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Latino Families, Primary Care, and Childhood Obesity:

A Randomized Controlled Trial

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Abstract

Background—Few successful treatment modalities exist to address childhood obesity. Given Latinos' strong identity with family, a family-focused intervention may be able to control Latino childhood obesity.

Purpose—To assess the feasibility and effectiveness of a family-centered, primary care-based approach to control childhood obesity through lifestyle choices.

Design—Randomized waitlist controlled trial in which control participants received the intervention 6 months after the intervention group.

Setting/participants—Forty-one Latino children with BMI >85%, aged 9–12 years, and their caregivers were recruited from an urban community health center located in a predominantly low-income community.

Intervention—Children and their caregivers received 6 weeks of interactive group classes followed by 6 months of culturally sensitive monthly in-person or phone coaching to empower families to incorporate learned lifestyles and to address both family and social barriers to making changes.

Main outcomes measures—Caregiver report on child and child self-reported health-related quality of life (HRQoL); metabolic markers of obesity; BMI; and accelerometer-based physical activity were measured July 2010–November 2011 and compared with post-intervention assessments conducted at 6 months and as a function of condition assignment. Data were analyzed in 2012.

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Results—Average attendance rate to each group class was 79%. Socio-environmental and family factors, along with knowledge, were cited as barriers to changing lifestyles to control obesity. Caregiver-proxy and child-self-reported HRQoL improved for both groups with a larger but not nonsignificant difference among intervention vs control group children ($p=0.33$). No differences were found between intervention and control children for metabolic markers of obesity, BMI, or physical activity.

Conclusions—Latino families are willing to participate in group classes and health coaching to control childhood obesity. It may be necessary for primary care to partner with community initiatives to address childhood obesity in a more intense manner.

Trial registration—This study is registered at [Clinicaltrials.partners.org](https://clinicaltrials.gov/ct2/show/study?term=2009P001721) 2009P001721.

Introduction

Obesity is a complex disorder involving biology, physical environments, societal structures and cultural determinants.^{1,2} Obesity is one of the most prevalent childhood chronic health conditions.^{3–5} Racial, ethnic, and socioeconomic disparities in the prevalence of obesity are well documented.^{4,6,7} In 2010, among those aged 2–19 years, 21% of Hispanics were obese compared to 14% of non-Hispanics.⁸

Many Latino children face barriers to maintaining a healthy weight, including lack of affordable healthy foods in their neighborhoods, dangerous neighborhoods that make being active outdoors difficult, and a lack of culturally relevant community activities.^{9–11} Families have inadequate time for play or food preparation and use food and TV to encourage desired behaviors.^{12–14} Treating obesity has proven difficult.¹⁵ Current standard medical care relies on primary care providers providing counseling on diet and exercise, at routine visits that are months apart.¹⁶ Cost-effective approaches to promote healthy lifestyle choices among Latino children are needed to reduce obesity rates.

Children whose parents are overweight are more likely to be overweight¹⁷ and are at an increased risk of obesity as adults.¹⁸ Thus, addressing risk factors for childhood obesity requires addressing family behaviors including diet and physical activity.¹⁹ Family-centered approaches have been successful in supporting healthy eating and physical activity in children.^{20–23} Family-centered approaches may be particularly relevant to Latino communities, given Latinos' sense of *familismo*,²⁴ which is valuing the family as central to behaviors and decisions.

To address challenges common to Latino communities, the authors piloted *Healthy Living Today!*, a family-centered, primary care-based approach to weight control. Tests were made of the feasibility and effectiveness of this novel pilot program, which included six interactive group classes focused on nutrition, physical activity, and stress management, followed by 6 months of monthly in-person or phone health coaching. We hypothesized that (1) Latino families would be willing to participate in an augmented primary care approach to treat obesity; and (2) children participating in the intervention would have improved quality of life, metabolic markers of obesity, BMI, and physical activity.

Methods

Study Design

Participating dyads were sequentially randomized to the intervention or control group in a 3:2 ratio during the first half of the study; and then 2:2 during the second half of the study to adequately fill the group classes. Intervention participants began classes immediately with control participants waiting 6 months prior to beginning the intervention, immediately following their 6-month assessment. Both intervention and waitlist control participants completed evaluation protocols at baseline and 6-months' postbaseline. Caregiver consent and child assent were obtained. Participating families were given a \$15 gift certificate at the first visit and a \$25 gift certificate at the second visit. This study was approved by the Partners IRB.

Participants

Eligible participants were Latino children aged 9–12 years who were overweight or obese (age- and gender-specific BMI in the 85th–94th and 95th percentile, respectively) who received primary care at a single community health center. Participants were identified by their primary care pediatrician and then recruited by phone. Children with chronic diseases other than asthma were excluded. Given population-wide physical activity levels among children aged 9–12 years,²⁵ to have an 83% probability of detecting a 9% increase (12 minutes) in mean average daily physical activity in the intervention group, the current authors anticipated that 21 children in each group would be required.

Intervention

The intervention consisted of two components: (1) *Power Up* classes that educated children and caregivers about healthy behaviors surrounding nutrition, activity, and stress management; and (2) culturally sensitive coaching to empower families to incorporate learned behaviors and address both family and social barriers to lifestyle changes. Classes were conducted in five consecutive weekly sessions, with a sixth 3 months later. Coaching began concurrently with the group classes and continued for a total of 6 months; meetings were in-person at the health center, at the families' home, or by phone. Ideal contact occurred monthly, although frequency and modality varied according to family preference. Classes occurred at the health center but outside of the pediatric practice in order to avoid pre-exposure for the waitlist control group.

Power-Up—Families attended interactive classes aimed at education and support in choosing healthy behaviors with the goal of reducing childhood obesity. Power-Up is a 1.5-hour interactive curriculum for overweight/obese children and their caregivers offered at an urban community health center during early evening hours. It is based on the 2007 American Association of Pediatricians (AAP) Obesity Guidelines¹⁶ and the 2008 DHHS Physical Activity Guidelines for Children and Adolescents.^{26,27}

Children and their caregivers were grouped separately, and participated in interactive games and activities (i.e., nutrition jeopardy, in-door jump-rope, and food pyramid bingo) that model behavior. Classes were led by a team of a health educator, physical therapist,

nutritionist, and primary care pediatrician. Topics included portion control, healthy snacking, the dangers of liquid calories, label reading, goal setting, TV viewing, making changes as a family, the relationship between stress and overeating, stress reduction, and fitting physical activity into daily life. Classes allowed for open discussion between the leader and the participants, who were encouraged to offer suggestions to the group.

Sessions ended with a physical activity component, which included instruction in the importance of warming-up, stretching, and maintaining adequate hydration during exercise. Lessons were reinforced at home via the use of journals, assignments, and give-away items to promote physical activity at home (i.e., balls for children and pedometers for caregivers). At a reunion session 3 months later, participants reviewed prior topics, and discussed their progress with lifestyle changes and self-image.

Health coaching—Coaching was modeled on a successful Latino adult diabetes program (ESFT Model)²⁸ and tailored to include the child and family, focusing on opportunities and solutions to behaviors affecting weight. ESFT emphasizes cultural sensitivity and relationship building to reveal patients' 'E'xplanatory model, 'S'ocial barriers, 'F'ears and understanding of 'T'reatment.²⁸ The coach supported families to overcome barriers, and provided accountability for family goal setting and progress toward these goals. The coach also empowered families to access community resources for healthy food choices and physical activity.

All families met with the coach in-person at least once, followed by periodic in-person or phone meetings during the 6 months after enrollment. Home visits were offered and families were encouraged to have contact with the coach at least monthly; however, each family's preferences and needs dictated the setting and timing of meetings. Family cases were documented in field notes, which were inductively coded to cite barriers to achieving lifestyle changes or participation.

Data Collection

Data were collected between July 2010 and November 2011 and analyzed in 2012.

Self-reported measures—Health-related quality of life (HRQoL) was assessed using the PedsQL™ child self-report and caregiver-proxy report generic core scales.^{29,30} The PedsQL™ provides information on the physical, emotional, social, and school-related aspects of HRQoL using a 5-point rating scale and asking about the previous month period. Scales range from 0 to 100, with higher scores indicating better HRQoL.³¹ Psychometric alphas of 0.92 and 0.90 for measuring HRQoL among healthy populations and children with chronic conditions are reported.^{29,32} The PedsQL™ has been validated among Spanish- and English-speaking Hispanic groups.³³

Nutrition knowledge and intake were assessed by the School Physical Activity and Nutrition (SPAN) questionnaire, a validated survey that assesses dietary and physical activity behavior, attitudes, and knowledge.^{34–38} SPAN includes 24-hour recall questions, with responses ranging from 0 to 3, and tests nutrition knowledge and attitudes. Agreement for food intake questions is reported at 70% to 98%, with κ statistics ranging from 0.54 to 0.93

and correlations between 0.66 and 0.97.³⁵ The initial validation population included 41% Hispanics. This questionnaire was piloted and collected only on a subset of participants ($n=19$, 46%).

Body composition and metabolic measures—Anthropomorphic data were collected by trained Harvard Catalyst Clinical Translational Science Center (CTSC) research dietitians. The data included height and weight measured in duplicate with a stadiometer and electronic scale, used to calculate each participant's BMI using age- and gender-specific CDC growth curves, then transformed to BMI-Z scores using SAS for CDC Growth Charts (www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm).

Metabolic markers—Lipids, glucose, insulin, HbA1C, AST/ALT, C-reactive protein, IL-6, and TNF- α and other markers were collected by venipuncture by CTSC nurses using standard protocols. Samples were processed by CTSC laboratories using published industry assays. IL-6 and Insulin were analyzed by Access Chemluminescent Immunoassay kit (Beckman Coulter). TNF- α was analyzed with Enzyme-linked Immunosorbent Assay kit (R & D Systems Inc). Lipids and glucose were analyzed by enzymatic testing with CHOD-PAP and quant Glucose/HK kits (Roche) respectively. HbA1C was done using the Tina-quant HbA1C Gen.2 kit (Roche). C-reactive protein was tested using the Cobas Integra Cardiac C-Reactive Protein (Latex) High sensitivity kit (Roche).

Physical activity measure—Physical activity data were collected over 5 weekdays and 2 weekend days using GT1M ActiGraph accelerometers, worn around the hip, a validated tool for assessing objective physical activity in children.³⁹ Acceleration in the vertical field was used to calculate physical activity counts at 30-second intervals. Data were then reintegrated into 1-minute time periods for analyses.

A valid day was defined as 8 hours of accelerometer wear with a minimum of 10% nonzero epochs per hour to be a valid hour; participants who had at least 1 valid day at both baseline and follow-up visits were included in analyses. Although 4 or more valid days is commonly used to estimate children's physical activity,⁴⁰ applying this standard would have decreased this pilot study's sample of subjects providing physical activity data by over 83% and would not have allowed for physical activity assessment. Valid accelerometer data were available for participants on at least 1 (94.4%); 2 (88.8%); 3 (77.7%); or 4 (72.2%) days at Visit 1, and at least 1 (88.8%); 2 (85.2%); 3 (80.5%); or 4 (70.5%) days at Visit 2.

Data Processing

Physical activity measure—Accelerometer data were downloaded to a computer using ActiLife software from which each child's total daily minutes of moderate-to-vigorous physical activity (MVPA) were calculated using age-appropriate counts-per-minute cutpoints.⁴¹ For all valid data, each participant's total daily minutes of MVPA and number of valid days were exported to Microsoft Excel where total minutes in moderate and vigorous activity were summed and divided by the number of valid days of accelerometer wear to obtain each participant's mean daily MVPA minutes.

Data Analysis

A difference-in-difference analysis was used, which measures the change in each outcome within the group of intervention children and also accounts for any trend not attributable to the intervention by controlling for the measured change in the control group. PedsQL™ items were reverse-scored and linearly transformed to a 0–100 scale and the total score, psychosocial health summary score, and physical health summary score were calculated per survey specifications.³¹ Matched case differences in the change in the PedsQL™ scores, metabolic biomarkers, and BMI z-scores were calculated.

Mixed-effects linear models were used to measure differences in each of the outcome variables. Backward selection of seven control variables was used; variable were chosen based on prior research, including child's age and gender; caregiver BMI; caregiver education; primary language spoken at home (English vs non-English); and average daily temperature. Model variables were chosen based on fit statistics at a $p < 0.10$ significance level due to the small sample size, except average temperature, which was forced into the model for physical activity outcome. Correlation analysis was done to ensure that control variables were not highly correlated with one another. Analysis was done using SAS 9.2.

Results

A total of 41 participants were enrolled, 18 of whom were in the control group. All 23 intervention participants took part in group classes. Attendance rate to each group class was 79%. Nine percent (2/23) dropped out of coaching and 26% (6/23) missed one mutually scheduled coaching appointment. Reasons given for inability to continue classes and coaching were work schedules, other extracurricular activities, transportation, and childcare (although siblings were allowed to participate). Fifteen participants (37%) did not return for Visit 2, either because they were lost to follow-up or withdrew from the study. A total of 67% (12/18) control and 61% (14/23) intervention participants took part in first and second visits (Figure 1).

The final sample included 26 (63%) participants (14 intervention, 12 control). Sensitivity analysis comparing the children's gender, primary language spoken in the home, and caregiver BMI, education, and chronic condition between dyads with incomplete and complete data suggests that those who did not complete both data collections were more likely to have a caregiver with a chronic condition compared to those who completed data collection ($p = 0.08$). Children's age, gender, and BMI z-score, and caregiver education were not different between groups at baseline (Table 1).

A majority of control and intervention group participants did not speak English as their primary language at home. The average reported maternal BMI was higher for the control group than the intervention group (32.4 vs 26.7, $p = 0.06$). No differences were observed between groups in accelerometer wear times or counts at baseline or follow-up. However, average valid days among control and intervention participants at Visit 1 were 12.4 and 13.0 hours/day ($p = 0.68$), respectively, and 10.1 and 11.8 hours/day ($p = 0.09$) at Visit 2. Mean total daily accelerometer counts among control and intervention participants at Visit 1 were

1,039,551 and 1,327,725 ($p=0.46$), respectively, and 1,137,541 and 1,088,754 ($p=0.90$) at Visit 2.

During coaching sessions, caregivers most often cited a lack of knowledge about healthy eating as a barrier to addressing their child's weight. This was followed by lack of ability to be physically active. Cited barriers to physical activity were: inability to find places where the family could exercise together, the cost of programs, transportation, competing non-active extracurricular activities, and safety concerns. Safety concerns included physical safety and the potential of meeting others who would encourage risky behaviors in their children. Lack of resources to buy groceries was cited by 26% (6) of families in coaching sessions. Other barriers cited included the inability to control school meals, discordance between caregivers about a child's weight leading to decreased family support, and tensions due to pre-adolescents' emerging independence.

Self-Reported Measures

Health-related quality-of-life measures—There was an overall improvement in the total scale for the control and intervention groups for caregiver-proxy and child reports (Figure 2). The physical health and psychosocial health subdomains also improved for all participants, with the exception of the control group's child self-report on the psychosocial health subdomain (−2.6 points). In the final models, caregiver scores were controlled for maternal BMI and caregiver education, and child scores were controlled for primary household language and child's gender. There was no significant improvement in PedsQL™ scores in the intervention group (+5.6) or the control group (+0.4; $p=0.48$).

Nutrition knowledge—Pilot nutritional survey data showed a gap between nutrition knowledge and actual nutrition based on a 24-hour food recall. Knowledge on suggested servings averaged 2.6 for both fruits and vegetables (compared to the correct answer of 5); 29.4% of children reported not knowing the answer. Twenty-four-hour recall of servings of fruit was 1.25, and 0.70 for vegetables. Many children reported eating meals at school always or often (88.2% for lunches and 33.3% for breakfast). Most children (82.4%) reported having a negative perception of school lunches (almost never or never healthy vs always/almost always/sometimes).

Body Composition and Metabolic Measures

Anthropomorphic measures—BMI z -scores did not change significantly for the control group (−0.05) or the intervention group (−0.03). After controlling for caregiver education and maternal BMI, the difference in the change in BMI z -scores between the control and intervention group was not significantly different ($p=0.31$; Table 2).

Metabolic biomarkers—Over the 6-month period there was no difference in changes between the control and intervention groups. While not reaching a priori-designated significance levels, the lipid panel showed an average decrease in cholesterol for the intervention group (−8.4mg/dL) compared to an increase in cholesterol for the control group (0.9 mg/dL) in final models adjusting for household language ($p=0.08$). Participant non-

fasting and laboratory processing problems contributed to variations in the sample size for each test (Table 2).

Physical activity—Complete data for the first and second visits were available for four control and 12 intervention participants. The most common reason for an incomplete data pair was loss of the accelerometer device. The average daily MVPA was higher for the intervention group (27.9 minutes) than for the control group (16.8 minutes) at baseline ($p=0.03$). On average, control group participants had a 1.6-minute (SD 3.2) decrease in daily MVPA compared to a 7.2-minute (SD 19.5) decrease among intervention group participants ($p=0.62$), corresponding to a 4.8% decrease and 0.3% increase in daily MVPA, respectively. After controlling for age, gender, primary household language, and change in average temperature, difference-in-difference analysis showed no difference in MPVA between the two groups ($p=0.88$; Table 2).

Discussion

Obesity is a multifactorial condition that is influenced by social environments, social networks, and individual decisions that are affected by context. Addressing the childhood obesity epidemic requires interventions at each level of influence, from national policy to individual choice. This pilot project begins to evaluate the feasibility and benefits of treating obesity through a family-centered lifestyle approach delivered in a primary care setting. Family-centered approaches to improving food and physical activity behaviors are increasingly recognized as central components to combating obesity, such as the First Lady's recently launched Let's Move (www.letsmove.gov/) initiative.

In a low-income community, Latino families with obese children are willing to participate in early evening sessions that allow for siblings to participate. They are also willing to work with a health coach. Social factors such as work hours, extracurricular activities, transportation, and childcare hindered participation. Many caregivers cited factors that were out of their control as challenges to adopting healthy behaviors. These included the inability to find family encompassing physical activities and to control what their child chooses to eat, emerging independence, and social stressors such as family discord, financial stress, and time pressures. However, due to lack of statistical power and families missing return visits needed solely for data collection, it was not possible to show that combining child and caregiver interactive education with health coaching may provide benefits over routine medical care.

The low quality-of-life scores observed among all participants suggest that obesity has a substantial impact on Latino children's quality of life. Latino children and their caregiver proxies reported PedsQL™ scores that are below ranges of children with cancer⁴² or diabetes⁴³ and even lower than scores previously reported among obese children in general.^{44,45} Possible explanations include direct health consequences such as joint pain and asthma, and impacts of obesity such as bullying, self-esteem, or body image. However, given that this study was conducted in a low-income urban community, the influences that financial stress, racism and bias have on this population cannot be discounted. Although changes in HRQoL scores over a 6-month period among the intervention group appeared

larger than in the control group, there was no significant difference between the two groups' changes.

Overall, the study found no differences among those receiving educational classes and coaching compared to controls. No differences in changes in BMI or metabolic markers were found between intervention and control group. No differences were noted in physical activity levels between the groups, with activity declining among both groups. These findings may be due to families requiring a more-intensive intervention that includes scheduled coaching and/or changes to the environmental context. The lack of significant findings may also be due to the small sample size.

The current findings suggest that improving school meal programs may offer a key potential community intervention. Over 80% of children in the pilot reported receiving meals at school consistent with state data.⁴⁶ Although school meals followed U.S. Department of Agriculture (USDA) regulations,⁴⁷ more than two thirds of children reported that their school meals were unhealthy. This points to the wide range of possible food options, some healthy, other less so, that qualify for school meal programs under USDA regulations.

Newly issued regulations will begin to go into effect to improve dietary balance in 2013–2014.⁴⁸ Nationally, in fiscal year 2010, more than 31.7 million and more than 11.6 million children participated each day in the National School Lunch⁴⁷ and National School Breakfast Programs,⁴⁹ respectively. Given the reach of school meal programs, community initiatives that aim to ensure implementation of regulations and maximize the nutritional quality of foods served in school could succeed both as population-level prevention intervention and population-level therapeutic intervention for obese children.

Limitations

The scope of the current results is limited due to power and generalizability. The sample size was small and fairly homogenous as it was drawn exclusively from a low-income, predominantly Latino community. Thus, findings are limited to populations that share these characteristics. However, this is a population that has traditionally not participated in research studies^{50,51}; thus, the current study provides needed insight into how to involve Latinos in research.

Although participants were randomized, due to the waitlist study design, neither participants nor study team members were blinded to group allocation. This may have resulted in bias, although the null effects suggest otherwise. In addition, numerous measures in the evaluation protocol were not subject to self-report bias (e.g., biomarkers and other measured data). Analysis was hindered by loss to follow-up among participants, thereby decreasing statistical power. Future initiatives working with similar communities must focus attention on explaining randomized trials, keeping participants engaged throughout the study, and tying data collection to visits that have additional value to participants.

One alternative strategy for engaging community members, which may be particularly important in studies involving under-represented populations, is community-based participatory research.⁵² In community-based participatory research, participants are

engaged members along every stage of the project, from problem and resource identification, to study design, to recruitment and data collection, and ultimately to dissemination of the findings.⁵³ Although the current study worked to engage the community, and the health coach incorporated and adjusted her specific recommendations to accommodate community aspects, it did not utilize the rigor of the community-based participatory research model, which may be successful in minimizing loss to follow-up.

Conclusion

Healthy Living Today!, an interactive educational program that models behavior coupled with family coaching to empower families to incorporate learned material into family and child lifestyles, has some promise for augmenting the standard of care for obesity treatment of children. It appeals to Latino's sense of "*familismo*"⁵⁴ and attempts to address individual and family barriers to success in the self-management of obesity. The current study showed that families are willing to participate, but further studies are needed to show that such models will provide clinical benefits over current models.

This study is in line with other obesity interventions showing null to minimal changes in outcomes.⁵⁵ As participants in the current study described the socio-environmental barriers that limit their ability to adopt healthy behaviors, we argue for the need to address childhood obesity at numerous levels, including national, state, and community policies. Public assistance programs provide some relief in families' financial stressors, have the potential to support healthy lifestyle changes, and can even directly intervene in children's eating habits, as in the case of school meals.

Further work is needed to better understand the interplay between socio-environmental factors, family, and individual barriers to treating obesity. One promising strategy emerging through the CDC's Healthy Communities Programs and the U.S. YMCA is a focus on improving the built environment, especially in low-income communities, as a means to boost physical activity among families.⁵⁶ Caregivers in this study articulated a need for community settings where caregivers and children could exercise together. At the same time, they cited safety concerns as a barrier to physical activity. Community-level interventions that engage municipal community development officials in an effort to renovate and build public park spaces that are well-utilized, well-lit, and appealing to family members across a wide age span may be especially important for Latino populations.^{57–60}

As local communities seek to address the rising obesity prevalence by identifying the socio-environmental factors that influence youth weight gain in the community, accompanying local, state and federal policies must be in place to improve and monitor the quality of foods served in schools, and provide adequate, public physical activity spaces, regardless of neighborhood demographics. Throughout, organized medicine must likewise find models that effectively and compassionately address each individual's experience of obesity.

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References

1. Wang YC, Gortmaker SL, Sobol AM, Kuntz KM. Estimating the energy gap among U.S. children: a counterfactual approach. *Pediatrics*. 2006; 118(6):e1721–33. [PubMed: 17142497]
2. Diaz VA, Mainous AG 3rd, Pope C. Cultural conflicts in the weight loss experience of overweight Latinos. *Int J Obes (Lond)*. 2007; 31(2):328–333. [PubMed: 16718284]
3. *JAMA*. 2007; 297(24):2755–2759. [PubMed: 17595277]
4. DHHS. Division of nutrition, physical activity, and obesity. www.cdc.gov/nccdphp/dnpa/
5. Flores G, Tomany-Korman SC. Racial and ethnic disparities in medical and dental health, access to care, and use of services in U.S. children. *Pediatrics*. 2008; 121(2):e286–98. [PubMed: 18195000]
6. Pan L, Galuska DA, Sherry B, Hunter AS, Rutledge GE, Dietz WH. Differences in prevalence of obesity among Black, White, and Hispanic adults—U.S., 2006–2008. *Morb Mortal Wkly Rep*. 2009; 58(27):740–744.
7. Massachusetts Department of Public Health, Bureau of Community Health Access and Promotion. www.mass.gov/Eeohhs2/docs/dph/com_health/school/status_childhood_obesity.pdf
8. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among U.S. adults, 1999–2010. *JAMA*. 2012; 307(5):491–497. [PubMed: 22253363]
9. Crespo CJ, Smit E, Carter-Pokras O, Andersen R. Acculturation and leisure-time physical inactivity in Mexican American adults: results from NHANES III, 1988–1994. *Am J Public Health*. 2001; 91(8):1254–1257. [PubMed: 11499114]
10. Snethen JA, Hewitt JB, Petering DH. Addressing childhood overweight: strategies learned from one Latino community. *J Transcult Nurs*. 2007 Oct; 18(4):366–372. [PubMed: 17911577]
11. King AC, Castro C, Wilcox S, Eyler AA, Sallis JF, Brownson RC. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. *Health Psychol*. 2000 Jul; 19(4):354–364. [PubMed: 10907654]
12. Kaufman L, Karpati A. Understanding the sociocultural roots of childhood obesity: food practices among Latino families of Bushwick, Brooklyn. *Soc Sci Med*. 2007; 64(11):2177–2188. [PubMed: 17383060]
13. Giammattei J, Blix G, Marshak HH, Wollitzer AO, Pettitt DJ. Television watching and soft drink consumption: associations with obesity in 11- to 13-year-old schoolchildren. *Arch Pediatr Adolesc Med*. 2003; 157(9):882–886. [PubMed: 12963593]
14. Diaz VA, Mainous AG 3rd, Koopman RJ, Geesey ME. Are ethnic differences in insulin sensitivity explained by variation in carbohydrate intake? *Diabetologia*. 2005; 48(7):1264–1268. [PubMed: 15864537]
15. Luttikhuis HO, Baur L, Jansen H, et al. Interventions for treating obesity in children. *Cochrane Database of Systematic Reviews*. 2009; (1)
16. Barlow SE. Expert Committee Recommendations Regarding the Prevention, Assessment, and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. *Pediatrics*. 2007; 120:164–192.
17. Goran MI, Gower BA. Longitudinal study on pubertal insulin resistance. *Diabetes*. 2001; 50(11):2444–2450. [PubMed: 11679420]

18. Golley RK, Magarey AM, Baur LA, Steinbeck KS, Daniels LA. Twelve-month effectiveness of a parent-led, family-focused weight-management program for prepubertal children: a randomized, controlled trial. *Pediatrics*. 2007; 119(3):517–525. [PubMed: 17332205]
19. Golan M, Fainaru M, Weizman A. Role of behaviour modification in the treatment of childhood obesity with the parents as the exclusive agents of change. *Int J Obes Relat Metab Disord*. 1998; 22(12):1217–1224. [PubMed: 9877257]
20. Janicke DM, Sallinen BJ, Perri MG, et al. Comparison of parent-only vs family-based interventions for overweight children in underserved rural settings: outcomes from project STORY. *Arch Pediatr Adolesc Med*. 2008; 162(12):1119–1125. [PubMed: 19047538]
21. Garipagaoglu M, Sahip Y, Darendeliler F, Akdikmen O, Kopuz S, Sut N. Family-based group treatment versus individual treatment in the management of childhood obesity: randomized, prospective clinical trial. *Eur J Pediatr*. 2008 Dec 16.
22. Wen LM, Baur LA, Rissel C, Wardle K, Alperstein G, Simpson JM. Early intervention of multiple home visits to prevent childhood obesity in a disadvantaged population: a home-based randomised controlled trial (Healthy Beginnings Trial). *BMC Public Health*. 2007 May 10;7:76. [PubMed: 17490492]
23. Campbell K, Hesketh K, Crawford D, Salmon J, Ball K, McCallum Z. The Infant Feeding Activity and Nutrition Trial (INFANT) an early intervention to prevent childhood obesity: cluster-randomised controlled trial. *BMC Public Health*. 2008; 8:103. [PubMed: 18373877]
24. Marín, GTH. Allocentrism as an important characteristic of Latin-Americans and Hispanics. In: Diaz-Guerrero, R., editor. *Cross-Cultural and National Studies in Social Psychology*. Amsterdam: Elsevier Science Publications; 1985.
25. Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M. Moderate-to-vigorous physical activity from ages 9 to 15 years. *JAMA*. 2008 Jul 16; 300(3):295–305. [PubMed: 18632544]
26. DHHS. www.health.gov/PAGuidelines/pdf/paguide.pdf
27. DHHS. web.health.gov/paguidelines/guidelines/Chapter3.aspx
28. Betancourt JR, Carrillo JE, Green AR. Hypertension in multicultural and minority populations: linking communication to compliance. *Curr Hypertens Rep*. 1999; 1(6):482–488. [PubMed: 10981110]
29. Varni JW, Burwinkle TM, Seid M, Skarr D. The PedsQL 4.0 as a pediatric population health measure: feasibility, reliability, and validity. *Ambul Pediatr*. 2003; 3(6):329–341. [PubMed: 14616041]
30. Varni, JW. Pediatric quality of life inventory version 4.0. Lyon, France: Mapi Research Institute; 1998.
31. The PedsQL Scoring Algorithm. www.pedsq.org/score.html
32. Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. *Med Care*. 2001; 39(8):800–812. [PubMed: 11468499]
33. Newman DA, Limbers CA, Varni JW. Factorial Invariance of Child Self-Report Across English and Spanish Language Groups in a Hispanic Population Utilizing the PedsQL™ 4.0 Generic Core Scales. *Eur J Psychological Assessment*. 2010; 26(3):194–202.
34. Thiagarajah, K., Bai, Y., Lo, K., et al. Assessing validity of food behaviour questions from the School Physical Activity and Nutrition Questionnaire. Conference proceeding from the 39th Annual Meeting of the Society for Nutrition Education; San Francisco CA. 2006.
35. Hoelscher DM, Day RS, Kelder SH, Ward JL. Reproducibility and validity of the secondary level School-Based Nutrition Monitoring student questionnaire. *J Am Diet Assoc*. 2003; 103(2):186–194. [PubMed: 12589324]
36. Hoelscher DM, Day RS, Lee ES, et al. Measuring the prevalence of overweight in Texas schoolchildren. *Am J Public Health*. 2004; 94(6):1002–1008. [PubMed: 15249306]
37. Penkilo M, George GC, Hoelscher DM. Reproducibility of the School-Based Nutrition Monitoring Questionnaire among fourth-grade students in Texas. *J Nutr Educ Behav*. 2008; 40(1):20–27. [PubMed: 18174100]

38. Thiagarajah K, Fly AD, Hoelscher DM, et al. Validating the food behavior questions from the elementary school SPAN questionnaire. *J Nutr Educ Behav*. 2008; 40(5):305–310. [PubMed: 18725149]
39. Sirard JR, Melanson EL, Li L, Freedson PS. Field evaluation of the Computer Science and Applications, Inc. physical activity monitor. *Med Sci Sports Exerc*. 2000; 32(3):695–700. [PubMed: 10731015]
40. Trost SG, McIver KL, Pate RR. Conducting accelerometer-based activity assessments in field-based research. *Med Sci Sports Exerc*. 2005; 37(11 Suppl):S531–43. [PubMed: 16294116]
41. Evenson KR, Catellier DJ, Gill K, Ondrak KS, McMurray RG. Calibration of two objective measures of physical activity for children. *J Sports Sci*. 2008; 26(14):1557–1565. [PubMed: 18949660]
42. Varni JW, Burwinkle TM, Katz ER, Meeske K, Dickinson P. The PedsQL? in pediatric cancer. *Cancer*. 2002; 94(7):2090–2106. [PubMed: 11932914]
43. Varni JW, Burwinkle TM, Jacobs JR, Gottschalk M, Kaufman F, Jones KL. The PedsQL™ in Type 1 and Type 2 Diabetes. *Diabetes Care*. 2003 Mar 01; 26(3):631–637. [PubMed: 12610013]
44. Williams J, Wake M, Hesketh K, Maher E, Waters E. Health-Related Quality of Life of Overweight and Obese Children. *JAMA*. 2005; 293(1):70–76. [PubMed: 15632338]
45. Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. *JAMA*. 2003; 289(14):1813–1819. [PubMed: 12684360]
46. Massachusetts Department of Environmental and Secondary Education 2011–2012 District Profile. profiles.doe.mass.edu/profiles/student.aspx?orgcode=00570000&orgtypecode=5&leftNavId=305&
47. U.S. Department of Agriculture. Food and Nutrition Service. National School Lunch Program Fact Sheet. www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf
48. USDA. New School Lunch standards. www.fns.usda.gov/cnd/Governance/Legislation/implementation_timeline.pdf. usda.gov/wps/portal/usda/usdahome?contentid=2012/01/0023.xml&navid=NEWS_RELEASE&navtype=RT&parentnav=LATEST_RELEASES&edeployment_action=retrievecontent
49. U.S. Department of Agriculture. Food and Nutrition Service. National School Breakfast Program Fact Sheet. www.fns.usda.gov/cnd/breakfast/AboutBFAST/SBPFactSheet.pdf
50. Kelly ML, Ackerman PD, Ross LF. The participation of minorities in published pediatric research. *J Natl Med Assoc*. 2005; 97(6):777–783. [PubMed: 16035575]
51. Ford JG, Howerton MW, Lai GY, et al. Barriers to recruiting underrepresented populations to cancer clinical trials: a systematic review. *Cancer*. 2008; 112(2):228–242. [PubMed: 18008363]
52. De Las Nueces D, Hacker K, Digirolamo A, Hicks LS. A systematic review of community-based participatory research to enhance clinical trials in racial and ethnic minority groups. *Health Serv Res*. 2012 Feb 21.
53. Israel, B.Eng, E.Schulz, A., Parker, E., editors. *Methods in community-based participatory research for health*. San Francisco: Jossey-Bass; 2005.
54. Perez GKCD. The impact of familism on physical and mental health among Hispanics in the U.S. *Health. Psychology Rev*. 2011:1–33. iFirst article.
55. Thomas H. Obesity prevention programs for children and youth: why are their results so modest? *Health Educ Res*. 2006; 21(6):783–795. [PubMed: 17099075]
56. Increased access to recreational sites/facilities. ymca.net/healthier-communities-guide/active-2.html
57. Lutfiyya MN, Garcia R, Dankwa CM, Young T, Lipsky MS. Overweight and obese prevalence rates in African American and Hispanic children: an analysis of data from the 2003–2004 National Survey of Children's Health. *J Am Board Fam Med*. 2008; 21(3):191–199. [PubMed: 18467530]
58. Osypuk TL, Diez Roux AV, Hadley C, Kandula NR. Are immigrant enclaves healthy places to live? The Multi-ethnic Study of Atherosclerosis. *Soc Sci Med*. 2009; 69(1):110–120. [PubMed: 19427731]
59. Sen, B., Mennemeyer, S., Gary, LC. The relationship between perceptions of neighborhood characteristics and obesity among children. In: Grossman, M., Mocan, N., editors. *Economic Aspects of Obesity*. Chicago IL: University of Chicago Press; 2011. p. 145-180.

60. Burdette HL, Whitaker RC. A national study of neighborhood safety, outdoor play, television viewing, and obesity in preschool children. *Pediatrics*. 2005 Sep; 116(3):657–662. [PubMed: 16140705]

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Figure 1.
Flow diagram of participants through the study

Figure 2.

Summary of PedsQL™ total scores for caregiver and child surveys: intervention and control groups

^a Adjusted for primary household language and child's gender

PedsQL, Pediatric Quality of Life Inventory

Table 1

Summary of demographic characteristics for control and intervention groups, % or M (SD) unless otherwise noted

	Control <i>n</i> =12	Intervention <i>n</i> =14	<i>p</i> -value [*]
Gender			
Male	41.7	35.7	0.22
Female	58.3	64.3	
Age (years)	10.4 (1.2)	10.2 (1.3)	0.69
Child BMI			
Percent BMI	97.8 (3.1)	97.3 (2.1)	
Male, <i>n</i> =10	99.3 (0.5)	97.6 (1.8)	
Female, <i>n</i> =16	96.8 (3.8)	97.2 (2.4)	
Child BMI <i>z</i> -score	2.2 (0.4)	2.0 (0.3)	0.33
Male, <i>n</i> =10	2.5 (0.2)	2.1 (0.3)	0.06
Female, <i>n</i> =16	2.0 (0.4)	2.0 (0.4)	0.91
Primary Household Language			
English	25.0	21.4	0.83
Non-English	75.0	78.6	
Highest Caregiver Education			
Below High School	25.0	50.0	0.19
High School or Higher	75.0	50.0	
Caregiver BMI	32.4 (6.5)	26.7 (1.2)	0.06
Caregiver Chronic Conditions ^a			
Yes	41.7	21.4	0.27
No	58.3	78.6	
Immigrant generation			
1 st	41.7	64.3	0.22
2 nd +	58.3	35.7	

^aIncludes obesity, hypertension, and diabetes mellitus

^{*}Chi-squared analysis or Fisher's Exact test and t-tests were used to test significance

Pre- and post-intervention BMI z-scores* and metabolic markers** with unadjusted and adjusted difference-in-difference models

Table 2

	Control		Intervention		Difference-in-difference	
	<i>n</i>	M (SD)	<i>p</i> -value	<i>n</i>	M (SD)	<i>p</i> -value
BMI z-score						<i>p</i> -value ^a
Pre		2.2 (0.4)			2.0 (0.3)	
Post		2.1 (0.5)			2.0 (0.4)	
Change	10	-0.05 (0.08)	0.13	13	-0.03 (0.14)	0.05
						1.00
LIPIDS						<i>p</i> -value ^b
Cholesterol (mg/dL)						
Pre		150.3 (36.3)			167.9 (30.2)	
Post		151.6 (34.1)			159.4 (23.4)	
Change	12	0.9 (16.9)	0.85	14	-8.4 (19.0)	0.12
						0.10
Triglycerides (mg/dL)						
Pre		91.0 (35.6)			108.6 (35.7)	
Post		89.3 (45.7)			113.0 (45.4)	
Change	8	4.5 (20.4)	0.55	7	4.4 (62.8)	0.86
						1.00
HDL (mg/dL)						
Pre		48.1 (11.4)			47.0 (13.4)	
Post		51.5 (12.7)			47.7 (14.7)	
Change	8	3.8 (5.8)	0.11	7	0.7 (8.4)	0.83
						0.42
VLDL (mg/dL)						
Pre		18.1 (7.1)			21.6 (7.2)	
Post		17.9 (9.0)			22.6 (8.9)	
Change	8	1.0 (3.9)	0.49	7	1.0 (12.4)	0.84
						1.00
						0.96

	Control			Intervention			Difference-in-difference		
	<i>n</i>	M (SD)	<i>p</i> -value	<i>n</i>	M (SD)	<i>p</i> -value	Unadjusted	Adjusted	
LDL (mg/dL)									
Pre		85.7 (37.0)			87.3 (28.4)				
Post		89.6 (33.7)			83.3 (23.5)				
Change	8	1.6 (16.1)	0.78	7	-4.0 (8.8)	0.78	0.43	0.44	
LIVER									
AST (Iu/L)									
Pre		25.6 (7.9)			24.1 (5.6)				
Post		20.8 (5.9)			23.1 (7.2)				
Change	11	-3.5 (2.7)	0.01	14	-1.1 (4.6)	0.40	0.06	0.17	
ALT (Iu/L)									
Pre		24.6 (13.7)			24.4 (12.6)				
Post		24.7 (18.7)			23.4 (15.5)				
Change	11	-1.9 (3.6)	0.11	14	-1.1 (11.1)	0.72	0.60	0.49	
GLUCOSE METABOLISM									
Hba1C (%)									
Pre		5.6 (0.3)			5.7 (0.2)				
Post		5.7 (0.3)			5.7 (0.3)				
Change	11	0.1 (0.2)	0.31	12	0.0 (0.2)	0.80	0.42	0.38	
Glucose (mg/dL)									
Pre		83.3 (4.1)			83.7 (17.3)				
Post		85.5 (5.2)			84.2 (5.6)				
Change	8	2.3 (2.7)	0.05	6	1.8 (5.0)	0.41	0.48	0.80	
Insulin (uIU/mL)									

	Control			Intervention			Difference-in-difference		
	<i>n</i>	M (SD)	<i>p</i> -value	<i>n</i>	M (SD)	<i>p</i> -value	Unadjusted	Adjusted	
Pre		11.5 (4.9)			21.8 (17.3)				
Post		13.2 (4.6)			24.2 (17.8)				
Change	4	2.2 (2.3)	0.62	4	2.4 (10.4)	0.32	0.98	0.98	0.98
INFLAMMATION									
C-Reactive Protein (mg/L)									
Pre		3.0 (4.0)			2.1 (1.8)				
Post		4.9 (9.1)			2.5 (2.1)				
Change	12	1.8 (5.2)	0.25	14	0.4 (1.6)	0.42	0.91	0.91	0.90
IL-6 (pg/mL)									
Pre		3.3 (1.9)			2.6 (2.0)				
Post		3.4 (2.5)			2.2 (0.7)				
Change	4	0.4 (2.2)	0.49	6	-0.7 (2.1)	0.27	0.51	0.51	0.55
TNF Alpha (pg/mL)									
Pre		3.1 (3.8)			1.9 (0.8)				
Post		1.3 (0.8)			1.9 (0.8)				
Change	5	-0.9 (0.5)	0.02	10	0.0 (1.1)	0.98	0.05	0.05	0.14

* Adjusted for caregiver education and maternal BMI

** Adjusted for primary household language

ALT, AST, HDL, high-density lipoprotein; LDL, low-density lipoprotein; TNF, VLDL,