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School-Wide Programs Aimed at Obesity Among Latino Youth in the United States: A Review of the Evidence

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Abstract

BACKGROUND: In the past 30 years, childhood obesity rates have tripled, disproportionately affecting Latino children. From 2003 to 2006, 43.0% of Mexican-American children were classified as overweight compared with 36.9% of non-Hispanic Whites. Obesity interventions targeting children can have a significant impact in the school setting.

METHODS: We conducted a systematic review of evidence-based, obesity-related interventions in the school setting. Inclusion criteria included: having 50% or more Latino children in the study, and usage of obesity-related outcomes (eg, body mass index [BMI] z-score, weight, and waist circumference, and body fat).

RESULTS: The majority of identified studies included interventions that targeted both nutrition and physical activity. The most successful interventions were randomized, controlled trials or quasi-experimental controlled studies and had few limitations in execution in the study; however,

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overall results were mixed. There are promising results for interventions targeting Latino children who are already overweight or obese, but evidence of effectiveness is sparse.

CONCLUSIONS: This review is the first to gather evidence-based research systematically aimed at obesity-related interventions in the school setting that are specifically focused on Latino children. Results of the review are promising and timely, given the exigency of the needed evidence, and the current state of childhood obesity in the United States.

Keywords

childhood obesity; Latino; school-based interventions; review

Latinos are the largest minority group in the United States, growing faster than any other minority group in the country. According to the 2010 Census, the Latino-American population increased from 35.3 million in 2000 to 50.5 million in 2010.[1] Latino Americans disproportionately experience disparities in health compared with non-Hispanic Whites and increasingly experience higher rates of obesity as they migrate to the United States. In 2009, adult Latino Americans were 1.2 times as likely to be obese than non-Latinos.[2]

Additionally, childhood obesity rates in the United States have tripled over the past 30 years, disproportionately affecting Latino children.[3] Between 2009 and 2010, 14.8% of Latino infants and toddlers under age 2 were classified as having a high weight-for-recumbent length, compared with 8.4% of non-Latino Whites.[4] Prevalence of a body mass index (BMI) in the 85th percentile or higher in Latino children and adolescents age 2-19 years was 39.1% in 2009-2010, whereas non-Latino Whites had a prevalence of 27.9%.[4]

Because childhood obesity is a risk factor for many chronic diseases (ie, diabetes, cardiovascular disease, and cancer) and the high prevalence has not declined in the United States, obesity prevention has become a public health priority. On average, a US student spends 5.7 to 6.2 hours/day in school and 160 to 180 days/year in school, which results in approximately 50% of a child's time being spent in school.[5,6] School-based programs provide a means to reach the at-risk child population by taking advantage of the many hours children spend in school. Prior school-based interventions had positive effects on heath behaviors and BMI.[7-10] Other school-based obesity interventions have been effective in a variety of populations including children aged 9 to 11 years and disadvantaged adolescent girls.[11,12] Currently, there is limited information available on the effect of school-based interventions on Latino youth.

The purpose of this article is to examine the effects of evidence-based research of obesity-related interventions on Latino children in schools in the United States. The overarching objective of this article is to identify specific strategies that can be used to combat childhood obesity, specifically in Latino youth.

METHODS

Data for this study were developed from a "parent" review, *Guide to Obesity Prevention in Latin America and the US* (GOL), a systematic literature review used to develop recommendations for effective obesity prevention strategies aimed at Latino adults and

children. Studies that were eligible for inclusion were abstracted using the Centers for Disease Control and Prevention (CDC) *Community Guide* online data abstraction system.[13] Design suitability and quality of intervention execution were also evaluated according to the guidelines developed by the CDC's *Community Guide*.[13] Each intervention was placed into various categories based on different levels of intervention strategies, such as school-based physical activity or individual-based healthy eating. On the basis of the data obtained through the abstraction process as well as effect size consistency, a breadth of evidence was compiled for effectiveness in each category. For this article, all interventions that utilized at least one school-based component were included.

Review Search Strategy

The review was conducted by investigators and staff at San Diego State University (SDSU) and the National Institute of Public Health of Mexico (Institute Nacional de Salud Pública [INSP]). Electronic databases were searched for articles published from 1965 to 2010, including PsycInfo, Medline/PubMed, CINAHL, Cochran Library, Current Controlled Trials, LILACS, Global Health, Global Index Medicus, and Web of Science.

The primary key words (and their Spanish or Portuguese translations) aimed at the outcomes of interests that guided the search included: body mass index (BMI), weight, waist circumference, percent body fat, overweight, and obese. Key words related to the outcome, comparison groups, Latino ethnicity, and geographical region were searched together.

Study Selection

Procedures for the literature review and intervention selection were adapted from *The Community Guide*, a resource provided by the CDC to inform and guide program and policy development.[14] Potentially relevant articles were screened based on title and abstract. Full text articles were retrieved for more detailed evaluation based on 7 inclusion criteria: (1) intervention focused on obesity-related topics (eg, not general health promotion); (2) sample included at least 50.0% Latino/Latin American participants or the results were stratified by race/ethnicity; (3) the intervention was evaluated and included obesity-related outcome measures; (4) the evaluated intervention compared people who were exposed to the intervention to those who were not exposed or exposed to varying degrees, and pre-post and crossover designs were included; (5) the intervention was conducted in a community setting, as opposed to in a laboratory, and primary care settings were included; (6) the intervention did not only focus on one-on-one health education, counseling, or advice in a health care setting (for a single participant); and (7) the intervention details were published in a format with viable information for abstraction and quality evaluation.

Reviewers, trained by the project manager and with technical assistance from the CDC, did not begin the screening process until a 90.0% inter-rater reliability was achieved based on training with example articles. Five reviewers (4 from SDSU, 1 from INSP), conducted the screening process.

Data Collection and Abstraction

Two independent graduate-level reviewers screened and evaluated each full-text article for inclusion in the review. For articles that met the inclusion criteria, 2 reviewers abstracted the details of the intervention into *The Community Guide's* online system for article abstraction. A third reviewer reconciled discrepancies during screening and abstraction. Quality evaluation of each study (ie, the type and number of limitations) was conducted by investigators.

Data Synthesis

Suitability of study design was evaluated as greatest (concurrent comparison groups and prospective measurement of exposure and outcome), moderate (multiple pre- or post-measurements but no concurrent comparison group), and least (single pre- and post-measurements and no concurrent comparison group).[13] Quality of the intervention or "execution" was based on 9 possible limitations in accordance with the *Community Guide* guidelines: (1) Was the study population and intervention well described? (2) Did authors specify the sampling frame? (3) Were there any selection bias issues? (4) Did authors attempted to measure that the exposure and exposure variables were valid and reliable? (5) Were the outcome and other independent variables valid and reliable measures of the outcome of interest? (6) Did authors conduct appropriate statistical testing? (7) Did at least 80% of enrolled participants complete the study? (8) Did the authors assess confounding, potential biases, or unmeasured/contextual confounders in the study?, and (9) Were there any other shortcomings that were not already mentioned elsewhere? Execution was categorized as: good (0-1 limitations), fair (2-4 limitations), or limited (≥5 limitations).

On the basis of the number of available studies, the strength of their design and execution, and effect size, the body of evidence of effectiveness for each given category was rated as strong, sufficient, or insufficient (Table 1).[13] Effect size was calculated using Cohen's d as the difference between posttreatment scores of intervention and control groups divided by the pooled standard deviation [$d = (x_1 - x_2)/s$], and categorized as: small (0.0-0.20), medium (0.21-0.79), and large (≥0.80).[15] For pre-post designs, Cohen's d was calculated using the difference between the last follow-up measure and the pre-intervention measure, divided by the pooled standard deviation. Priority for recommendation development came from intervention strategies in the strong or sufficient body of evidence categories.

RESULTS

Of 325 obesity-related interventions identified in the GOL review, 113 met the criteria for inclusion in the review and were abstracted, excluding interventions with same-source data. Investigators subsequently excluded 8 interventions that either utilized prescribed medications or involved a nonrepresentative sample (ie sample consisting of individuals with mental health disabilities). A final total of 105 interventions (53.3% conducted in the United States, 23.8% in Mexico, 15.2% in Brazil, and 7.6% in other Latin American countries) were included in the GOL (parent) review.

Of 105 obesity-related intervention studies identified in the larger review, 15 studies focused on school-based interventions in the United States and included more than 50% Latino youth or stratified data by ethnicity.[16-30] Thirteen interventions focused on children only, whereas 2 interventions focused on both children and their parents. Study sample sizes ranged from 20 to 4603. Across the 15 studies of interest, mean age of child participants was 10.29 years, with a range of 3 to 18 years. The mean age of parent participants was 37.05 years, for studies with available data on parent age. Across all studies, there was an average of 63.2% female participants. Additionally, the studies had an average of 70.1% Latino participants. Intervention duration ranged from 1week to 3 years, while frequency of intervention delivery ranged from less than once a week to 7 days a week. Data for each intervention included in this review can be found in Table 1, including focus, effect sizes, percentage of Latinos, and study design.

In addition to having a school-based component, 5 interventions also included a community-based component. Most interventions utilized both physical activity and healthy eating components (N = 13), whereas the other 2 studies focused exclusively on physical activity. Additionally, most interventions were aimed at prevention (N = 11). Four studies were considered “treatment” and were aimed at children who were already overweight or obese. The interventions were delivered by various professionals, such as teachers and other school staff, dietitians, undergraduate students, fitness coaches, and nurses. Intervention details can be found in Table 2.

Eleven of the interventions had the greatest study design suitability, being either a randomized controlled trial, group randomized trial, or a nonrandomized trial. Four interventions had a study design suitability rated as least suitable, as they were pre-post tests that lacked a comparison group. Five studies had good execution (0-1 limitations) and the rest (N = 10) had fair execution with 2-4 limitations. No studies were found to have limited execution (≥5 limitations). Cohen’s *d* effect sizes could be calculated for 9 studies and ranged from −0.83 to 1.48. Studies that did not provide adequate data to calculate an effect size were rated as either sufficient (when significant findings were present) or small (when no significant findings were found). Two interventions had large effect sizes (≥0.80), 5 had sufficient effect sizes (0.21-0.79), and 8 had small effect sizes (≤0.20). Relative percentage change ranged from −13.47 to 11.48. The effect sizes (Cohen’s *d* and percent relative) could not be calculated for 4 interventions because the authors did not report variance and/or used outcome measures that were not included as part of the review (eg percent children above 95th percentile). A breakdown of effect sizes for the 2 main outcomes of each intervention can be found in Figure 1. Three studies were able to demonstrate a statistical change in outcome measures of interest to this review (ie, reduction of BMI z-score) within intervention schools compared with a control school or post-test measures.[22,26,27]

DISCUSSION

This review found mixed results among obesity-related interventions in the school setting with Latino child participants. While many of the studies received the highest marks in study design suitability, few had significant results related to obesity outcomes compared with a control group or postintervention assessment. Effect sizes ranged considerably and

most studies received a rating of “fair” in execution, as determined by number of limitations. However, 3 studies were able to demonstrate significant improvements in BMI or weight for children in an intervention school versus control school.[22,26,27] The strategies implemented in these studies provide promising directions for future research aimed at obesity prevention and treatment among Latino students in the United States.

For the studies that statistically reduced obesity-related outcomes compared with a control group,[22,26,27] all had the greatest study design suitability. Additionally, these studies only had 1-2 limitations in execution. Although other studies that did not find significant results also had high ratings in study design and execution, no studies with 3 or more limitations or lower ratings in study design suitability were able to demonstrate improvements in obesity-related outcomes of interest to this review. To understand the impact of school-based interventions better, it will be important for future studies to choose suitable study designs (eg, those with a comparison group) and to apply methods and protocols that would reduce the potential for limitations in execution of the study. For example, among studies in this review, the most common limitations were a lack of measurement to gauge exposure, not correcting for potential biases or confounders, maintaining less than 80% of the sample at follow-up, and various selection biases.

Most of the school-based interventions identified in this article (74%) were categorized as preventive in nature. That is, intervention strategies were applied to the general body of students. Several studies demonstrated promising results up to 3 years postintervention. In a subanalysis of free/reduced-price lunch options for students (68.0% Latino), Hollar et al[26] demonstrated that children in intervention schools were more likely to reduce their BMI z-score and weight z-score compared with children in control schools, with up to 2 years of follow-up. This intervention was a multilevel and multisector prevention program. Similarly, Foster et al[22] demonstrated that children in intervention schools (54.2% Latino) were 19% less likely to be obese compared with those in control schools up to 3 years postintervention. A notable characteristic of these 2 studies is that both are multicomponent interventions that address nutrition, physical activity, and behavioral skills. The majority of the studies in this review implemented strategies aimed at both nutrition and physical activity, though generally results of effectiveness continue to be mixed. Four studies included some aspect of cultural tailoring in the intervention,[21,23,28,30] such as modifying the existing interventions for developmental and cultural needs,[31] or including contextually relevant themes and bilingual interventionists.[30] The 11 prevention-focused studies examined in this article had fewer execution limitations (mean = 1.5) compared with the 4 treatment-focused studies aimed at students who are overweight or obese (mean = 3.0). Traditionally, school-based interventions are designed for prevention. However, there is some evidence that targeted interventions are promising for Latino children who are overweight or obese.[27]

Of the studies reported in this review, only one fourth was characterized as “treatment” and were aimed at overweight/obese children.[17,24,27,29] Despite 3 of 4 studies having greatest design suitability, execution scores were lower than that of prevention studies. Despite the sparseness of evidence-based research aimed at overweight/obese children in the school setting, Johnston et al[27] were able to reduce BMI z-scores significantly in children exposed to the intervention versus those exposed to the control condition which were consistent

of a self-help plan. Despite the sparseness of evidence-based research aimed at overweight/obese children in the school setting, Johnston et al[27] were able to reduce BMI z-scores significantly that consisted of a self-help plan. The intervention included daily, intensive sessions for 12 weeks among overweight/obese children who all identified as Mexican Americans. The daily sessions were then followed by another 12 weeks of biweekly sessions. Both the intervention and control conditions focused on nutrition and physical activity. Johnston et al[27] aimed to demonstrate that an intensive school-based intervention could impact weight. However, the costly nature of such intensive programs was also acknowledged. Because a large portion of Latino, and specifically Mexican-American children are already overweight or obese in the United States, further identifying best practices in school-based "treatment" strategies is important, especially in conjunction with prevention interventions.

Limitations

This review has limitations. One limitation is the focus of obesity-related measures as the outcome of interest. Interventions that target nutrition and physical activity as the primary outcome may also impact obesity. That is, success in other behavioral factors related to obesity may also improve children's BMI status or influence weight loss. Second, we used 1 type of framework to guide the methods of our article.[10] Other types of frameworks for gathering evidence may have resulted in a more expansive view of school-based interventions, including studies that are promising or emerging (eg, Brennan[32]). Finally, due to the variety in study designs and methodologies, the effect sizes may not be comparable. For that reason, this discussion highlighted school-based interventions that were able to demonstrate statistical improvements in obesity-related measures compared with a control group.

Conclusions

For school-based interventions in the United States aimed at Latino children, this review was able to show that the most common approaches integrated multi-component strategies (ie, nutrition and physical activity). The most successful interventions were characterized as having the greatest study designs and few limitations in execution. Given the urgent need to address childhood obesity, especially in the growing Latino population, it is important to continue improving school-based interventions that are aimed at obesity prevention. It is also a priority to further explore and contribute to evidence-based research that targets children who are already afflicted by the overweight/obesity epidemic.

IMPLICATIONS FOR SCHOOL HEALTH

The majority of the interventions in this review included strategies that addressed both nutrition and physical activity. Studies that were able to demonstrate a statistically significant reduction in weight or BMI z-scores also included strategies to improve behavioral skills (eg, goal setting, self-monitoring) or an intensive, daily program; thus, there is a strong recommendation stemming from this review for the development of school-based obesity interventions. The evidence around targeted interventions for overweight/obese children is more limited and strategies require greater intensity and tailoring compared with

prevention interventions. Whereas intensive interventions have shown promise in reducing weight gain among overweight/obese children, cost is a limiting factor.

Overall, the implications presented here apply to schools with high proportions of Latino children, which is the unique contribution of this article. Given that Latino children suffer a disproportionate rate of obesity compared with other ethnic groups, the timing and exigency of this review is relevant as we continue to tackle childhood obesity in the United States.

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Human Subjects Approval Statement

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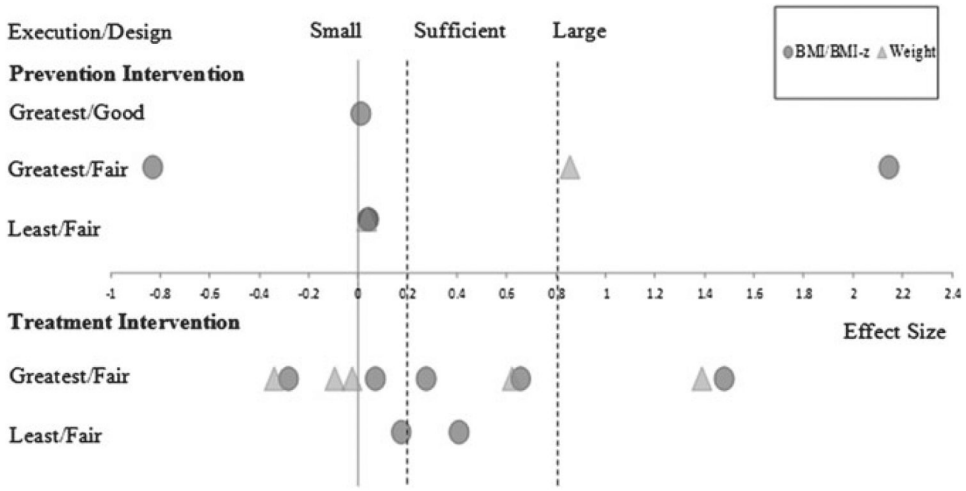

Figure 1.
Effect Sizes of School-Based Interventions Targeting Latino Children in the United States

Table 1.

Summary of US School-Based Interventions to Prevent Obesity in Latino Children (N = 15)

Author (Year)	Focus	Effect Size (Cohen's *d*)	Percent Latino	Study Design	Study Design Quality	Execution	Effect Size	Number of Limitations
Banda et al (2007)	PA, HE	n/a	100.0	RCT	Greatest	Good	Small	1
Berry and Wilschanski (2009)	PA, HE	0.173 (BMI, parents); 0.407 (BMI, children)	32.0	Pre-post test	Least	Fair	Sufficient	2
Chehab et al (2007)	PA, HE	n/a	60.0	Pre-post test	Least	Fair	Sufficient	2
Chomitz et al (2010)	PA, HE	0.05 (BMI)	14.0	Pre-post test	Least	Fair	Small	3
Fitzgibbon et al (2006)	PA, HE	1.026 (BMI)	73.3	Group randomized trial	Greatest	Fair	Large	2
Foster et al (2010)	PA, HE	0.01 (BMI)	54.8	Group randomized trial	Greatest	Good	Small	1
Hingle (2008)	PA, HE	−0.161 (BMI, level 2); 0.073 (BMI, level 3)	88.0	Nonrandomized trial	Greatest	Fair	Small	4
Hoelscher et al (2010)	PA, HE	n/a	61.0	Nonrandomized trial	Greatest	Good	Sufficient	1
Hollar et al (2010)	PA, HE	n/a	52.2	Nonrandomized trial	Greatest	Fair	Large	2
Johnston et al. (2007)	PA, HE	0.655 (BMI, ITT); 1.48 (BMI, completers);	95.0	RCT	Greatest	Fair	Small	2
Taitano (1998)	PA, HE	0.046 (BMI)	66.0	Nonrandomized trial	Greatest	Fair	Small	4
Trevino et al (2004)	PA, HE	n/a	82.5	Group randomized trial	Greatest	Good	Small	0
Colchico (1999)	PA	0.043 (BMI)	76.7	Pre-post test	Least	Fair	Small	2
Spruijt-Metz et al (2008)	PA	−0.83 (BMI z-score)	72.8	Group randomized trial	Greatest	Fair	Small	2
Coleman et al (2005)	PA, HE	n/a	93.0	Group randomized trial	Greatest	Good	Sufficient	1

PA, physical activity; HE, health eating; n/a, not applicable; BMI, body mass index; ITT, intent to treat; RCT, randomized controlled trial.

Table 2.

US School-Based Intervention Strategy Details (N = 15)

Author (Year)	Setting	Delivered by	Intervention Method Details	Duration in Months (Frequency)
Banda et al (2007)	School	Trained research assistants (PA classes), pediatric nutrition instructor (nutrition classes)	PA classes led by RAs trained in physiology, psychology, and nutrition. Nutrition classes given by an instructor of pediatric nutrition at the Baylor School of Medicine. Participants followed up for 12 months.	12 (> 1x/week)
Berry and Wilschanski (2009)	School	Dietitians, exercise physiologists	Nutrition classes (kids and parents), behavior modification classes for kids, and coping skills classes for parents. Nutrition classes focused on learning how to read food labels, portion control, and lowering caloric per fat intake. They also received 45-minute exercise classes twice a week to decrease sedentary behavior and increase PA. Participants followed up for 6 months.	6 (2-3x/week)
Chehab et al (2007)	School	Lifestyle and fitness coach (program creator)	Nine month program for inner-city girls which focused on addictive food avoidance, exercise, and self-esteem building through knowledge, regular exercise, positive self-views, and avoidance of trigger food to combat unhealthy behaviors that can lead to obesity. Participants followed up for 9 months.	9(1x/week)
Chomitz et al (2010)	Community	Teachers and nurses	A multicomponent intervention targeting community, school, family, and individuals, through city policies, community awareness campaigns, physician education enhancements, food service reforms, farm-to-school-to-home programs, nutrition counseling, and family outreach and BMI/fitness reports. Intervention was for K-5th graders. 5-2-1 was taught: 5 daily servings fruits/vegetables, 2 or less daily hours of TV/screen time, and 1 or more daily hours of physical activity. Participants followed for 36 months.	36 (N/A)
Fitzgibbon et al (2006)	School	Teacher	A 14-week intervention comprised of 3 classroom session a week that had 20 minutes of nutrition instruction using hand puppets and focusing on the education of the food pyramid followed by 20 minutes of aerobic physical activity. Parent component included newsletters and homework assignments sent to the home and intended to be done as an interactive activity between child and parent. Participants followed up for 24 months beyond the core intervention.	3.5 (3x/week)
Foster et al (2010)	School	PE teachers, registered dietitian, classroom teachers	Schools were given nutrition, behavioral, and PA components, and curriculum. Cafeteria foods and vending machines, etc were changed, PE classes were modified, and students were given additional curriculum in the classroom. The intervention consisted of 4 integrated components: nutrition, PA, behavioral knowledge, and skills, and communications and social marketing. Participants followed up for 36 months.	36 (N/A)
Hingle (2008)	School and YMCA (community)	Teacher (in school program)	Classes in school focusing on nutrition, PA, and behavior modification skills in conjunction with after-school classes at local YMCA and weekly family fun nights at the school. Participants followed up for 18 months.	18(1x/week)
Hoelscher et al (2010)	School/ community	Not specified	CATCH BasicPlus program with a community involvement component. Intervention given to 4th-grade students via classroom curricula, PE program, child nutrition services component, and family involvement. Community was involved for larger partnerships to extend school programs to surrounding community. Participants followed up for 12 months.	12 (5x/week)
Hollar et al (2010)	School	Teachers	Healthier options for public schoolchildren (HOPS): a multilevel (individual, community, and policy) and multiagency collaboration. Teachers were trained on curriculum and given technical assistance. Components included modified school meal menus, nutrition/lifestyle educational curricula, in-school PE, and wellness projects like growing gardens. Participants followed up for 24 months.	24 (n/a)
Johnston et al (2007)	School	Undergraduate students trained in PA/ nutrition	Nutrition and physical activity program for 6th- and 7th-grade Mexican-American children at their schools. Participants attended a healthy lifestyle class during last period of class time. A nutrition component was done in a classroom 1 day/week, and then students participated in physical activity outside 4 days/week. Parents	3 (5x/week)

Author (Year)	Setting	Delivered by	Intervention Method Details	Duration in Months (Frequency)
			were invited to attend monthly meetings about adapting family meals and activities to facilitate health changes. Participants followed up for 6 months.	
Taitano (1998)	School	Teacher	Physical activity participation and education curriculum for teens in high school. Curriculum was evaluated by assessing changes in knowledge, attitudes, self-efficacy, stage of change for exercise and fat intake behaviors, dietary behaviors, physical fitness indices, and certain physiological parameters. Classes were taught 3-5 times per week by a teacher in the public school system. Participants followed up for 21 months.	21 (3-5x/week)
Trevino et al (2004)	School and community	PE teachers, after-school caretakers, school cafeteria staff	Bienestar Health Program comprised of 50 health education and behavior sessions with 4 main components: (1) health and physical education class, (2) after-school health club, (3) family fun fiesta, and (4) school food service. Sessions reinforced 3 main health messages to children: decrease dietary saturated fat intake, increase dietary fiber intake, and increase physical activity in children. Participants followed up for 6 months.	7(>5x/week)
Colchico (1999)	After school and community	Not specified; coaches and facilitators	After-school PA program attempting to create an enjoyable and health-enhancing environment for youth. Weeks included structured and free-play games and fitness training. Participants also received feedback, verbal praise, and positive reinforcement to cultivate feelings of positive self-worth, confidence, and self-esteem. Participants followed up for 3 months.	3 (3x/week)
Spruijt-Metz et al (2008)	School	PE teachers	Theory-based tailored classroom media intervention for Latina middle school girls. Children formed teams of 7-10 children each to create a team under the guidance of research staff and a media developer. Children also received weekly lessons designed to increase positive meanings of physical activity and increase intrinsic motivation for physical activity. Participants followed up for 6 months.	0.25 (5-7 days)
Coleman et al (2005)	School	Classroom and PE teachers, school staff	Community level study using elementary schools involved in the CATCH program. All 3rd graders were eligible to participate. CATCH staff provided training and materials to schools to improve their PE curriculum, cafeteria foods, and classroom healthy lifestyle education. Participants followed up for 36 months.	36 (n/a)

x, times; YMCA, Young Men's Christian Association; PE, physical education; PA, physical activity; RA, research assistant; CATCH, coordinated approach to child health.