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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

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Abstract

Background—Underserved children, particularly girls and those in urban communities, do not meet the recommended physical activity guidelines (>60 min of daily physical activity), and this behavior can lead to obesity. The school years are known to be a critical period in the life course for shaping attitudes and behaviors. Children look to schools for much of their access to physical activity. Thus, through the provision of appropriate physical activity programs, schools have the power to influence apt physical activity choices, especially for underserved children where disparities in obesity-related outcomes exist.

Objectives—To evaluate the impact of a nurse directed, coordinated, culturally sensitive, school-based, family-centered lifestyle program on activity behaviors and body mass index.

Design, settings and participants: This was a parallel group, randomized controlled trial utilizing a community-based participatory research approach, through a partnership with a University and 5 community schools. Participants included 251 children ages 8–12 from elementary schools in urban, low-income neighborhoods in Los Angeles, USA.

Methods—The intervention included Kids N Fitness®, a 6-week program which met weekly to provide 45 min of structured physical activity and a 45 min nutrition education class for parents and children. Intervention sites also participated in school-wide wellness activities, including health and counseling services, staff professional development in health promotion, parental education newsletters, and wellness policies for the provision of healthy foods at the school. The Child and Adolescent Trial for Cardiovascular Health School Physical Activity and Nutrition Student Questionnaire measured physical activity behavior, including: daily physical activity, participation in team sports, attending physical education class, and TV viewing/computer game playing. Anthropometric measures included height, weight, body mass index, resting blood

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pressure, and waist circumference. Measures were collected at baseline, completion of the intervention phase (4 months), and 12 months post-intervention.

Results—Significant results for students in the intervention, included for boys decreases in TV viewing; and girls increases in daily physical activity, physical education class attendance, and decreases in body mass index *z*-scores from baseline to the 12 month follow-up.

Conclusions—Our study shows the value of utilizing nurses to implement a culturally sensitive, coordinated, intervention to decrease disparities in activity and TV viewing among underserved girls and boys.

Keywords

Community based participatory research; Gender; Health disparities; Obesity in children; Physical activity; School-based interventions

What is already known about the topic?

- Childhood obesity is serious public health threat today; both globally and within the United States.
- Physical activity is a key component to obesity prevention.
- The role of nurses has rapidly expanded to play a central role in obesity prevention interventions for children.
- Community-based participatory research is an emerging field in decreasing health disparities among children.

What this paper adds

- This paper shows that daily physical activity can be increased in male and female students who participate in culturally appropriate school-based interventions.
- School-based interventions can also increase daily physical education class attendance in male and female students.
- School-based interventions can decrease body composition (e.g., body mass index *z*-scores) and this decrease can be sustained over a 1 year period for female students.

1. Background

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 time engaging in sedentary activities (e.g., playing video games or watching TV). Recent studies report that in the United States (Whitt-Glover et al., 2009) and Canada (Colley et al., 2011) children and youth spent an average of 6–8 h a day being sedentary. Studies report 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 rapid increase in prevalence of children who are overweight (body mass index (BMI) > 84–94th percentile) or obese (BMI > 95th percentile) (Khan et al., 2009); where globally in 2010 approximately 42 million children under the age of five were overweight (World Health Organization, 2011), and in the USA, the percentage of overweight school-aged children (aged 5–14 years) has doubled in the last 30 years, from 15% to 32% (Ogden et al., 2010a, b). Of concern are the disproportionate rates of childhood obesity among racial/ethnic minority groups particularly

Black/African-American, Hispanic/Latinos, girls, and those from a lower socioeconomic status (SES) (Ogden, 2009; Ogden et al., 2010a,b; Wright, 2011). For children and youth physical activity includes physical education, recreation, games, sports, or planned exercise, in the context of school, family, and community activities (World Health Organization, 2011). There are many benefits to physical activity. Regular physical activity improves muscular strength builds healthy bones and muscles, and endurance, reduces the risk for developing chronic disease risk factors, improves self-esteem, and reduces stress and anxiety (Goldfield et al., 2001). Beyond these known health effects, physical activity may also have beneficial influences on academic performance (Oude Luttikhuis et al., 2009).

1.1. 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 environments of low SES communities. From a public health outlook, individual behaviors must be addressed in the context of socioeconomic and environmental influences at the community level where children and youth live (Egan et al., 2010). Schools serve as an excellent venue to provide students with the opportunity for daily physical activity, to teach the importance of regular physical activity to build skills that support active lifestyles (Hoelscher et al., 2004; Kelder et al., 2005; Pratt et al., 2008). Schools have access to school nurses who can provide screening, counseling and continuum of care (Hoelscher et al., 2004; Kelder et al., 2005; Pratt et al., 2008).

In contrast to clinical programs, school programs can be delivered at little or no cost to families and can reach low-income and urban children who otherwise may not receive treatment.

Therefore, strategies that engage stakeholders across the contexts of school, home and environment offer more promise of delivering an effective response to the obesity epidemic than efforts made by a single entity. Consequently, community-university collaborations targeting obesity prevention are increasingly being pursued as they have the potential to bridge resources and reach a greater number of individuals than either partner could alone. Community-based participatory research (CBPR) has been recommended as an effective way to bring collaborative stakeholders from the university and the community setting all together to create partnerships to prevent health disparities in childhood obesity. Through CBPR, each partner brings resources to the table, including funding, research skills, leadership, and staff-support to create an intervention program that is based in the community (e.g., the school setting), thus giving crucial services to children who may not otherwise have access to them.

The literature shows that school-based obesity prevention programs are most effective if they follow a coordinated, comprehensive program for school health (Economos et al., 2007; Hayman et al., 2004; Kelder et al., 2005; McKenzie et al., 1996). The comprehensive health program model for schools (Summerbell et al., 2005) consists of eight interacting components: school-health services; school counseling and psychology programs; school-health environment; school health instruction (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 (Khan et al., 2009).

Table 1

CONSORT 2010 flow diagram.

2. Aim of the study

While many studies have looked at coordinated school-based obesity prevention programs (Brown and Summerbell, 2009), and the role of nurses in obesity prevention (Kubik et al., 2007), few have examined the impact of a nurse coordinated school-based obesity prevention program among inner city minority children. The purpose of this study among high risk, inner-city early elementary school children, was to evaluate the impact of a nurse coordinated comprehensive school health program that is culturally and linguistically responsive, family-centered, and lifestyle focused, on physical activity and BMI *z*-scores. We hypothesized that girls participating in the program would have sustained increases in daily physical activity and sustained decreases in their BMI *z*-scores between baseline and the 12-month follow-up.

3. The study

We used a community-based participatory research conceptual framework called community-academic partnered participatory research (CPPR) that was created by Jones and colleagues (Wells and Jones, 2009; Wright et al., 2010). 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 the development of a research study, *Kids Health Research Study*, ensued. In following 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 (Wells and Jones, 2009; Wright et al., 2010). The study was approved by the University of California Los Angeles Institutional Review Board, the ethical and research governing body.

4. Methods

4.1. Participants

Students ($n = 251$) were English or Spanish speaking, had a BMI > the 85th percentile, between the ages of 8–12 years of age and had no physical limitations preventing 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). Table 1 indicates the characteristics of the sample by group.

4.2. Procedures

The study was a parallel-group, randomized control trial. Between January, 2008 and September, 2010 students were recruited from 5 underserved elementary schools in Los Angeles, CA, USA, who 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 (see CONSORT Table 1). Questionnaire data and anthropometric measures were collected by trained research staff at the school sites. Students were compensated for their time with small tokens (stickers and/or small toy). Parents were compensated for their time with a small token (\$10 grocery store gift card).

Randomization occurred at the school level, where schools were randomized to either the Kids N Fitness© intervention group (KNF©) (2 schools) or to the general education (GE) group (3 schools). Thus students were directed into the program that the school was randomized to. The general education group participated in the standard physical activity program given by their respective schools and did not receive any physical or nutrition education. The KNF intervention had two components, a family-centered educational lifestyle program, KNF© providing physical activity and nutrition education, and school-level environmental activities at the school site.

Environmental interventions at the school-level included: School Wellness Policy involving dietary changes, staff professional development; at the community-level included, establishing partnerships with local community clinics for health and mental health services; and, home-level activities included parental outreach via bi-monthly educational newsletters mailed to their homes. The intervention components were developed by the study team, which included a nutritionist, advanced practice nurse, registered nurses, an exercise physiologist and a psychologist. Once developed, it was reviewed by the CAB and pre-tested with 25 youth, who also provided review and cultural and linguistic modifications.

4.3. Intervention fidelity

To ensure fidelity of the intervention, instructors were thoroughly trained to implement protocols through full-day in-person training. Instructors used a checklist of the course contents to assure that protocols were consistently followed and they rated how well the material was covered, and research staff used the checklist during classroom observations. If instructors were not following the protocol they were given assistance and as necessary, retrained (<10% of classes).

4.3.1. The Kids N Fitness (KNF©) Intervention—The lifestyle intervention program, Kids N Fitness© (KNF©), that was used in this study was developed at Children's Hospital Los Angeles in 2000, by Dr. Francine Kaufman (Monzavi et al., 2006). KNF© is a 6-week after-school program with weekly 90-min sessions conducted by 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. The physical activity component lasted 45 min and was taught by a physical education specialist. The major focus was on reducing sedentary behaviors that may compete with activity. In addition, students learned creative ways to exercise in a non-structured exercise program, including culturally and developmentally appropriate approaches including, warm-up and stretching, basketball, soccer, Hip Hop and Salsa dancing, relay race activities, jump rope, power walking, and running (Monzavi et al., 2006). Parents did not participate in the exercise portion due to the inability to reliably provide or reasonably attain medical clearance. During the exercise portion parents were taught the implications of obesity in children and adults, and the importance of healthy lifestyles to prevent obesity. In addition parents participated in a parent support group, moderated by a registered nurse where they were able to discuss their challenges and success stories regarding diet and exercise modification. Following the exercise, children and parents were given a 45-min nutrition education/behavioral modification session. All sessions were conducted simultaneously in English and in Spanish and all materials were also in both languages. The major dietary goal was to provide the highest nutritional quality for the lowest caloric intake. Emphasis was placed on improving drink and food choices, lowering dietary fat intake to below 30%, and decreasing total calories by focusing on appropriate portion sizes, while including culturally specific foods and being sensitive to the costs of foods. Topics also included the food pyramid, how to reduce total and saturated fat and cholesterol intake, how to determine and limit carbohydrate intake, portion control, improving the quality of snacks, strategies for eating out of the home, understanding food labeling, and healthy food shopping (Monzavi et al., 2006).

All sessions and materials were in English and in Spanish. Students were compensated for their time after each session attended with 1 small token per session (pedometer, t-shirt, ball, Frisbee, jump rope, water bottle). Parents were compensated for their time with small tokens after each session (\$10 grocery store gift card, pedometer, cookbooks and t-shirt).

4.3.2. Environmental activities—At each intervention school participating children received health services; including a full physical exam by nurse practitioner students (e.g., registered nurses who were training for an advanced practice degree as a nurse practitioner) who were proctored by the Principal Investigator who is a Board Certified Pediatric Nurse Practitioner. Student psychological counseling was offered for all children who requested it or were identified by research team staff as having a need for counseling (examples of counseling referrals include children wanting to talk to a counselor regarding low self esteem or low body image). A School Health Advisory Council (Advisory Council) was created at each intervention school to discuss the overall issue of wellness, health promotion and disease prevention for their school population. The Advisory Council was made up of representatives from the University, school administrators and staff, parents and community partners, including representatives from the local health clinic, city government (including parks and recreation), the local library, and from local businesses. The Advisory Council recommended wellness policies to be implemented at the school site that and would reflect the current research on obesity prevention. These wellness policies included the availability of foods lower in energy density, with an emphasis on fruits, vegetables, whole grains and low-fat dairy, 100% fruit juice, low fat or nonfat milk and the elimination of sugary drinks such as sports drink and sodas. In addition, physical education classes during school reflected policies that enforced the recommended types of moderate to physical activities

presented by the current physical activity guidelines (Hootman, 2009). The Advisory Council also recommended wellness policies that would provide and enforce that both staff and administration received educational training regarding health promotion and that parents received additional educational materials on health promotion and an update of the preventative efforts occurring at the school site via a bi-monthly educational newsletter that the Advisory Council would create. Staff professional development seminars taught by trained research team members provided teachers and school administration the 45-min nutritional education component of the KNF© program. Teachers were taught weekly, in a separate class, but in the same sequence and curriculum that the children and parents were taught.

4.4. Measurements and instruments—Data were collected at baseline, at completion of the intervention phase (4 months), and 12 months after the end of the intervention, using the following instruments.

4.5. 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) School Physical Activity and Nutrition (SPAN) Student Questionnaire, which included questions on date of birth, age, gender, primary language spoken, and race/ethnicity (see Table 2). Questionnaires were in both English and Spanish.

4.6. Anthropometric measures—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 (also called BMI standard deviation (SD) scores, are measures of relative weight adjusted for child age and sex) (Must and Anderson, 2006) were calculated using Epi Info software developed by the Centers for Disease Control and Prevention (Centers for Disease and Prevention, 2002). 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.

4.7. Health behaviors/knowledge—Activity behaviors were assessed using the CATCH SPAN Questionnaire, utilizing 5 items (e.g., daily physical activity, participation in team sports, attends PE class, TV computer/video game use); acceptable reliability and validity of the instruments were determined during testing in a diverse sample of 96 elementary schools (McKenzie et al., 1996). Internal consistency for activity behavior questions was $\alpha = .85$.

4.8. Statistical analysis—Baseline characteristics were compared using *t*-tests for continuous variables and chi-square tests for categorical variables. Individual data were analyzed under the intent-to-treat principle whereby all randomized subjects were analyzed in the group to which they were randomized (O'Brien et al., 2004). The intent-to-treat analysis was performed on all 305 randomized subjects. This included the 251 ($n = 251$) child participants who were randomized, participated in the evaluation and completed 50% or more of the intervention; as well as 54 children who were randomized and participated in

the evaluation but did not complete 50% or more of the intervention. For the primary analysis, a mixed model of repeated measures analysis (adjusted for baseline scores, child 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) (Rubin, 1976) i.e., given the observed outcomes and covariates, missing data are not dependent on unobserved values (Economos et al., 2007). We used predicted least square means 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 (SAS/STAT Users Guide, 2004). A power analysis showed that for a large effect size of 0.5, an alpha of 0.05 and power of 0.80, 130 students were needed in the study.

5. Results

5.1. Demographics—Of the 305 students initially enrolled in the KNF© program, 251 students (82%) attended at least half of the sessions and 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 3rd grade, and more parents with an elementary school education. Thirty students (25%) were lost to follow-up at 12 months in the KNF© group, compared to thirty-one students (23%) in the GE group ($p = 0.75$).

5.2. Anthropometric outcomes—In female students in the KNF group, BMI ($p = 0.047$) and BMI z -score ($p = 0.05$) decreased from baseline to 4 months and the effects were sustained at 12 months. While BMI and BMI z -scores decreased in males, this was not significant (see Tables 3 and 4).

5.3. Activity outcomes—At baseline, there were significant differences between the KNF and GE group for both males and females in three distinct areas, daily physical activity, PE class attendance and TV viewing (see Table 3). However, as time progressed, some of these differences did not remain significant. Both males and females had increases of participating in at least 60 min of activity per day from baseline to 4 months and the effect was sustained for both males ($p = 0.002$) and females ($p = 0.005$) at 12 months. In addition, both males and females had increases in PE class attendance, from baseline to 4 months and the effect was sustained for both males ($p = 0.003$) and females ($p = 0.002$). TV viewing significantly decreased for both males and females from baseline to 4 months; however the effect was sustained at 12 months for males only ($p = 0.030$).

6. Discussion

Obesity is one of the most serious public health threats today and is increasing at an alarming rate in children, especially among Hispanic/Latino and African-American and female populations. Given the huge economic toll extracted by obesity, interventions that prevent obesity are urgently needed. Therefore, this study was designed to address the gap in knowledge by furthering our understanding of the potential for nurses to direct a comprehensive school-based family intervention to reduce BMI z -scores and increase daily physical activity behaviors among underserved children. The goal of the KNF© program was to provide children and their families interactive activity-based education aimed at improving dietary habits, at increasing after-school physical activities, and at modifying unhealthy behaviors through participation in weekly group sessions. The curriculum was designed to maximize active participation by having participants in a group setting, and thus did not include individual sessions with a child or child-parent unit. Similarly, a study by Goldfield et al. (2001) found that a family-based behavioral intervention employing group

treatment alone was a more cost-effective approach to treating childhood obesity than a mixed group plus individual format (Goldfield et al., 2001).

In the present study we revealed gender-differences in physical activity an established cause of overweight. At baseline, females as compared to males reported to be less engaged in daily physical activities, including attending PE class. Gender frameworks are not only important to our understanding of the determinants of health, but also for the development of effective health promotion programs (Keleher, 2004). Our results support the development of health promotion programs that include gender-focused activities as a strategy to reduce the burden of overweight and consequent chronic diseases.

6.1. Gender and health behaviors

Several studies have shown that males engaged more in physical activity than females (Botton et al., 2007; Sherar et al., 2007; Storey et al., 2009). Physical activity counter-balances excess energy intake and the risk for overweight. This risk seems to be particularly present in urban, low-income schools and calls for programs to promote physical activity, particularly among females during their transition from childhood to adolescence and adulthood, as longitudinal studies have shown a drop in activity levels during these years (Sweeting, 2008).

Our study population constitutes grades three to five students who are primarily preadolescent. Adolescence is a period of psychosocial, physical, emotional and cognitive, change that may be linked to physical maturity and may affect physical activity behaviors (Sallis and Saelens, 2000). Thomson et al. (2005) showed that gender differences in physical activity diminished when aligned on maturational age, suggesting that sexual maturation may be intricately involved in the adolescent decline in physical activity. As girls mature approximately 2 years before boys (Malina et al., 2004), relative more girls than boys are expected to have entered sexual maturation in our study population. This may have contributed to the higher physical activity levels among boys relative to girls observed in this study. A U.S.-based study by Wang (2002) suggested that early-maturing girls are twice as likely to be obese compared with early-maturing boys. If this were to apply to our study participants, we should anticipate changing gender differentials in overweight in the years to come.

6.2. Sustained changes in health behavior

Despite the initial gender differences, both males and females had improved health outcomes post-intervention. This current study demonstrates that it is possible for nurses to successfully address childhood obesity during a critical period in their lives and increase health outcomes for both males and females, through a culturally appropriate, multifaceted educational and environmental change approach that involves the community, schools, families and students. The study's hypothesis for both females and males were met. Data showed significant decreases in BMI *z*-scores, increases in daily physical activity as well as increases in PE class attendance for female students post-intervention; and significant decreases in TV viewing and increases in PE class attendance for male students post-intervention.

This study should be put into the context of other published obesity prevention trials that have been conducted on school children (Coleman et al., 2005; McKenzie et al., 1996; Summerbell et al., 2005). The few studies that have demonstrated successful obesity prevention range from highly controlled clinical, clinically based, cognitive behavior family-centered approaches to educational and coordinated school-based interventions (Summerbell et al., 2005). The clinical studies that utilized a medical model for treatment of obesity,

while demonstrating success, appeared to be most appropriate for highly motivated, well-resourced parents who have access to comprehensive programming (Summerbell et al., 2005). In the high-risk population of children participating in this study, all of the children were already overweight. This demonstrates the need for involvement in childhood obesity prevention and management far beyond the routine health practitioner office visit. Although timely identification of obesity by primary care providers is an essential step in prevention and management of obesity, studies show that providers fail to identify up to one half of obese children (O'Brien et al., 2004).

Only a few school-based and community-wide interventions that have targeted changes in behaviors such as screen time, physical activity and dietary intake have demonstrated success in obesity prevention (Goran and Reynolds, 2005; Robinson, 1999; Spiegel and Foulk, 2006). These studies, however, have focused largely on children in late elementary to middle school years or with lower to middle class children, and did not have nurses either leading or involved in the intervention. The present study targeted young, low-income, urban children, predominately Mexican-American, with an average age of 8.3 ± 1.6 years to evaluate the potential for nurse-driven prevention strategies in early life, during a critical stage of their growth and development. The current study focused on male and female elementary school children because they have been affected more by the pediatric obesity epidemic than any other group or cohort, in both the United States and in Europe (Lobstein and Frelut, 2003; Lobstein and Jackson-Leach, 2007).

There are several prominent studies that utilized comprehensive school-health programs to combat obesity among minority and low-income populations. Some focused on Hispanic children physical activity only, and found, like the current study, a decrease in BMI (Flores, 1995). Another study by Foster et al. (2008) focused on the effects of a multi-component, School Nutrition Policy Initiative, and like the current study found decreases in BMI z-scores and TV viewing for both males and females.

The most comprehensive school-based trial to promote health, the Coordinated Approach To Child Health (CATCH) program, formerly known as the Child and Adolescent Trial for Cardiovascular Health program, reported several behavioral changes, but only one study, like the current study, has shown an increase in risk of overweight in low-income schools with predominately Hispanic/Latino populations (Coleman et al., 2005). However, none of the aforementioned studies, unlike the current study utilized nurses as part and/or to lead these school-based programs and thus missed a cost-effective opportunity to provide a comprehensive program to low-income schools.

According to the literature, comprehensive programs engaging community partnerships to prevent childhood obesity in early elementary school children, both male and female, represent the next logical step in the child obesity research continuum (Hayman et al., 2004). The current health promotion study is unique in that it utilized a community-based comprehensive school health model that was driven by nurses who created sustainable partnerships partnered with several underserved schools. A key effort of our study was the formation of a community advisory board and school-health advisory council that included school and community partners, which guided the intervention development, implementation, and evaluation. This group greatly helped with the integrity of the program in terms of culture and development.

An additional strength of this study included an important tenant of community based participatory research, capacity building. The nurses used an interactive approach to build the capacity of the underserved communities by working with an integrative team of teachers and community health workers who came from the schools. This allowed for

increasing the capacity of the school staff by giving them additional skills, tools and knowledge that they may not have received from another source. In addition, this had an advantage of more rapid adoption in the school and community setting, plus the opportunity to “reach children where they are” (Berry et al., 2006), and subsequently we had several schools embrace the program and join in the research study; thus we were able to positively affect a substantial number of low-income children who may not otherwise get these services.

6.3. Nursing implications

This study showed that nurses have a critical role in childhood obesity prevention efforts. Nurses, whether they are school nurses or assist in clinical outreach programs, have the knowledge and expertise to promote the prevention of overweight and obesity and address the needs of overweight and obese minority children in schools. Nurses working in schools can collaborate with students, families, school personnel, and health care providers to promote healthy weight and identify overweight and obese children who may be at risk for health problems. They can refer and follow up with students who may need to see a health care provider. The school nurse also educates and advocates for changes in the school and district that promote a healthy lifestyle for all students. Nurses can also work with community or school-based wellness advisory boards to keep members abreast of the current evidenced research on obesity prevention programs and standards and participate in or led comprehensive school-based programs to prevent childhood obesity.

7. Limitations

There are some limitations that should be taken into account in the interpretation of the data. First, the sample population was predominately Hispanic/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 (Bautista-Castano et al., 2004). There are several possible reasons for this low retention in attendance. The schools involved were in the inner-city with low reading and math test scores and high absenteeism. Students routinely were pulled from after school programs to attend tutorial reading and math classes 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.

8. Conclusion

In summary, this study highlights gender-differences in physical activity an underlying cause of overweight, in a sample of low-income, minority elementary school children. This study showed effective decreases BMI z-scores in females, decreased TV use in males; and increased daily physical activity and PE class attendance for both males and females, in a group of high-risk school-age children through a nurse-driven community-based, multi-faceted intervention program. The results add to our understanding of the importance of gender in primary prevention of chronic disease. Recognizing gender inequalities may allow for the development of more effective health promotion strategies. Without such gender

considerations in health promotion, gender inequalities may in fact enhance. The effectiveness of a community-based model offers a step toward turning the tide in the enormous public health problem of childhood overweight and obesity and decreasing gender inequalities. Lifestyles become set relatively early in life; parents, teachers, health policies, and services provide key guidance leading to the development of a healthy or unhealthy environment (Osler, 2006). Comprehensive, culturally appropriate strategies occurring at critical periods in a child's development involving changes in multiple environments that are reinforced with policies ensuring healthy living hold promise for great health gains in the future.

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Table 2

Baseline (pre-intervention) demographic characteristics by group

	KNF© group ^a (n = 121)	GE group ^a (n = 130)
Age, mean (SD)	9.0 (1.6)	8.3 (1.1)
Grade, mean (SD) ^b	4.0 (1.2)	3.5 (1.5)
Gender ^b		
Male, N (%)	51 (42)	50 (38)
Female, N (%)	70 (58)	80 (62)
Primary Spanish speaking, N (%) ^b	70 (58)	73 (56)
Diagnosed with asthma, N (%)	15 (12)	13 (10)
Child race/ethnicity, N (%) ^{b,c}		
Black or African American	5 (4)	1 (1)
Hispanic/Latino	116 (96)	120 (92)
Mexican/Mexican American	115 (95)	120 (100)
Parent gender – female ^d	70 (88)	65 (93)
Parent education, N (%) ^{b,d}		
1–8th grade	36 (45)	30 (43)
9–11th grade	16 (20)	9 (13)
Grade 12 or GED	24 (30)	28 (40)
College 1–4 years	4 (5)	3 (4)
Parent marital status, N (%) ^{b,d}		
Single parent household ^e	27 (34)	30 (43)
Married	53 (66)	40 (57)
Parent income, N (%) ^{b,d}		
0–\$15K	45 (56)	43 (61)
\$15K–\$25K	35 (44)	27 (39)

^aKNF© group = Kids N Fitness (intervention group); GE group = general education group (control group).

^b $p < .05$ by t -test (age and grade) or χ^2 (all others).

^cRacial/ethnicity Categories Taken from Child and Adolescent Trial for Cardiovascular 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). Other – 5 (4%).

^dParent (e.g., parent is defined as the primary caregiver/guardian). KNF group $N = 80$; GE group $N = 70$.

^eSingle parent household = divorced, separated, member of unmarried couple; KNF group missing = 10.

Table 3

Baseline outcome data between KNF intervention and GE groups by gender

	KNF group pre-intervention (N = 121)	GE group pre-intervention (N = 130)	p-Value ^a
	Mean (SD)	Mean (SD)	
<i>Boys</i>			
Body mass index (kg/m ²)	21.89 (6.26)	21.25 (6.68)	0.183
Body mass index z-score	.90 (.50)	1.00 (.78)	0.081
Waist circumference	26.91 (4.16)	26.82 (3.91)	0.481
Physical activity 60 min/day ^b	1.51 (.50)	1.55 (.69)	0.002
Participation in team sports ^c	1.32 (.47)	1.38 (.40)	0.828
Daily physical education class attendance ^d	1.36 (.48)	1.39 (.52)	0.049
TV viewing ^e	1.32 (.47)	1.35 (.38)	0.021
Computer/video game use ^f	1.21 (.41)	1.15 (.49)	0.118
<i>Girls</i>			
Body mass index (kg/m ²)	22.65 (6.92)	22.95 (6.28)	0.040
Body mass index z-score	.98 (.59)	1.01 (.88)	0.028
Waist circumference	27.89 (5.29)	27.95 (5.91)	0.681
Physical activity 60 min/day ^b	1.21 (.50)	1.60 (.58)	0.001
Participation in team sports ^c	1.20 (.40)	1.22 (.33)	0.228
Daily physical education	1.40 (.54)	1.42 (.58)	0.003
Class attendance ^d TV viewing ^e	1.38 (.51)	1.35 (.40)	0.020
Computer/video game use ^f	1.02 (.33)	1.05 (.39)	0.981

^a $P < .05$ by *t*-test: significant values in bold; sustained significance at the 12 month follow-up visit.^bOn 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 60 min? (*Source*: CATCH SPAN).^cDuring the past 12 months, on how many sports teams did you play? Sports teams include soccer, basketball, baseball, softball, swimming, gymnastics, cheerleading, wrestling, track, football, dance, tennis, and volleyball teams. (*Source*: CATCH SPAN).^dLast week, on how many days did you go to physical education (PE) or gym classes? (*Source*: CATCH SPAN).^eYesterday, how many hours did you watch TV or video movies away from school? (*Source*: CATCH SPAN).^fHow 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).

Table 4

Mixed model analysis of outcomes between KNF and GE groups by gender: changes from baseline to 12-month follow-up (95% CI)

	KNF group 12 month follow-up (95% CI) <i>N</i> = 91	GE group 12 month follow-up (95% CI) <i>N</i> = 99	<i>p</i> -Value ^a
<i>Boys</i>			
<i>Anthropometric</i>			
Body mass index (kg/m ²) ^a	-2.56 (-4.31, -1.25)	1.35 (-5.01, 4.10)	0.150
Body mass index <i>z</i> -score ^a	-0.19 (-0.38, 1.01)	0.79 (-1.92, 1.85)	0.781
Waist circumference	-0.03 (-1.21, 1.02)	0.42 (-1.52, 1.33)	0.090
<i>Activity</i>			
Physical activity 60 min/day ^b	2.52 (1.98, 9.18)	0.98 (-3.10, 2.11)	0.002
Participation in team sports ^c	0.09 (-0.01, 1.21)	0.05 (-1.57, 1.80)	0.381
Daily physical education class attendance ^d	2.36 (1.55, 4.01)	1.12 (-5.21, 3.18)	0.003
TV viewing ^e	-0.14 (-0.31, -0.01)	0.95 (-2.98, 1.98)	0.030
Computer/video game use ^f	-0.07 (-1.00, 1.30)	0.28 (-2.18, 3.12)	0.212
<i>Girls</i>			
<i>Anthropometric</i>			
Body mass index (kg/m ²) ^a	-3.65 (-5.81, -1.78)	1.23 (-4.12, 3.41)	0.047
Body mass index <i>z</i> -score ^a	-0.70 (-1.00, -0.40)	0.58 (-1.82, 1.59)	0.050
Waist circumference	-0.79 (-1.17, -0.48)	0.94 (0.30, 1.51)	0.227
<i>Activity</i>			
Physical activity 60 min/day ^b	2.49 (-4.10, 9.47)	0.10 (-0.40, 0.70)	0.005
Participation in team sports ^c	0.01 (-1.60, 1.61)	0.80 (-0.49, 0.52)	0.270
Daily physical education class attendance ^d	2.49 (-4.10, 9.47)	0.05 (-1.57, 1.80)	0.002
TV viewing ^e	-0.35 (-0.41, -0.12)	0.14 (-0.21, 1.21)	0.002
Computer/video game use ^f	-0.02 (-1.50, 1.21)	0.10 (-0.44, 0.75)	0.132

^a *p* values by *t*-test: significant values in bold; *p*-values show differences between KNF and GE groups at the 12 month follow-up visit.

^b 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 60 min? (*Source*: CATCH SPAN).

^c During the past 12 months, on how many sports teams did you play? Sports teams include soccer, basketball, baseball, softball, swimming, gymnastics, cheerleading, wrestling, track, football, dance, tennis, and volleyball teams. (*Source*: CATCH SPAN).

^d Last week, on how many days did you go to physical education (PE) or gym classes? (*Source*: CATCH SPAN).

^e Yesterday, how many hours did you watch TV or video movies away from school? (*Source*: CATCH SPAN).

^f 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).