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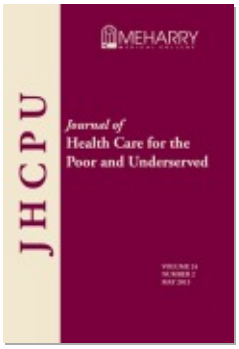

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ORIGINAL PAPER

Improving Overweight among At-risk Minority Youth: Results of a Pilot Intervention in After-school Programs

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Abstract: Childhood overweight and obesity disproportionately affect low-income communities. Most school-based health promotion efforts occur during the school day and are limited in scope. This study evaluated the effectiveness of an after-school program among 3rd–5th graders (n=121; 73% 8 to 9 years old; 57% female; 60% Asian) at eight study sites (four intervention, four comparison). After-school staff were trained on implementing the Catch Kids Club Curriculum on nutrition and physical activity. Data were collected on students' nutrition and physical activity knowledge and behavior, and their height and weight measurements. Using Stata 10.1/SE, cross-lagged regression models assessed changes over time. Results showed a reduction in overweight and obesity (defined as body mass index >85th percentile for age and sex) among children in the intervention group, but mixed results regarding diet and physical activity knowledge and behavior. Enhancing after-school physical activity opportunities through evidence-based programs can potentially improve overweight and obesity among low-income children.

Key words: Low-income, elementary school age children, after-school programs, overweight, obesity.

Over the last 30 years, both adults and children in the United States have embodied dramatic increases in overweight and obesity.[1] Recent data from the National Health and Nutrition Examination Study (NHANES) suggest body mass index (BMI) among children and adolescents are leveling off.[2] Nonetheless, pediatric obesity remains

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a critical public health issue in California; one-third of low-income children enter the school system in kindergarten either overweight or obese[3] and between 2005 and 2010, 31 out of the 58 counties experienced an increase in the prevalence of childhood overweight.[4]

Although multiple factors contribute to childhood overweight and obesity, poor dietary and physical activity behaviors are strongly associated with childhood overweight.[5–9] In turn, a child's adherence to nutritional and physical activity guidelines is influenced by social determinants exacerbating health disparities. For example, studies have identified a clear association between living in lower socioeconomic communities and factors associated with childhood overweight and obesity.[10] Indeed, low-income neighborhoods in Los Angeles County (LAC) have the lowest number of supermarkets and highest number of fast-food establishments in comparison with more affluent neighborhoods;[11] thus, children living in low-income neighborhoods may have limited access to affordable healthy food.[11,12] Furthermore, physical activity in low-income communities is hindered by the perception that the physical environment is neither safe nor conducive to exercise.[12,13,14] In LAC, almost 20% of parents report lacking access to a safe place for their children to play.[12] These findings are significant considering that children in neighborhoods perceived to be less safe are at higher risk of becoming obese.[12,13,14]

Given the large proportion of time children spend at school, schools have been identified as institutions through which healthy behaviors and positive attitudes can be fostered.[5,15–17] However, there are limitations to the conventional strategies employed in school-based obesity prevention and treatment programs including a lack of a standardized and comprehensive nutrition education curricula[17] and limited teacher training in these areas.[15] Moreover, schools are facing constraints such as lack of time and increased pressure to improve academic performance, thus reducing opportunities for physical activity during recess and physical education.[18–19]

The majority of health promotion activities to address child overweight have focused on the school day, however, non-school hours are when children often overeat and behave in sedentary ways.[20] Since an estimated 8.4 million youth in the U.S. attend some form of an after-school program, expanding efforts to increase quality physical activity among other health promoting behaviors into after-school hours is a logical next step.[16,21] During after-school programs children can be provided with healthy snacks and opportunities for physical activity that they would otherwise not have access to because of the limitations of existing physical education programs, school schedules, and parents' work schedules.[20,22,23] The details of why an after-school program is effective in improving physical activity remains largely unclear given the wide range of program components, varying methods of implementation, and heterogeneity of populations.[6,19,21,24] Furthermore, existing statewide policies on physical activity in after-school programs have been established based on expert opinion and/or by adapting existing regulations from other contexts. Thus, there is a lack of evidence guiding these statewide policies on physical activity in the after-school setting.[24] Once there is a clearer understanding of effective evidence-based program components, leaders in the after-school programs will be better informed to design strategies to increase physical activity that can in turn lead to successful obesity prevention efforts.

This pilot study aimed to evaluate the effectiveness of an after-school intervention on a low-income, diverse elementary school population in LAC, the largest county in the U.S. The primary hypothesis was that by providing training and on-going mentoring to after-school youth specialists, children in the intervention group would receive quality nutrition education and physical activity opportunities that would enhance their nutrition and physical activity knowledge, attitudes and practices and improve their weight status at the end of the school year compared with children in other after-school programs without support for nutrition education and physical activity.

Methods

Sample. The pilot program was implemented in the Alhambra Unified School District (AUSD), a school district in eastern Los Angeles County. The AUSD has 13 kindergarten through 8th grade public schools and five public high schools collectively serving approximately 18,400 students.[25] The racial/ethnic profile of students in AUSD during the 2008–2009 academic year was 52.1% Asian, 39.8% Latino/Hispanic, 3.9% White, and 4.2% Other.[26] More than two-thirds (67.8%) of the students qualified for free or reduced-cost meals indicating family income below 200% of the federal poverty level.[26]

Twelve of the 13 AUSD kindergarten through 8th grade schools offer a free after-school enrichment program to children who live in low-income households. The Alhambra After-school Adventures (AAA) program enrolls approximately 1,800 kingergarten–8th grade students every year (150 students per school). The current study focused on implementing the intervention among the elementary school age children (kindergarten through 5th grade). At each school there is an after-school supervisor, referred to as a Youth Specialist and 7–10 staff members referred to as Program Leaders. The AAA offers academic services including assistance with homework and tutoring as well as enrichment activities such as sports, arts and crafts, and cooking. Prior to the pilot project, all of the AAA sites offered physical activity and nutrition as part of their usual after-school program. Examples of the activities offered during the existing programs included demonstrations on how to prepare healthy snacks and also competitive game activities including soccer. However, the activities were not well-defined, not mandated, and not monitored. Additionally, after-school program staff had not received substantial training in the delivery of nutrition and physical activity components.

Human subjects. The AUSD and the UCLA Office for Protection of Research Subjects approved the study.

Study design and site selection. This evaluation study employed a pretest-posttest quasi-experimental (comparison group) design, among a convenience sample of eight of the 13 after-school sites, kindergarten through 8th grade schools (four intervention and four comparison). Schools were identified based on interest by the after-school program staff, were Title 1 schools (12/13 were Title 1) and the recommendations of the district supervisor of the Alhambra After-school Adventures program. Participation in the study was strictly voluntary.

Intervention. The four participating intervention sites received staff training in nutrition, child development and enhanced physical activity routines, curriculum resources, and regular mentoring and technical assistance visits.

Training and orientation on nutrition education and physical activity was conducted using the Catch Kids Club curriculum. Catch Kids Club is an evidence-based program that is designed to teach students nutrition and the skills to make healthy dietary and physical activity choices at school, in the community and at home.[6,23,24] It is a 32-lesson after-school enrichment program developed with the support of the National Heart, Lung, and Blood Institute and designed for the early prevention of cardiovascular disease.[23] It includes a nutrition education manual, an activity box, and hands-on snack preparation activities.[27]

After-school Youth Specialists were coached to increase the students' opportunities to participate in moderate to vigorous physical activity. The curriculum consisted of physical activity cards that gave the after-school Youth Specialists and Program Leaders creative ideas to get the students active. The physical activity cards provided the staff with ideas of activities that they could implement that required minimal or no equipment and were inclusive of children regardless of their physical activity talents, or abilities.[23] The cards included instructions and illustrations, and identified the skills learned from each physical activity. Some examples of activities included bean-bag freeze tag and Houdini Hoops (a game in which children form a circle by holding hands and try to move a hula-hoop around the circle without breaking the circle). The after-school Youth Specialists were also encouraged to serve as positive role models to the children by not eating foods that the curriculum described as "junk food" and to encourage healthy dietary choices and more physical activity.

The two-day staff training for after-school Youth Specialists and Program Leaders from the four intervention schools occurred in August 2008, prior to the start of the school year. A team of UCLA faculty and program staff with expertise in nutrition, physical activity promotion, child development and program implementation conducted the training. Fifteen staff members participated in the training, representing 83% of the after-school staff from the four schools participating in the intervention. The training included basic nutrition concepts as well as a focus on strategies to implement nutrition education and physical activity promotion in the after-school program. The hands-on, interactive, participant-focused training provided an opportunity for the leaders to share their experiences, strategies and challenges in engaging children in learning about healthy food and in meaningful physical activity.

In addition to the two-day training, each site was visited by a UCLA staff member at least once a month during the school year. The lessons and physical activity cards were handed out monthly over the course of the year during site visits. The site visits also allowed for UCLA program staff to provide ongoing mentorship for the Program Leaders to maintain enthusiasm for the intervention activities.

Measures. The evaluation measured changes in student nutrition and physical activity knowledge, attitudes, and behaviors associated with the program. Evaluation data were collected from students in grades 3–5 at the intervention and comparison schools. Although program participants included students from grades kindergarten through 5th grade, evaluation data were restricted to grades 3–5 considering the challenges in administering the questionnaire among younger children, specifically in a group setting. Data were collected at baseline, in September, and at follow-up at the end of the school year in June.

Dietary intake, nutrition knowledge and physical activity measures. The Catch Kids Club questionnaire was modified to evaluate the impact of the program on students' physical activity knowledge, perception and behaviors. The Day in the Life Questionnaire was used to measure fruit, vegetable, and snack foods intake[28] and the Previous Day Physical Activity Recall (PDPAR) was used to measure physical activity behavior.[29] These measures have been validated for use with elementary school aged children[28,29] and have been previously used successfully by the study's investigators.[30,31]

To measure the level of physical activity, the questionnaire asked students about their behavior the previous day. For example, items about recess and lunchtime activities asked whether they "sat around, stood around, walked around or ran around" during those times. Another question asked how they got home from school with the following close-ended responses: "walked, biked, took the bus or in a car." The average of seven questions about daily activities was calculated to measure "Total Daily Activity." Knowledge and attitude questions on physical activity were measured by asking questions such as "You should exercise every day to stay healthy" and whether a student preferred a more physical or sedentary activity (TV/video games or playing sports/being active). Response options were "yes" or "no" and were dichotomized as either the more active/healthy response (for "yes") or not (for "no").

To assess nutritional knowledge, the questionnaire included nine items asking students to choose which of two food items they thought was "best for your health" as well two questions on daily recommended serving sizes for different food groups including fruits and vegetables. The percentage of correct responses was calculated to determine each student's "Nutrition Knowledge Score." Attitudes about dietary behavior were measured by questions on perceived adequate intake of fruits and vegetables. Responses were dichotomized to differentiate between those who reported eating the "just right" amount and those who reported eating less. Dietary behavior was measured by questions capturing the frequency of fruit, vegetable, junk food and juice consumption on the previous day. The "Total Healthier Eating Choices" was calculated by taking the average of healthy food choices selected per student (there were six questions total).

All questionnaires were administered in a group setting to children who had assented to participate in the study and whose parents had given written consent. Students received small incentives of school supplies for participating.

Body mass index. Weight was measured on a Seco beam balance to the nearest 100 grams. Heavy clothes and shoes were removed before weighing and measuring the child. Height was measured to the nearest 0.1 cm using a stadiometer board. Body mass index was calculated as weight in kilograms divided by height in meters, squared ($kg\ m^2$). Ages were calculated from the birthdates of the children and the date on which the measurements were made. The sex of each child was also recorded. Using standard CDC growth charts,[32] each child's BMI percentile (and associated BMI z-score) for age and sex was calculated. In adherence with the CDC growth charts, a BMI greater than 85th percentile (for age and sex) was considered "overweight or obese" for the outcome analysis.[32]

Statistical analyses. *Outcome measures*. Analyses were conducted with the data from the questionnaire and anthropometric measurements, using Stata 10.0/SE.[33] The analyses assessed baseline differences between intervention and comparison schools,

Table 1.

BASELINE DEMOGRAPHIC CHARACTERISTICS (N=121)[a]

Demographic Characteristics	Comparison n=48 Percentage (n)	Intervention n=73 Percentage (n)	p
Race/Ethnicity			.009*
Hispanic/Latino	39.6 (19)	15.1 (11)	
Asian or Pacific Islander	50.0 (24)	67.1 (49)	
Other Race or Ethnicity	10.4 (5)	17.8 13)	
Sex			
Female	56.3 (27)	58.9 (43)	.772
Male	43.8 (21)	41.1 (30)	
Age (years old)			.173
6–7	2.1 (1)	9.6 (7)	
8–9	82.3 (39)	68.5 (50)	
10–11	16.7 (8)	21.9 (16)	
Grade			.773
3rd	52.1 (25)	48.0 (35)	
4th	31.3 (15)	30.1 (22)	
5th	16.7 (8)	21.9 (16)	

*p<.05
[a]Chi-square statistics were used to assess the distribution of demographic characteristics by intervention condition.

and included t-tests (for continuous variables) and chi-squared analysis (for categorical variables). Assessment of changes over time between baseline and follow-up used cross-lagged linear, Poisson, or logistic regression models depending on the outcome variable of interest. Each model regressed the outcome of interest on its baseline values, were conducted to compare main and interactive effects of intervention exposure (intervention school or comparison school). In these models, the interaction of baseline value*intervention exposure indicates whether the change in that outcome over time differs between intervention and comparison participants. To account for the clustering of students within schools, the regression models used clustered robust standard errors.

Results

The study did not face major issues regarding retention of study participants. Two children voluntarily withdrew from the study (one intervention and one comparison). There were 137 participants with data at both baseline and follow-up, and that number was reduced by 16 because of missing data and implausible values for height and/or weight. Thus, the following results were derived from baseline and follow-up data collected from a total sample size of 121 participants (73 intervention and 48

Table 2.

CHANGE OVER TIME IN CHILDREN'S NUTRITION OUTCOMES BY INTERVENTION CONDITION (N=121)[a]

Nutrition Outcomes	Comparison n=48 (SD)	Intervention n=73 (SD)	p
Knowledge			
Nutrition Knowledge Score[b] (mean percentage correct)			
Pretest	64.6% (1.388)	64.9% (1.750)	
Posttest	67.1% (18.654)	71.1% (12.397)	
Change	*+ 2.5*	*+ 14.4*	.009*
Attitudes			
Amount of Vegetables You Eat Each Day is . . . (proportion responding, "Just right")[c]			
Pretest	75.0% (3.655)	75.3% (4.395)	
Posttest	66.7% (20.400)	79.5% (9.400)	
Change	*–8.3*	*+4.2*	.415
Amount of Fruit You Eat Each Day is . . . (proportion responding, "Just right")[d]			
Pretest	71.7% (5.076)	73.4% (4.752)	
Posttest	62.5% (0.167)	74.0% (0.188)	
Change	*–9.2*	*+0.6*	.093
Behaviors			
Frequency of Eating Fruit Yesterday[c]			
Pretest	0.77 (0.291)	0.72 (0.329)	
Posttest	0.49 (0.228)	0.55 (0.137)	
Change	*–0.28*	*–0.17*	.309

(Continued on p. 19)

comparison). The baseline demographics of program participants are summarized in Table 1 reflecting general similarities between the intervention and comparison sites. The majority of students were Asian (67.1% at intervention and 50.0% at comparison), female (58.9% at intervention and 56.3% at comparison), between 8 and 9 years of age (68.5% at intervention and 82.3% at comparison) and in the 3rd grade (48.0% at intervention and 52.1% at comparison sites). However, there was a significant difference in race/ethnicity between intervention and comparison sites with a larger percentage of Hispanic/Latino students (15.1% *vs.* 39.6%) at the comparison sites.

Nutrition knowledge, attitudes and behaviors. The results of cross-lagged regression models showed a statistically significant difference in children's nutrition knowledge increase over time (p=0.009) as well as a decrease in junk food consumption (p=.035) between the intervention and comparison sites. However, intervention sites did experience an increase in juice consumption, although not as much as the comparison group

Table 2. *(continued)*

Nutrition Outcomes	Comparison n=48 (SD)	Intervention n=73 (SD)	p
Frequency of Eating Vegetables Yesterday[c]			
Pretest	0.36 (0.092)	0.37 (0.117)	
Posttest	0.46 (0.140)	0.37 (0.284)	
Change	*+0.10)*	*0.00*	.084
Frequency of Drinking Juice Yesterday[d]			
Pretest	0.83 (0.355)	0.66 (0.258)	
Posttest	1.27 (0.163)	0.84 (0.520)	
Change	*+0.44*	*+0.18*	.000**
Frequency of Eating "Junk Food" Yesterday[c]			
Pretest	1.50 (0.269)	1.51 (0.333)	
Posttest	1.51 (0.447)	1.28 (0.153)	
Change	*+0.01*	*–0.23*	.035***
Total Healthier Eating Choices (range 0–6)[d]			
Pretest	4.21 (0.210)	4.13 (0.182)	
Posttest	4.33 (1.160)	4.56 (0.719)	
Change	*+0.12*	*+0.43*	.229

*p<.01
**p<.05
***p<.001
[a]Results are from cross-lagged regression models (linear, Poisson, or logistic, based on the nature of the outcome). Standard deviations for the point estimates are shown in parentheses. P-values are based on standard errors that were adjusted for the clustering of children within school sites, using the -robust cluster- command in Stata.
[b]Results from linear regression.
[c]Results from logistic regression (dichotomous outcome).
[d]Results from Poisson regression (count outcome).

(p=.000). There were no other significant differences between groups with regard to changes in nutrition related attitudes or behavior (Table 2). Of note, frequency of fruit and vegetable consumption was lower than national recommendations[34] at baseline and follow-up for both intervention and comparison participants.

Physical activity knowledge, attitudes and behaviors. There were no significant differences between the intervention and comparison groups regarding physical activity knowledge, attitudes, or behavior (Table 3).

Body mass index. From baseline to follow-up, the proportion of children who were overweight or obese showed a significantly greater decrease among the intervention group compared with the comparison group. The percentage of overweight or obese children decreased by 3.1% (from 40.6% to 37.5%) among the intervention group versus 2.0% (from 46.7% to 44.7%) among the comparison group (p=0.000) (Table 3).

Table 3.

CHANGE OVER TIME IN CHILDREN'S PHYSICAL ACTIVITY & INACTIVITY AND WEIGHT CATEGORY OUTCOMES BY INTERVENTION CONDITION (N=121)[a]

Physical Activity and Weight Category Outcomes	Comparison n=48 (SD)	Intervention n=73 (SD)	p
Knowledge			
You Should Exercise Every Day to Stay Healthy (proportion responding "Yes")[b]			
Pretest	94.0% (2.227)	92.9% (1.821)	
Posttest	91.7% (5.270)	93.1% (4.850)	
Change	*–2.3*	*+0.2*	.986*
Attitudes			
Prefer TV/video Games to Playing Sports/ Being Active (proportion responding "Yes")[b]			
Pretest	35.6% (10.257)	37.7% (11.443)	
Posttest	35.8% (20.000)	28.2% (10.640)	
Change	*+0.2*	*–9.5*	.570**
Thinks People Playing Sports Seem to Have Fun (proportion responding "Yes")[c]			
Pretest	76.5% (2.570)	75.5% (2.177)	
Posttest	66.7% (1.550)	83.3% (13.900)	
Change	*–9.8*	*+7.8*	.434
Behaviors			
Total Daily Activity (range 1–7, with higher values indicating greater physical activity in a typical day)[b]			
Pretest	3.72 (0.137)	3.65 (0.122)	
Posttest	3.67 (0.440)	3.81 (0.138)	
Change	*–0.05*	*+0.16*	.156
Weight Category			
Proportion overweight or obese (BMI above 85th percentile for age and sex)[c]			
Pretest	46.7% (12.707)	40.6% (9.347)	
Posttest	44.7% (48.151)	37.5% (40.331)	
Change	*–2.0*	*–3.1*	.000***

*p<.05
**p<.0
***p<.001

[a]Results are from cross-lagged regression models (Poisson or logistic, based on the nature of the outcome). Standard deviations for the point estimates are shown in parentheses. P-values are based on standard errors that were adjusted for the clustering of children within school sites, using the -robust cluster- command in Stata. Body Mass Index percentiles were based on Centers for Disease Control and Prevention 2000 clinical growth charts by age and sex.

[b]Results from Poisson regression (count outcome).

[c]Results from logistic regression (dichotomous outcome).

Discussion

The intervention significantly improved the body mass index of elementary school students who participated in a pilot after-school program in a low-income community within one academic year. These findings are signficiant for childhood obesity efforts considering that children from low-income neighborhoods are at a higher risk of overweight and obesity than children from affluent neighborhoods.[4,11,12,13] Furthermore, this study helps address the dearth of published research on childhood obesity among Asian Americans. The lack of data on childhood obesity among Asian Americans is an important public health concern[35] given that they are the fastest growing racial group in the U.S.,[36] and the literature suggests current definitions of obesity underestimate the disease risk among this subgroup.[37] Thus, these findings may help inform the literature on childhood obesity as well as disparities between racial/ethnic groups.

Evaluation of the students' knowledge, attitudes and practices related to dietary and physical activity revealed mixed results, however. This study yielded positive findings including a significant increase in nutrition knowledge and a significant decrease in junk food consumption among the intervention group compared with those from the comparison group. While there were trends towards a positive change in physical activity levels and some attitudes towards physical activity in the intervention group compared with negative changes in the comparison group, the differences were not significant. Some studies have found similar mixed results,[5,23] but others have found that increasing opportunities for physical activity in after-school programs were influential in improving BMI and physical activity levels among students.[18] Nonetheless, the outcomes from this study suggest that after-school programs can play an important role in the prevention and treatment of childhood overweight; however, the reasons for this improvement merit further study.

A possible contributing factor to the healthier BMI outcomes of students may have been the training, mentoring and monthly reflections of the after-school Program Leaders. The staff not only completed the two-day UCLA training but UCLA staff maintained communication on a monthly basis throughout the school year providing mentorship and guidance to after-school Program Leaders. During this monthly visit the UCLA staff delivered the next set of modules, addressed any questions and received process feedback. The association between positive outcomes and the active and enthusiastic involvement of after-school program staff has been discussed in other studies.[22,23] It is also possible that participants were in pre-adolescent/adolescent years at the time of the study and their BMI percentile decreased as a result of physiological/body habitus changes generally observed during this time period.

Findings from this study indicate that implementing evidence-based curricula that offer training in after-school programs, such as the Catch Kids Club, can provide an effective and feasible strategy to address childhood obesity. Moreover, after-school programs have the potential to provide opportunities for enhanced physical activity and development of healthy habits for children from socio-economically disadvantaged families who may have more limited access to nutritious food and environments conducive to physical activity.[20,21] This study adds to the literature on childhood obesity programs and after-school programs by demonstrating that the CATCH Kids Club

curriculum, in conjunction with 2 day training and regular mentoring of the staff, can be implemented successfully in an after-school setting. This is also evidence of the translation of research to action requiring relatively limited resources in a high-risk population.

Study constraints. The study results highlight some of the limitations the program faced. There was no significant improvement in the measures of physical activity behavior. It is possible the small sample size limited the ability to detect significant differences between the intervention and comparison groups. Additionally, while the questionnaire measured behavior during physical education and at home on the weekdays and on the weekends, it did not address physical activity at an after-school program; utilizing a pedometer in future studies to document physical activity may mitigate this limitation. The study was also limited by budgetary constraints and therefore could not conduct 24-hour dietary recalls which could have enhanced the analyses of dietary behavior before and after the intervention. Further research will be necessary to tease out the specific pathways explaining the positive results regarding BMI including measures of perceptions and behavior of physical activity during the after-school program as well as how nutrition education can be enhanced in an after-school setting.

Conclusion. Poor dietary and physical activity behaviors and persistent racial/ethnic disparities in overweight have an impact on the health of Californian children. The majority of school-based health promotion activities occur during the regular school day and are limited in scope. Thus, we are experiencing a missed opportunity to improve the well-being and levels of health disparities among children by not investing in after-school programs. This study demonstrates the potential of after-school programs to address the rising rates of overweight and obesity among children in low-income communities both in the short and long term. Specifically, this pilot intervention led to a decrease in BMI levels among elementary school students who participated in an after-school program using an evidence-based, sequential nutrition and physical activity curriculum. Further programs and research are needed for enhancing our understanding of the mechanisms for reducing the BMI levels specifically in an after-school context.

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Notes

1. Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of overweight and obesity in the United States, 1999–2004. JAMA. 2006 Apr 5;295(13):1549–55.
2. Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of high body mass index in US children and adolescents, 2007–2008. JAMA. 2010 Jan;303(3):242–9.
3. California Department of Education. Keeping children healthy in california's child care environments: recommendations to improve nutrition and increase physical activity. Sacramento, CA: California Department of Education California Health and Human Services Agency, 2009.

4. Babey SH, Wolstein J, Diamant AL, et al. A patchwork of progress: changes in overweight and obesity among california 5th-, 7th-, and 9th-graders, 2005- 2010. Los Angeles, CA: Center for Health Policy Research and California Center for Public Health Advocacy, 2011.
5. Weschler H, Devereaux RS, Davis M, et al. Using the school environment to promote physical activity and healthy eating. Prev Med. 2000 Aug;31:S121–S37.
6. Coleman KJ, Tiller CL, Sanchez J, et al. Prevention of the epidemic increase in child risk of overweight in low-income schools: the El Paso coordinated approach to child health. Arch Pediatr Adolesc Med. 2005 Mar;159(3):217–24.
7. Samuels SE, Craypo L, Boyle M, et al. The California endowment's healthy eating, active communities program: a midpoint review. Am J Public Health. 2010 Nov; 100(11):2114–23.
8. Johnson L, Mander AP, Jones LR, et al. Energy-dense, low-fiber, high-fat dietary pattern is associated with increased fatness in childhood. Am J Clin Nutr. 2008 Apr;87(4):846–54.
9. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. Lancet. 2002 Aug 10;360(9331):473–82.
10. Gordon-Larsen P, Nelson MC, Page P, et al. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics. 2006 Feb;117(2):417–24.
11. Los Angeles County Department of Public Health. Preventing childhood obesity: the need to create healthy places. Los Angeles, CA: Los Angeles County Department of Public Health, 2007.
12. Los Angeles County Department of Public Health. Childhood Obesity: Tipping the Balance Toward Healthy, Active Children, LA health. Los Angeles, CA: Los Angeles County Department of Public Health, 2008.
13. California Department of Health. Children now. Sacramento, CA: Department of Health California, 2012.
14. Singh GK, Siahpush M, Kogan MD. Neighborhood socioeconomic conditions, built environments, and childhood obesity. Health Aff (Millwood). 2010 Mar–Apr;29(3): 503–12.
15. Story M, Nanney MS, Schwartz MB. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. Milbank Q. 2009 Mar; 87(1):71–100.
16. de Heer HD, Koehly L, Pederson R, et al. Effectiveness and spillover of an after-school health promotion program for Hispanic elementary school children. Am J Public Health. 2011 Oct; 101(10):1907–13.
17. Prelip M, Slusser WM, Lange L, et al. Participatory prevention research model promotes environmental change for healthier schools. Health Promot Pract. 2010 Jan; 11(1):54–61.
18. 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 Jun;36(6):527–37.
19. Trost SG, Rosenkranz RR, Dzewaltowski D. Physical activity levels among children attending after-school programs. Med Sci Sports Exerc. 2008 Apr;40(4):622–29.
20. Mahoney JL, Lord H, Carryl E. After-school program participation and the development of child obesity and peer acceptance. Applied Developmental Science. 2005;(4):202–15.
21. Beets MW, Wallner M, Beighle A. Defining standards and policies for promoting physical activity in after-school programs. J Sch Health. 2010 Aug;80(8):411–7.

22. Coleman KJ, Geller KS, Rosenkranz RR, et al. Physical activity and healthy eating in the after-school environment. J Sch Health. 2008 Dec;78(12):633–40.
23. 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 Apr;8(2):133–40.
24. Beets MW. Enhancing the translation of physical activity interventions in after-school programs. Am J Lifestyle Med. 2012 Jan;6(4):328–41.
25. California Department of Education. Alhambra unified school district's website. Sacramento, CA: Department of Education California, 2011.
26. California Department of Education. Educational demographics unit. Sacramento, CA: Department of Education California,2009.
27. Sharpe EK, Forrester S, Mandigo J. Engaging community providers to create more active after-school environments: results from the Ontario CATCH kids club implementation project. J Phys Act Health. 2011 Jan;8 Suppl 1:S26–31.
28. Edmunds LD, Ziebland S. Development and validation of the Day in the Life Questionnaire (DILQ) as a measure of fruit and vegetable questionnaire for 7–9 year olds. Health Educ Res. 2002 Apr;17(2):211–20.
29. Weston AT, Petosa R, Pate RR. Validation of an instrument for measurement of physical activity in youth. Med Sci Sports Exerc. 1997 Jan;29(1):138–43.
30. Prelip M, Slusser W, Thai CL, et al. Effects of a school-based nutrition program diffused throughout a large urban community on attitudes, beliefs, and behaviors related to fruit and vegetable consumption. J Sch Health. 2011 Sep;81(9):520–9.
31. Prelip M, Kinsler J, Thai C, et al. Evaluation of a school-based multi-component nutrition education program to improve young children's fruit and vegetable consumption. J Nutr Educ Behav. 2012 Jul–Aug;44(4):310–8.
32. Centers of Disease Control and Prevention. Clinical Growth Charts. Atlanta, GA: Centers of Disease Control and Prevention, 2000.
33. StataCorp. Stata statistical software: release 10. College Station, TX: StataCorp, 2007.
34. U.S. Department of Health. Dietary guidelines for Americans. Washington, DC: U.S. Department of Health, 2010.
35. Shabbir S, Kwan D, Wang MC, et al. Asians and Pacific Islanders and the growing childhood obesity epidemic. Ethn Dis. 2010 Spring;20(2):129–35.
36. Pew Research Center. Social and Demographic trends, the rise of Asian Americans. Washington, DC: Pew Research Center, 2012.
37. Golden SH, Brown A, Cauley JA, et al. Health disparities in endocrine disorders: biological, clinical, and nonclinical factors—an Endocrine Society scientific statement. J Clin Endocrinol Metab. 2012 Sep;97(9):E1579–639.