pharmacy health-care directed pilot study, participants had a reduction of body mass index, body mass index percentile, systolic blood pressure, waist circumference, and improvement in certain survey results at the end of 12 weeks despite no further intervention after 4 weeks.

Keywords

Blood pressure, body mass index, child, exercise, health education, Hispanic Americans, nutrition, pharmacists, rural population

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Introduction

Childhood obesity continues to remain a concern despite federal government goals to decrease obesity. Extra vigilance is warranted in obese children because they are at risk for becoming obese adults with long-term health consequences of diabetes, hypertension, and hyperlipidemia.[1,2] Increases in obesity-related health problems in children, such as type 2 diabetes,[3,4] require monitoring for cardiovascular disease risk factors, especially in minorities.[2,5]

Children in rural communities in the United States are more likely to be overweight or obese compared with those who live in urban communities.[6–9] Low-income families and minorities are at an increased risk for obesity or being overweight,[6,10–13] specifically those who live in the South Central regions of the United States,[14,15] including Texas.[14] Texas is the second largest Hispanic populated US state with the largest rural population at risk for obesity. Compared with national averages, higher body mass index (BMI) is more prevalent in rural communities[16] that have less access to healthier food choices,[17] increased consumption of unhealthy foods,[7] and decreased physical activity levels.[7] High-risk populations of minorities and children in rural communities are two groups recommended for future childhood obesity prevention and treatment research.[18]

The implementation of afterschool physical activity and nutrition education programs with moderate to vigorous exercise (e.g. bicycle riding, jumping rope, running, soccer, basketball, and game of tag) promotes changes in lifestyle, yielding healthier eating and physical activity practices.[19] Previous studies have demonstrated positive results with school-based intervention programs,[19–22] although other statements, reviews, and studies have reported varied results.[23–25] US rural populations have shown benefit from the implementation of school-based intervention programs.[26–30] Rural communities may be limited in providing school-based programs due to limited resources. Out-of-school time (OST) programs in rural communities offer supervised activities that may assist with personal, academic, and recreational development within rural communities with insufficient resources. OST programs may be designed to provide personal development of physical activity and nutrition education to children that are directed to local community conditions.

Improvements in physiologic (systolic blood pressure (SBP)) and anthropometric parameters (BMI, weight, and waist circumference (WC)) are seen in the literature following intervention-based studies.[31] These nonrural intervention-based studies produced changes in BMI, WC, and blood pressure (BP).[31–35] The typical duration of intervention programs is at least a year or more,[25] with physiologic and anthropometric parameter changes after 6–12 weeks.[4,33,36] Community health-care professionals[37,38] including pharmacists are medically trained individuals who may assist in providing OST rural community physical activity and nutrition education programs to impact physiologic and anthropometric parameters.

The primary aim of this study was to determine whether a 12-week pilot pharmacy health-care professional OST physical activity and nutrition education community program with vigorous intensity exercise for fourth- and fifth-grade children in a rural Texas community could influence the physiologic and anthropometric measurements of BMI, BP, WC, and weight. The secondary aims were to evaluate population characteristics and the effects of the intervention on the After-School Student Questionnaire (ASSQ) results.

Methods

Study design, participants, and setting

The Texas Tech University Health Sciences Center Institutional Review Board for the Protection of Human Subjects approved this study. Enrollment in the prospective 12-week cohort study required all of the participants to provide an informed written child assent form, a parent's consent form for the child, and a parent's consent form (baseline demographics). The participants were recruited before the start of the school year in August 2012 and participated from August 2012 to November 2012. Announcements for the study were disseminated at local community events, on electronic and posted message boards, and in the local newspaper. The inclusion criteria included fourth- and fifth-grade elementary schoolchildren who reside in Bailey County, Texas, a rural community with an estimated population of 7130 in 2012, 60% of whom were of Hispanic or Latino origin in 2011 and 19.2% of whom were at or below the poverty level between 2007 and 2011.[39] Participants were excluded from the study if they could not exercise; complete the questionnaire or the exercise interventions because of physical or cognitive impairments; for medical reasons; if neither parent participated in the study to provide baseline characteristics; or did not complete the study (missing data collection). All of the participants received a t-shirt. The children were categorized into the following groups according to their body mass index percentile (BMI%): healthy (5th to <85th percentile), overweight (85th to <95th percentile), or obese (≥95th percentile).[40]

Intervention

This study was conducted in two phases (Figure 1), took place at the community center and park, and involved a team of a pharmacist and pharmacy student researcher (data collection, physical activity, and nutrition education), and junior high school coach (physical activity). In phase I (week 0), baseline data were obtained; weeks 1–4: study parameters were collected, the physical activity and nutrition education intervention were implemented, exercise events of warm-up drills and running were incorporated, and track meets

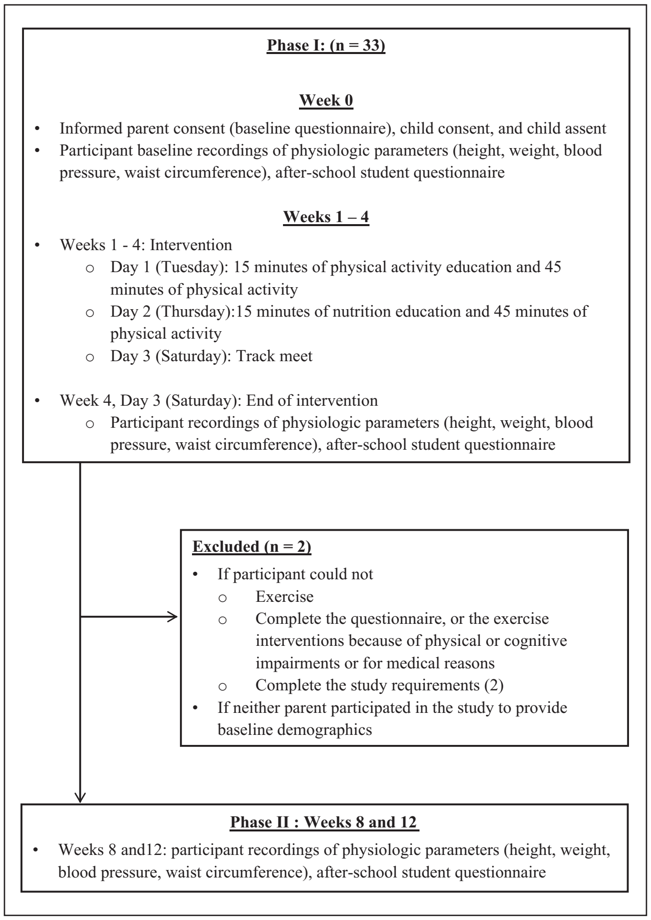

Figure 1. Baseline data collection flowchart.

sponsored by study personnel with study participants occurred. In phase II (weeks 8 and 12): the final study data measures were documented.

Phase I

In phase I (week 0), eligible children and parents met at a local community facility to complete the baseline questionnaire and the ASSQ. The researchers measured the baseline study parameters of BMI, BMI-percentile-for-age, BP, WC, height, and weight. Parents completed the demographic questionnaire, which assessed the child's information of age, gender, and school grade; family demographics; and socio-economic information of ethnicity, income, marital status, and language.

BMI was calculated as weight in kilograms divided by the square of height in meters. BPs were obtained using a manual pediatric BP cuff on the right arm. Anthropometric measurements consisted of a flexible tape measure placed around the trunk at the top of the iliac crest for the WC, and the same calibrated scale was used at each session for height and weight. Both height and weight were measured with the shoes removed. Height and WC were measured to the nearest 0.1 cm, and weight was measured to the nearest 0.1 kg. BP, height, weight, and WC were measured by the same personnel at 0, 4, 8, and 12 weeks with the exception of WC at 4 weeks.

The US and Canada widely implemented Coordinated Approach to Child Health (CATCH) Curriculum ASSQ is a 58-question multiple-choice student survey for multiple ethnicity third- to fifth-grade elementary schoolchildren; the ASSQ evaluates food preferences, dietary knowledge, and selection of recent food options and activities, including video game, computer, and television use. The ASSQ is an instrument that is adapted from the School-based Nutrition Monitoring Student Questionnaire and the Health Behavior Questionnaire, which have validity and reliability tests associated with them.[41,42] These two questionnaires have established reliability and validity with internal consistency greater than 0.6.

Weeks 1–4 consisted of 4 weeks of physical activity and nutrition education with consistent vigorous intensity exercise sessions (i.e. warm-up drills and running) across the 4 weeks at the local community park with data collection. Each week the participants attended two, 60-min evening sessions (total n = 8) for a 1-month period. The weekly sessions focused on 15 min of alternating physical activity and nutrition education with 45 min of vigorous intensity exercise (i.e. day 1 (15 min of physical activity education + 45 min of vigorous intensity exercise), day 2 (15 min of nutrition education + 45 min of exercise)). Subjects participated in a study-sponsored track meet at the end of each week for 4 weeks as part of the intervention. At the completion of phase I (week 4), the participants completed the ASSQ and had their physiologic and anthropometric parameters measured at the community center.

Physical activity and nutrition education program provided to subjects

Research personnel provided twice weekly 15-min alternating physical activity (four sessions) and nutrition (four sessions) education evening sessions (i.e. week 1: day 1—physical activity education; day 2—nutrition education) that alternated in content during the 4 weeks. These nutrition or physical activity topic sessions focused on providing an overview of the designated topic session, highlighting important points of the topic, asking participant views on the topic, correcting any items discussed by subjects, and recommending the implementation of a goal (e.g. reducing the intake of sugary foods; goal to change at least one beverage to water) for each session to complete for the following event and discuss. Resources used for the education of the study participants were not part of one curriculum, but incorporated items from two resources: 10 Tips Nutrition Education Series[43] and the Physical Activities Guidelines for Americans: Active Children and Adolescents.[44] At the end of each session, 10 Tips Nutrition Education Series[43] handouts were provided to the participants based on the scheduled topic session. The children were encouraged to read and complete the activity handouts and to discuss them at the following session to better retain the information.

Nutrition education days consisted of selected topic sessions that included learning about dietary guidelines;[45] identifying and selecting low-fat, nutritious foods; reducing the intake of sugary foods; limiting saturated fat; selecting water as a beverage over drinks with a high sugar content; identifying appropriate portion sizes; interpreting nutrition labels; and participating in food group discussions to improve eating that corresponded with the 10 Tips Nutrition Education Series.[43] The participants were encouraged to make different food choices based on the education sessions.

Physical activity education days included learning about physical activity guidelines, information on types of recommended physical activities beyond baseline activity, and discussions of sedentary behavior activities of texting, as well as phone, computer, video game, and television use. The participants were encouraged to maintain an active lifestyle with a reduction in sedentary activities by completing the recommended 60 min of daily moderate and vigorous intensity physical activity (e.g. running, hopping, skipping, and jumping) by the Physical Activities Guidelines for Americans: Active Children and Adolescents and limiting screen time of cell phone, television, computer, or video game to 2 h per day.[44]

Exercise program provided to subjects

Exercise activities were selected with the assistance of the local junior high school coach at the sessions that provided the guideline recommended moderate- and vigorous-intensity physical activity level. Each exercise session occurred at the park in the evening and consisted of warm-up drills and vigorous intensity running activities that lasted approximately 45 min twice a week (i.e. week 1: day 1—45 min; day 2—45 min). Each session had a brief warm-up consisting of light aerobic and stretching activities, followed by running with a rest break.

Each participant competed in a weekend study investigator developed track meet unless injury or illness barred his or her participation. Families cheered on the participants during the family-attended track meets. For track meets, the participants were divided into four weekly rotating teams of the enrolled participants. Each participant alternated teams and rotated distances each week. Each team member competed in races of 220, 440, 660, and 880 yards, with individuals running 55, 110, 165, and 220 yards. Running times were not measured for the track meets. Race 1 consisted of four different team members each running 55 yards before passing the baton to a teammate until 220 yards had been run. This same model was repeated for the remaining distances. All of the participants had an opportunity to rest between races. At the end of the track meet, motivational participation ribbons with encouraging words were distributed to all of the team members.

Phase I completion

At the end of phase I (week 4), participants met at the community center to complete the ASSQ and to have their physiologic and anthropometric parameters documented.

Phase II

Phase II consisted of two data collection sessions at the end of 8 and 12 weeks. The physiologic and anthropometric parameters were obtained upon completion of the ASSQ at the community facility.

Statistical methods and data analysis

The data were evaluated using the Excel statistics add-on package Analyze-it v 3.20.2 ©1997–2013 (Analyze-it Software, Ltd., Leeds, England, United Kingdom). The nominal data were evaluated using Pearson's chi-square test or Fisher's exact test as appropriate. Continuous data were evaluated as paired data using the Wilcoxon sign-rank test for nonparametric data and the paired Student's *t*-test for parametric data. Repeated measures ANOVA was used to analyze the physical parameter changes from baseline to 12 weeks. The change in BMI from baseline to 12 weeks was compared to the change in SBP from baseline to 12 weeks using Spearman correlation. No power analysis was performed for sample size because no a priori response rates were available for the calculation. The α level of significance was set at 0.05.

Results

Thirty-three children consented to participate in the study. Of these children, 31 completed the study, yielding an overall completion rate of 94%. One individual dropped out of the study because of a sports activity conflict and one did not complete the ASSQ. The majority of the participants were Hispanic (28 of 31 (90%)) and girls (23 of 31 (74%)). Of those who participated, 13 of the 31 children (42%) were considered overweight or obese according to the BMI%. One third of the study participants were categorized as living in poverty according to the 2012 guidelines[46]. The baseline characteristics are provided in Table 1. The mean age of the children was 9.6 years, and the majority were in the fifth grade, lived in a two-parent home with a median of three children, and spoke English and English/Spanish at home.

The physiologic and anthropometric results of the study are presented in Tables 2 and 3. Between baseline and 12 weeks, there was a reduction in mean change in BMI (−0.30 (95% confidence interval (CI), −0.44 to −0.17); P=<0.0001), BMI% (−2.75 (95% CI, −4.89 to −0.62);

Table 1. Baseline patient characteristics for fourth and fifth graders enrolled in the study (N = 31).

Mean age ± SD	9.6 ± 0.8
Gender, female (%)	25 (81%)
Ethnicity, n (%)	
Hispanic	29 (94%)
Other	2 (6%)
Mean weight (kg) ± SD	41.63 ± 12.06
Mean height (in) ± SD	56.29 ± 3.42
Mean BMI (kg/m^2) ± SD	20.14 ± 4.57
BMI% 5th to <85th percentile	19 (61.2%)
BMI% >85th to <95th percentile	3 (9.7%)
BMI% ≥ 95th percentile	10 (32.3%)
Mean waist circumference (cm) ± SD	28.04 ± 4.51
Mean SBP (mm Hg) ± SD	106.6 ± 5.8
Mean DBP (mm Hg) ± SD	64.2 ± 4.0
School grade, n (%)	
Fourth grade	11 (35%)
Fifth grade	20 (65%)
2012 Poverty Household Guideline,[46] n (%)	10 (32%)
Two-parent household	25 (81%)
Median total number of children at home (IQR)	3 (1)
Spoken language at home	
English only	15 (48.4%)
English and Spanish	14 (45.2%)
Spanish only	2 (6.4%)

IQR: interquartile range; BMI: body mass index (kg/m^2); SD: standard deviation; n: number; SBP: systolic blood pressure; DBP: diastolic blood pressure.
Nominal data were evaluated using Pearson's chi-square test or Fisher's exact test as appropriate.

Table 2. Study parameter changes (N = 31).

Measurement	Mean	SD	Mean change (95% CI) between baseline and week 12	Repeated measures ANOVA P-value
Baseline BMI	20.14	4.57	−0.30	<0.0001
4-week BMI	20.03	4.55	(−0.44 to −0.17)	
8-week BMI	19.90	4.43		
12-week BMI	19.84	4.41		
Baseline BMI%	71.46	25.99	−2.75	0.0026
4-week BMI%	69.86	26.90	(−4.89 to −0.62)	
8-week BMI%	69.24	27.28		
12-week BMI%	68.71	27.59		
Baseline WC	28.04	4.51	−0.47	<0.0001
4-week WC	27.34	4.38	(−0.85 to −0.10)	
8-week WC	27.47	4.43		
12-week WC	27.57	4.40		
Baseline SBP	106.6	5.8	−1.9	<0.0001
4-week SBP	105.4	4.8	(−2.9 to −0.9)	
8-week SBP	105.2	4.6		
12-week SBP	104.7	4.0		
Baseline SBP%	58.75	18.54	−5.21	0.0543
4-week SBP%	56.18	15.88	(−10.11 to −0.30)	
8-week SBP%	54.94	14.75		
12-week SBP%	53.54	13.82		

SD: standard deviation; BMI: body mass index (kg/m^2); BMI%: body mass index percentile; WC: waist circumference; SBP: systolic blood pressure; SBP%: systolic blood pressure percentile; ANOVA: analysis of variance; CI: confidence interval.
Continuous data were evaluated as paired data using repeated measures ANOVA.

P = 0.0026), SBP (−1.9 (95% CI, −2.9 to −0.9), P = <0.0001), SBP percentile (SBP%) (95% CI, −5.21 (95% CI, −10.11 to −0.30); P = 0.0543), and WC (−0.47 (95% CI, −0.85 to −0.10); P = <0.0001). Despite the baseline to week 12 WC decrease, weeks 8–12 resulted in an increase of WC. The BMI and SBP in the 12 subjects >85th percentile decreased more at the end of 12 weeks than in those 19 subjects ≤85th percentile (BMI median change = −0.375 (−0.694 to −0.309) vs −0.150 (−0.425 to −0.079), P = 0.0231; SBP mean change = −3.5 ± 3.1 vs −0.8 ± 1.8, P = 0.0231) (see Table 3). Figure 2 is a scatter plot that shows a significant correlation (rs = 0.422, P = 0.0197) between the differences in BMI and SBP from baseline to 3 months in the participants.

Children ASSQ scores were evaluated from baseline to the 3-month follow-up; results and questions are displayed in Table 4. Eleven results from the ASSQ scores are not provided due to the lack of relevance to the study outcome measures including the evaluation of exercise in the past year, understanding of the role of food, and heart disease or cancer as a few examples. Decreases were significant in the ingestion of fried foods or sweets (3 (interquartile range (IQR), 1.0–4.0) to 0 (IQR, 0.0–1.0); P = <0.0001). Vegetables, beans, fruit, or fruit juice intake was not increased (4 (IQR, 2.0–4.0) to 3 (IQR, 2.0–4.0); P = 0.4319). Exercise activity increased in participants at the end of 12 weeks (0 (IQR, 0.0–1.0) to 1 (IQR, 0.0–1.0); P = 0.0413). The number of television shows and videos viewed increased for participants from baseline to 12 weeks (3 (IQR, 2.2–4.0) to 4 (IQR, 2.0–6.0); P = 0.0492), while the time spent on video games and computer use decreased (3 (IQR, 2.0–4.0) to 1 (IQR, 0.0–2.0); P = 0.0018) by the end of the study. Change in knowledge occurred in the selection of the most healthy food group servings per day in children (0 (IQR, 0.0–0.0) to 0 (IQR, 0.0–1.0), goal 2; P = 0.0313) but not in the least healthy servings per day (1 (IQR, 1.0–1.0) to 1 (IQR, 1.0–1.0), goal 1; P = 0.5625). Healthier food selection choices increased when the participant was offered two choices and then asked, "which would you pick?" (3 (IQR, 1.2–4.0) to 5 (IQR, 2.2–7.0), goal 8; P = 0.0051) and "which is better for your health?" (3 (IQR, 2.0–5.0) to 6 (IQR, 3.0–8.0), goal 10; P = 0.0003). Increases in scores at 12 weeks compared with baseline were noted for the following questions: (1) "how sure you are about being able to eat some foods?" (9 (IQR, 6.0–11.0) to 13.0 (IQR, 7.5–15.0), goal 16; P = <0.0001) and (2) "how sure you are about being physically active?" (5 (IQR, 3.0–7.0) to 7 (IQR, 6.0–8.0), goal 8; P = <0.0001).

Table 3. Comparison of study parameter changes between healthy and overweight/obese subjects (N = 31).

Study parameters	12 weeks	P-values
Median BMI change in subjects >85th percentile from baseline to 12 weeks (n = 12)	−0.375 (−0.694 to −0.309)	0.0231
Median BMI change in subjects ≤85th percentile from baseline to 12 weeks (n = 19)	−0.150 (−0.425 to −0.079)	
Mean SBP change in subjects >85th percentile from baseline to 12 weeks (n = 12)	−3.5 ± 3.1	0.0050
Mean SBP change subjects ≤85th percentile from baseline to 12 weeks (n = 19)	−0.8 ± 1.8	

BMI: body mass index (kg/m²); SBP: systolic blood pressure (mm Hg). Continuous data were evaluated as paired data using the Wilcoxon sign-rank test for nonparametric data and the paired Student's *t*-test for parametric data.

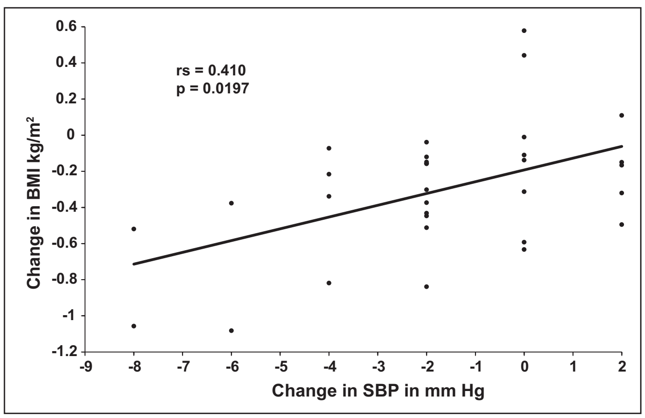

Figure 2. Spearman correlation between BMI versus SBP from baseline to 3 months.
BMI: body mass index; SBP: systolic blood pressure.

Discussion

This study reports on the findings of a pilot OST physical activity and nutrition education program with vigorous intensity exercise in fourth and fifth graders in a rural Texas community. Several implications regarding this pilot are identified regarding the affected study population representing high-risk obesity groups of minorities and rural populations; impact on physiologic and anthropometric parameters of BMI, BMI%, SBP, and WC; and changes within the nutrition and physical activity survey results.

The population enrolled in this rural study is similar to that found in the literature at risk of obesity; specifically, 42% of our participants were overweight or obese, and they were predominantly of Hispanic origin at 93%. Although our percentage of overweight and obese study subjects was higher than state (32.2%) and national (31.6%) data, it may be due to the available statistics of overweight or obese children aged 10–17 years.[47] The greater number of Hispanic participants in our study population compared to the county statistics could be related to the locations of the study announcements that included churches, television bulletins, and flyers at the local grocery store and laundry center. Other considerations in our participants are related to the parental income that may limit the access to physical activity programs associated with a cost. Physical activity programs[34,35,48–50] provided positive results with an impact on low-income minority children.[34] Findings are similar to our study results with one-third of participants identified as living in poverty that may benefit from physical activity programs.

Community-based education and physical activity obesity interventions[4,32] and moderate-to-vigorous physical activity interventions[35,49,51] found decreases of BP, BMI, and WC in children. Wright et al.[33] studied 251 children aged 8–12 years from urban elementary schools in low-income neighborhoods. Following a 6-week program with 45 min each of physical activity and nutrition education for parents and children, they evaluated BMI, BP, WC, and weight in children. Significant findings were seen with BMI decreases from baseline to 4 months with sustained benefits at 12 months in female child participants. These findings were not identified in boys. Similarly, in our study, we saw a BMI reduction in our subjects. Our participants had a positive reduction of other physiologic and anthropometric parameters following the intervention program. The smaller sample size in our study may have potentiated an increase in the effect from the intervention and influenced the statistical significance of our results. Despite this small sample size, the small changes of the BMI were steady and consistent following the intervention program. Participants >85th percentile had the largest reduction in BMI, BMI%, and SBP at 4, 8, and 12 weeks. WC decreased from baseline to 12 weeks but increased from 8 to 12 weeks. This change may be due to differences in temperatures and clothing during the month of November. Although there were no further interventions after 4 weeks, the intervention impacts on BMI, BMI%, and SBP changes were maintained at the 8- and 12-week evaluations. These results are encouraging due to the short intervention time similar to the study by Wright et al.[33] Our results are likely due to the children who were overweight with the reflective changes observed more quickly than a child below average BMI. Despite the short 4-week duration of the intervention, the positive result suggests a change is possible during this time period. The typical duration of similar intervention programs is at least a year or more,[19,25] with physiologic and anthropometric parameter changes after 6–12 weeks.[4,33,36] Our study results may have varied with a longer conducted program, but the data highlights changes may occur with physiologic and anthropometric parameter changes in short intervention periods.

The ASSQ is helpful in identifying important factors regarding enhanced knowledge of food modifications as

Table 4. Changes in ASSQ scores from baseline to 12 weeks (N = 31).

Group of questions	Median baseline score (IQR)	Median 12-week score (IQR)	P-value
Yesterday, did you eat French fries, chips, sweet rolls, doughnuts, cookies, brownies, pies, or cake? (0–6 pts; goal of 0)	3 (1.0–4.0)	0 (0.0–1.0)	<0.0001
Yesterday, did you eat any vegetables, beans, fruit, or fruit juice? (0–12 pts; goal of 12)	4 (2.0–4.0)	3 (2.0–4.0)	0.4319
Yesterday, did you exercise for at least 20 min? (0–1 pts; goal of 1)	0 (0.0–1.0)	1 (0.0–1.0)	0.0413
During the week/weekend, how many television shows or videos did you watch? (0–6 pts; goal of 0)	3 (2.2–4.0)	4 (2.0–6.0)	0.0492
During the week/weekend, how many hours per day do you usually play video games or use the computer? (0–8 pts; goal of 0)	3 (2.0–4.0)	1 (0.0–2.0)	0.0018
From which food group should you select the most servings each day? (0–2 pts; goal of 2)	0 (0.0–0.0)	0 (0.0–1.0)	0.0313
From which food group should you select the fewest servings each day? (0–1 pt; goal of 1)	1 (1.0–1.0)	1 (1.0–1.0)	0.5625
Of the two choices, which would you pick? (0–8 pts; goal of 8 for healthier food)	3 (1.2–4.0)	5 (2.2–7.0)	0.0051
Of the two choices, which is better for your health? (0–10 pts; goal of 10)	3 (2.0–5.0)	6 (3.0–8.0)	0.0003
How sure are you about being able to eat some foods? (0–16 pts; goal of 16)	9 (6.0–11.0)	13.0 (7.5–15.0)	<0.0001
How sure are you about being physically active? (0–8 pts; goal of 8)	5 (3.0–7.0)	7 (6.0–8.0)	<0.0001

ASSQ: After-School Student Questionnaire; IQR: interquartile range.
Continuous data were evaluated as paired data using the Wilcoxon sign-rank test for nonparametric data.

well as physical activity.[42] Kelder et al.[42] pilot-tested the ASSQ survey in 16 Texas after-school programs. The ASSQ enabled us to evaluate the information learned from the researcher conducted educational sessions. Results were positive with changes in food knowledge and physical activity; however, the implementation of the education did not occur in all areas. In this study, our participants were able to identify and make better food choices, decrease video games and computer use, and increase their knowledge concerning food and exercise during the intervention program. Our study revealed no differences in television show and video viewing, the identification of the least number of servings food group consumed, and the ingestion of healthier foods of fruits, fruit juice, vegetables, and beans. These may be related to the lack of access of healthier foods in a rural setting and the lack of available routine extracurricular activities to deter television show and video viewing. Although in our patient population we did not evaluate if other factors may have contributed to the changes such as exercise while watching television, our results varied in comparison to results of Wright et al.[33] that found a decrease in television viewing possibly resulting from an urban environment with more access to physical activity resources. Despite the positive ASSQ scores about food knowledge, it appears that participant behaviors on food selections were not made.

Physical activity is a movement that requires energy by the body to move. Physical activity is further classified into intensity type categories that provide benefits for health. Physical activity beyond baseline activity consisting of moderate and vigorous exercise alternating with periods of rest is recommended for children. Physical activity programs consisting of fun activities with varied fitness levels[51,52] are recommended. Despite the competiveness of the track meet, we provided positive comment ribbons in contrast to placement awards that resulted in enthusiasm by the parents and participants during the distribution. The Physical Activity Guideline recommends moderate and vigorous intensity physical activities, such as running, for a total of 1 h or more each day, for children older than 6 years of age[45] to obtain the benefits of more favorable cardiometabolic risk factors.[51,53,54] We provided activities the children enjoyed and evaluated their increase in exercise with the ASSQ (described examples of physical activity) that was positive on "exercise for at least 20 min" and "how sure are you about being active." One item that may have caused confusion for subjects taking the ASSQ related to the evaluation of exercise which listed 20 min versus the recommended 60 min of exercise per day. In our physical activity sessions, we described the current recommend-ations to avoid confusion. It should be noted that the participants completed less than 1 h of exercise during the evening intervention sessions. Despite the sessions consisting of less than 1 h of exercise, the total amount of daily exercise exceeded 1 h when combined with physical activities at school. Wright et al.[55] had increased participation in physical activity at 4 months, and it was sustained at 12 months. Phelps et al. showed the benefit of noncompetitive after-school physical activity with an increased physical activity level. In our study, participants exercised during the intervention period; however, we did not have other data to determine subject's activity during the nonintervention period of the study. No additional measures were obtained from the track meet during the intervention. Results from the ASSQ suggest positive changes by the participants in regard to exercise; however, a lack of physical activity data prevents a full evaluation of exercise performed by subjects. Additionally, the continued changes in anthropometric and physiologic measures suggest that increased physical activity continued during the subsequent 8 weeks of the study.

Our pilot study has several limitations. The major limitation of the study is a lack of a control group. Future studies would be improved with a control group to further evaluate the impact of physical activity and education in the daily routine of children. The 4-week duration of the intervention was short. The typical duration of similar intervention programs is at least a year or more,[19,25] with physiologic parameter changes after 6–12 weeks.[4,33,36] The study results may have varied with a longer conducted program. The small sample of participants and a predominance of Hispanics and girls limited the extrapolation of these data to other ethnicities and boys. A short enrollment period limited the study population. A longer enrollment period may have produced different results. The WC and weight of the children were measured while the children were wearing their clothes. The additional clothing during the final data collection may have influenced the weight and WC measurements; however, due to a lack of increase in the BMI or weight, it is probably not related. The evaluation of exercise of one of the questions within the ASSQ indicated the recommended exercise time as 20 min versus the 60 min. This may have influenced our results, but we feel that the knowledge by the participants helped to prevent any confusion among the participants when answering the question. Despite these limitations, this study provides a useful template for health-care professionals, community leaders, parents, and schools that show promise.

In this study, the community leaders of local businesses, the school system, and parents expressed support of the project by providing different opportunities to promote and deliver the no cost volunteer delivered intervention. The community center was provided at no cost; however, the time associated with the delivery of the study was extensive and therefore community buy in is essential. This study suggests that community-vested interest contributes to the success of an intervention program delivery to participants in rural communities. The prevention of childhood obesity benefits from a multisystem approach by parents, school systems, and health-care professionals.[53,54] Interested community leaders, health-care professionals, and school systems provide an avenue through which to promote healthy behaviors in rural communities.[4,37,56,57] Previous studies indicate a potential role of health-care providers in assisting with intervention programs with success in interdisciplinary groups.[4,37] Our study of a pharmacist and pharmacy student provides evidence of a potential role of pharmacy health-care professionals.

Conclusion

Our prospective pilot study highlights a health-care professional OST 4-week physical activity and nutrition education intervention program with exercise in a rural Texas community yielded decreases in parameters of BMI, BMI%, and SBP. Increases in physical activity knowledge, identification of better food choices; decrease in video games and computer use, and an increase in knowledge concerning food and exercise in fourth- and fifth-grade Hispanic children occurred at 12 weeks with a short 4-week intervention period. This study further underscores the important role of health-care professionals in rural populations with high rates of overweight or obese individuals and the opportunity to reduce obesity. Although study participant parameters improved, future studies implementing OST programs in a rural area should monitor participants for a longer period to evaluate long-term impact.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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References

1. Juonala M, Magnussen CG, Berenson GS, et al. Childhood adiposity, adult adiposity, and cardiovascular risk factors. *N Engl J Med* 2011; 365: 1876–1885.
2. National Heart, Lung, and Blood Institute. Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. *Pediatrics* 2011; 128(Suppl. 5): S213–S256.
3. Pinhas-Hamiel O and Zeitler P. Clinical presentation and treatment of type 2 diabetes in children. *Pediatr Diabetes* 2007; 8(Suppl. 9): 16–27.
4. Farris JW, Taylor L, Williamson M, et al. A 12-week Interdisciplinary Intervention Program for Children who are obese. *Cardiopulm Phys Ther J* 2011; 22: 12–20.
5. Rodriguez BL, Fujimoto WY, Mayer-Davis EJ, et al. Prevalence of cardiovascular disease risk factors in U.S. children and adolescents with diabetes: the SEARCH for diabetes in youth study. *Diabetes Care* 2006; 29: 1891–1896.
6. Liu J, Bennett KJ, Harun N, et al. Urban-rural differences in overweight status and physical inactivity among US children aged 10–17 years. *J Rural Health* 2008; 24: 407–415.
7. Davis AM, Bennett KJ, Befort C, et al. Obesity and related health behaviors among urban and rural children in the United States: data from the National Health and Nutrition Examination Survey 2003–2004 and 2005–2006. *J Pediatr Psychol* 2011; 36: 669–676.

8. Liu JH, Jones SJ, Sun H, et al. Diet, physical activity, and sedentary behaviors as risk factors for childhood obesity: an urban and rural comparison. *Child Obes* 2012; 8: 440–448.
9. Lutfiyya MN, Lipsky MS, Wisdom-Behounek J, et al. Is rural residency a risk factor for overweight and obesity for U.S. children? *Obesity (Silver Spring)* 2007; 15: 2348–2356.
10. Singh GK, Kogan MD, Van Dyck PC, et al. Racial/ethnic, socioeconomic, and behavioral determinants of childhood and adolescent obesity in the United States: analyzing independent and joint associations. *Ann Epidemiol* 2008; 18: 682–695.
11. Ogden CL, Lamb MM, Carroll MD, et al. Obesity and socioeconomic status in children and adolescents: United States, 2005–2008. *NCHS Data Brief* 2010; 51: 1–8.
12. Rossen LM and Schoendorf KC. Measuring health disparities: trends in racial-ethnic and socioeconomic disparities in obesity among 2- to 18-year old youth in the United States, 2001–2010. *Ann Epidemiol* 2012; 22: 698–704.
13. Eichner JE, Moore WE, Perveen G, et al. Overweight and obesity in an ethnically diverse rural school district: the Healthy Kids Project. *Obesity (Silver Spring)* 2008; 16: 501–504.
14. Singh GK, Kogan MD and van Dyck PC. A multilevel analysis of state and regional disparities in childhood and adolescent obesity in the United States. *J Community Health* 2008; 33: 90–102.
15. Singh GK, Kogan MD, Siahpush M, et al. Prevalence and correlates of state and regional disparities in vigorous physical activity levels among US children and adolescents. *J Phys Act Health* 2009; 6: 73–87.
16. Montgomery-Reagan K, Bianco JA, Heh V, et al. Prevalence and correlates of high body mass index in rural Appalachian children aged 6–11 years. *Rural Remote Health* 2009; 9: 1234.
17. Sharkey JR and Horel S. Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. *J Nutr* 2008; 138: 620–627.
18. Pratt CA, Stevens J and Daniels S. Childhood obesity prevention and treatment recommendations for future research. *Am J Prev Med* 2008; 35: 249–252.
19. Dobbins M, Husson H, DeCorby K, et al. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. *Cochrane Database Syst Rev* 2013; 2: CD007651.
20. Kriemler S, Zahner L, Schindler C, et al. Effect of school based physical activity programme (KISS) on fitness and adiposity in primary schoolchildren: cluster randomised controlled trial. *BMJ* 2010; 340: c785.
21. Beets MW, Beighle A, Erwin HE, et al. After-school program impact on physical activity and fitness: a meta-analysis. *Am J Prev Med* 2009; 36: 527–537.
22. Sun C, Pezic A, Tikellis G, et al. Effects of school-based interventions for direct delivery of physical activity on fitness and cardiometabolic markers in children and adolescents: a systematic review of randomized controlled trials. *Obes Rev* 2013; 14: 818–838. DOI:10.1111/obr.12047.
23. Marcus BH, Williams DM, Dubbert PM, et al. Physical activity intervention studies: what we know and what we need to know: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity); Council on Cardiovascular Disease in the Young; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research. *Circulation* 2006; 114: 2739–2752.
24. Harris KC, Kuramoto LK, Schulzer M, et al. Effect of school-based physical activity interventions on body mass index in children: a meta-analysis. *CMAJ* 2009; 180: 719–726.
25. Dzewaltowski DA, Rosenkranz RR, Geller KS, et al. HOP'N after-school project: an obesity prevention randomized controlled trial. *Int J Behav Nutr Phys Act* 2010; 7: 90.
26. Phelps J, Hermann JR, Parker SP, et al. Advantages of gardening as a form of physical activity in an after-school program. *J Extension* 2010; 48(6). www.joe.org/joe/2010december/pdf/JOE_v48_6rb5.pdf.
27. Williamson DA, Champagne CM, Harsha DW, et al. Effect of an environmental school-based obesity prevention program on changes in body fat and body weight: a randomized trial. *Obesity (Silver Spring)* 2012; 20: 1653–1661.
28. Greening L, Harrell KT, Low AK, et al. Efficacy of a school-based childhood obesity intervention program in a rural southern community: TEAM Mississippi Project. *Obesity (Silver Spring)* 2011; 19: 1213–1219.
29. Hawley SR, Beckman H and Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. *J Community Health Nurs* 2006; 23: 69–80.
30. Cornwell L, Hawley SR and St Romain T. Implementation of a coordinated school health program in a rural, low-income community. *J Sch Health* 2007; 77: 601–606.
31. Taylor RW, McAuley KA, Barbezat W, et al. APPLE Project: 2-y findings of a community-based obesity prevention program in primary school age children. *Am J Clin Nutr* 2007; 86: 735–742.
32. Sacher PM, Kolotourou M, Chadwick PM, et al. Randomized controlled trial of the MEND program: a family-based community intervention for childhood obesity. *Obesity (Silver Spring)* 2010; 18(Suppl. 1): S62–S68.
33. Wright K, Giger JN, Norris K, et al. Impact of a nurse-directed, coordinated school health program to enhance physical activity behaviors and reduce body mass index among minority children: a parallel-group, randomized control trial. *Int J Nurs Stud* 2013; 50: 727–737.
34. Hollar D, Lombardo M, Lopez-Mitnik G, et al. Effective multi-level, multi-sector, school-based obesity prevention programming improves weight, blood pressure, and academic performance, especially among low-income, minority children. *J Health Care Poor Underserved* 2010; 21: 93–108.
35. Angelopoulos PD, Milionis HJ, Grammatikaki E, et al. Changes in BMI and blood pressure after a school based intervention: the CHILDREN study. *Eur J Public Health* 2009; 19: 319–325.
36. Wong PC, Chia MY, Tsou IY, et al. Effects of a 12-week exercise training programme on aerobic fitness, body composition, blood lipids and C-reactive protein in adolescents with obesity. *Ann Acad Med Singapore* 2008; 37: 286–293.
37. Johnston CA, Moreno JP, El-Mubasher A, et al. Impact of a school-based pediatric obesity prevention program facilitated by health professionals. *J Sch Health* 2013; 83: 171–181.
38. Harrell TK, Davy BM, Stewart JL, et al. Effectiveness of a school-based intervention to increase health knowledge of cardiovascular disease risk factors among rural Mississippi middle school children. *South Med J* 2005; 98: 1173–1180.

39. U.S. Department of Commerce, United States Census Bureau. *State and County QuickFacts: Bailey County, Texas*, http://quickfacts.census.gov/qfd/states/48/48017.html (2013, accessed 20 June 2013).
40. Centers for Disease Control and Prevention. Clinical growth charts, August 4, http://www.cdc.gov/growthcharts/clinical_charts.htm (2009, accessed 8 December 2012).
41. Coordinated Approach to Child Health (CATCH). After-School Student Questionnaire, http://catchusa.org/documents/CKC/AFTER%20SCHOOL%20QNNE%20final.pdf (accessed 15 May 2012).
42. Kelder S, Hoelscher DM, Barroso CS, et al. The CATCH Kids Club: a pilot after-school study for improving elementary students' nutrition and physical activity. *Public Health Nutr* 2005; 8: 133–140.
43. United States Department of Agriculture. 10 tips nutrition education series handouts, http://www.choosemyplate.gov/healthy-eating-tips/ten-tips.html (accessed 18 April 2012).
44. U.S. Department of Health and Human Services. 2008 physical activity guidelines for Americans: active children and adolescents, http://www.health.gov/paguidelines/guide-lines/chapter3.aspx (2008, accessed 13 April 2012).
45. United States Department of Agriculture, Center for Nutrition Policy and Promotion. Dietary guidelines for Americans, 2010, http://www.cnpp.usda.gov/dgas2010-policydocument.htm (2012, accessed 7 July 2012).
46. United States Department of Heallth & Human Services. 2012 HHS Poverty Guidelines, http://aspe.hhs.gov/poverty/12poverty.shtml (2013, accessed 20 June 2013).
47. Data Resource Center for Child and Adolescent Health. 2007 childhood obesity state report cards: Texas state fact sheet, http://www.childhealthdata.org/docs/nsch-docs/texas-pdf.pdf (2007, accessed 13 December 2012).
48. Taylor MJ, Mazzone M and Wrotniak BH. Outcome of an exercise and educational intervention for children who are overweight. *Pediatr Phys Ther* 2005; 17: 180–188.
49. Gidding SS, Barton BA, Dorgan JA, et al. Higher self-reported physical activity is associated with lower systolic blood pressure: the Dietary Intervention Study in Childhood (DISC). *Pediatrics* 2006; 118: 2388–2393.
50. Farpour-Lambert NJ, Aggoun Y, Marchand LM, et al. Physical activity reduces systemic blood pressure and improves early markers of atherosclerosis in pre-pubertal obese children. *J Am Coll Cardiol* 2009; 54: 2396–2406.
51. Alberga AS, Medd ER, Adamo KB, et al. Top 10 practical lessons learned from physical activity interventions in overweight and obese children and adolescents. *Appl Physiol Nutr Metab* 2013; 38: 249–258.
52. Strong WB, Malina RM, Blimkie CJ, et al. Evidence based physical activity for school-age youth. *J Pediatr* 2005; 146: 732–737.
53. Boyle M, Lawrence S, Schwarte L, et al. Health care providers' perceived role in changing environments to promote healthy eating and physical activity: baseline findings from health care providers participating in the healthy eating, active communities program. *Pediatrics* 2009; 123(Suppl. 5): S293–S300.
54. Davis MM, Gance-Cleveland B, Hassink S, et al. Recommendations for prevention of childhood obesity. *Pediatrics* 2007; 120(Suppl. 4): S229–S253.
55. Wright K, Norris K, Newman Giger J, et al. Improving healthy dietary behaviors, nutrition knowledge, and self-efficacy among underserved school children with parent and community involvement. *Child Obes* 2012; 8: 347–356.
56. Filbert E, Chesser A, Hawley SR, et al. Community-based participatory research in developing an obesity intervention in a rural county. *J Community Health Nurs* 2009; 26: 35–43.
57. Salmon J, Booth ML, Phongsavan P, et al. Promoting physical activity participation among children and adolescents. *Epidemiol Rev* 2007; 29: 144–159.