Active and Healthy Families: A Randomized Controlled Trial of a Culturally Tailored Obesity Intervention for Latino Children

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Received for publication November 4, 2014; accepted February 9, 2015.

ABSTRACT

OBJECTIVE: There is a critical need for culturally relevant interventions to address obesity among Latino children, who have a greater risk of obesity and diabetes than non-Hispanic white children. To test the impact of a family-centered, culturally tailored obesity intervention delivered through group medical appointments on body mass index (BMI) and other measures of cardiovascular risk among Latino children.

METHODS: In a randomized controlled trial, 55 parent-child dyads were assigned to Active and Healthy Families (AHF) or a usual care wait-list control condition. Dyads were eligible if they spoke Spanish and if the child received care in a federally qualified health center, was aged 5 to 12 years, had a BMI in the 85th percentile or higher, and had not participated in AHF. The 10-week AHF intervention included biweekly group sessions delivered by a registered dietitian, physician, and promotora triad. Sessions covered topics such as parenting, screen time, healthy beverages, physical activity, and stress due to immigration.

RESULTS: Child BMI (kg/m^2) decreased (−0.50) in the AHF group and increased (+0.32) in the control group, yielding an adjusted difference in change of −0.78 (95% confidence interval [CI] −1.28, −0.27). Children assigned to AHF also exhibited relative improvements over controls in BMI *z* score (−0.10; 95% CI −0.19, −0.02) and triglycerides (−26.8 mg/dL; 95% CI −50.1, −3.6), but no significant between-group differences were observed for blood pressure or other fasting blood measures.

CONCLUSIONS: AHF resulted in reductions in child BMI, BMI *z* score, and triglycerides. AHF, which was designed for low-income Latino families, has potential to reduce health disparities, but future studies are needed to determine long-term impact.

KEYWORDS: child; community health center; family; Hispanic American; obesity

ACADEMIC PEDIATRICS 2015;15:386–395

WHAT'S NEW

There is a dearth of randomized trials of primary care approaches to address obesity among Latino children. This 10-week trial of a group appointment intervention is the first culturally tailored program to show significant body mass index improvements among Latino children aged 5 to 12.

OVERWEIGHT AND OBESITY affect one-third of children in the United States,[1] posing one of the most serious public health challenges of our time. Minority[1] and low-income youth[2] bear a disproportionate burden of obesity, further increasing their risk of type 2 diabetes and other serious health conditions.[3] Consequently, developing and evaluating targeted strategies to address obesity in minority and low-income populations has been identified as a national research priority.[4,5]

Latinos represent the largest and fastest growing racial/ethnic minority group in the United States.[6] Thus, addressing the especially high prevalence of obesity among Latino youth[1] is of utmost public health importance. Many Latinos face unique barriers to maintaining good health, such as those related to low wages and limited access to employer-provided health insurance, language, culture, and immigration.[7,8] For instance, only 23% of first-generation Latinos are fluent in English.[9] Also, there appears to be a cultural perception that heavier children are healthier.[10,11] As such, it is imperative to develop and evaluate culturally and linguistically tailored obesity interventions for this population.

Thus far, systematic reviews of childhood obesity interventions support the efficacy of multicomponent,[4] family-based approaches.[12,13] Therefore, this study sought to determine the extent to which a multicomponent, family-centered, and culturally tailored intervention delivered through group medical appointments could

improve body mass index (BMI), as well as other measures of cardiovascular risk, among Latino children aged 5 to 12 years seen in federally qualified health centers (FQHCs). Financial implications of the intervention were also examined.

METHODS

STUDY DESIGN

The 10-week Active and Healthy Families (AHF), or Familias Activas y Saludables, intervention was assessed with a balanced (1:1), unblinded, multisite, parallel-group randomized controlled trial (RCT). AHF was implemented in fall 2012 and spring 2013 in 2 FQHCs in Contra Costa County, California. FQHCs are publicly funded health centers providing comprehensive services to underserved populations. Stratified by FQHC, parent-child dyads were randomized to AHF or a usual-care wait-list control condition using computer-generated randomization lists. AHF was offered to controls approximately 1 to 2 months after trial completion. This study was approved by the University of California, Berkeley's Committee for the Protection of Human Subjects and the Contra Costa Regional Medical Center and Health Centers Investigational Review Committee. ClinicalTrials.gov, www.clinicaltrials.gov, NCT02044705.

PARTICIPANTS AND RECRUITMENT

Primary care physicians in 2 FQHCs referred Latino families with overweight or obese children to AHF. Promotoras—lay health workers from the families' community—called families to assess interest in AHF and prescreen for study eligibility. Eligible families spoke Spanish and had a child aged 5 to 12 years, with a BMI in the 85th percentile or higher for age and sex,[14] and with no previous participation in an AHF pilot series. A trained research assistant met with interested families to conduct eligibility screenings, obtain informed consent/assent, and take baseline measures. Participants were informed of intervention allocation by phone. The planned sample size of 60 provided 80% power to detect a difference in BMI change between groups of 0.5 kg/m^2. Five of the 60 participants who attended the baseline screening appointment were deemed ineligible. Therefore, 55 participants were randomized (Figure).

INTERVENTION

The culturally tailored AHF intervention consisted of five 2-hour group medical appointments every other week for 10 weeks in the families' medical home. These sessions occurred on weekdays from 3 to 5 PM or 4 to 6 PM, depending on FQHC. Sessions were delivered by a provider triad: a registered dietitian, who coordinated and taught the curriculum; a physician, who taught the curriculum and provided leadership, medical expertise, and credibility; and a promotora, who engaged families and facilitated understanding of content. The promotoras and dietitian were bilingual, native Spanish speakers. In one clinic, the physician was fluent in Spanish, and in the other, the physician spoke basic Spanish. Between sessions, promotoras called families twice to check on progress, answer questions, and remind families about the next session.

AHF's content was based on evidence-based practice guidelines from the Expert Committee Recommendations on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity[15] and from the American Academy of Pediatrics.[16] Content also focused on obesogenic behaviors for which disparities exist between Latino and non-Hispanic white children, including screen time[17] and consumption of sugar-sweetened beverages.[18] AHF was designed to be family-centered with a focus on parenting (due to the efficacy of family-based obesity interventions),[19] the importance of familism in Latino culture across country of origin,[20] and evidence that parenting style is associated with child eating patterns and obesity among Latinos.[21,22] Having evolved from a shorter program that was not culturally specific, AHF was additionally tailored in several ways: a promotora was added; sessions focused on foods and beverages commonly consumed by the target population (eg, pan dulce, tortillas, Sunny Delight); families received a culturally appropriate recipe book and in-session snacks; AHF targeted cultural perceptions and practices, (eg, viewing overweight children as healthy, reluctance denying children additional helpings, and using food as a reward); and a module on immigration was added. Tailoring was informed by interviews with Latino parents of children in local elementary schools, field visits to local food markets, and focus groups with parents participating in AHF pilot series.

Before each AHF session, a medical assistant measured children's vitals. Each session included one-on-one meetings with the physician, who assessed obesity-related problems and checked on progress meeting behavioral goals.

AHF group sessions (Table 1) covered the following topics: definition and consequences of obesity, sugar-sweetened beverages, parenting, nutrition labels, healthier snacks and fast food, portion size, meal planning, screen time, physical activity, emotional eating, and stress and immigration. The curriculum included interactive activities, such as role playing how to set screen time limits and a physical activity game for children incorporating identification of healthy and unhealthy foods. Open discussions were encouraged. Parents and children participated together, except for advanced or sensitive topics (eg, immigration, parenting and family dynamics, and child's weight status), during which children partook in physical activity. Families received take-home items, such as a pedometer, water pitcher, and appropriately sized cereal bowl. During the last session, children received a physical activity item of their choice (eg, soccer ball). For a family missing a session, the dietitian conducted a brief review before the next session, and the family still received the missed session's handouts and giveaways.

AHF was informed in part by the Transtheoretical Model and addressed processes of change. For instance, stimulus control techniques included advising parents to turn off TV during meals and use the provided water pitcher and cereal bowl to encourage water consumption and healthy

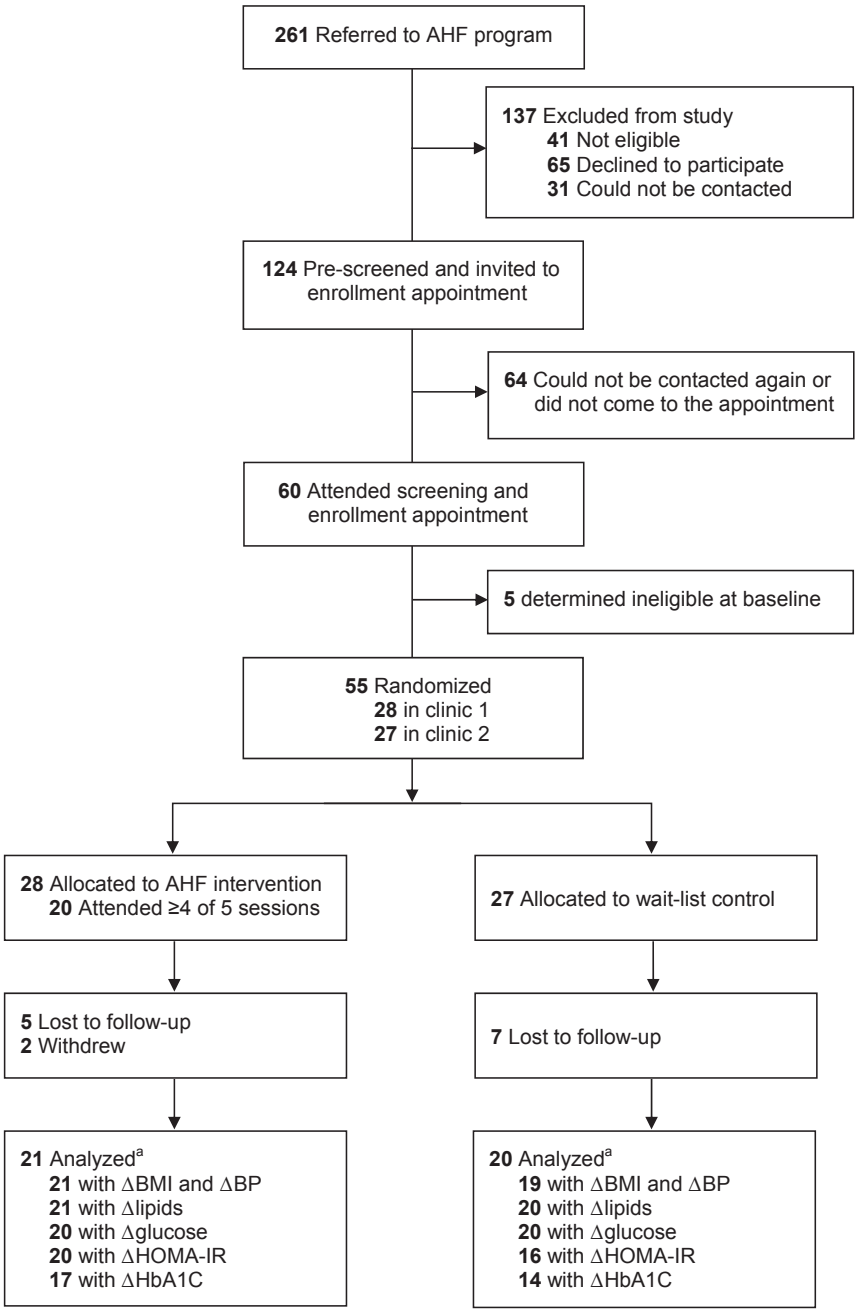

Figure. *Participant flow for the Active and Healthy Families study.* [a] *Those excluded from analyses were not included due to missing outcome data. Δ indicates change; BMI, body mass index; BP, blood pressure; HbA1C, hemoglobin A1C; and HOMA-IR, homeostatic model assessment estimate of insulin resistance.*

portions. To improve parents' self-efficacy to set limits, providers modeled limit-setting scenarios. Additionally, AHF included personalized goal-setting, by having families develop realistic action plans, and self-monitoring, by having families record daily step counts—both of which were reviewed each session.

During the final session, families received certificates of completion and celebrated their successes. Table 2 displays a sample lesson plan. A detailed description of AHF and its training materials are located on Contra Costa Health Services' website (http://cchealth.org/ahf/). Session sizes ranged from 6 to 10 families.

OUTCOMES

The primary outcome was change in child BMI. BMI is recommended over BMI z score for examining change in adiposity over time.[23,24] To calculate risk difference and number needed to treat, a decrease or stabilization in BMI was considered a clinically meaningful outcome. Secondary outcomes included changes in BMI z score, blood pressure and fasting lipids, blood glucose, insulin, homeostasis model assessment-estimated insulin resistance (HOMA-IR, ie, [fasting insulin $\times$ fasting glucose] /22.5), and hemoglobin A1c (HbA1c). Change in parent weight was also examined.

Table 1. Overview of Active and Healthy Families Program Sessions

Session Name	Objectives	Sample Take-Home Materials*	Sample Activities
Session 1: Living Healthy … The Way to Go	• Understand that child's weight falls in unhealthy category • Identify healthy beverages	• Pedometer • Water pitcher • Handouts on limiting juice, choosing water and low-fat/ nonfat milk	• Discussion of health effects of overweight/obesity • Demonstration of teaspoons of sugar in sweetened drinks
Session 2: Setting Limits & Being a Role Model	• Examine personal and cultural style of discipline and consequences on child diet • Recognize responsibility to be a role model and set limits	• Cereal bowl • Handouts on buying whole-grain and low-sugar cereals and limiting TV	• Role-playing and modeling of buying cereal at the store and limiting TV
Session 3: Eating Smart	• Understand nutrition facts labels • Identify healthy food and drinks, appropriate portion sizes, and components of a healthy meal	• Recipe book • Handouts on meal planning and healthier fast food	• Go, slow, and whoa foods physical activity game for children • Discussion on portion sizes • Healthy snack demonstration
Session 4: Immigration, Stress, Obesity, and Exercise	• Recognize impact of stress due to immigration • Distinguish emotional eating from physical hunger • Understand importance of exercise	• Handouts on self-esteem and overweight	• Physical activity stations for children • Parent discussion of immigration • Lecture on assessing hunger
Session 5: Review	• Review previous objectives	• Physical activity item of child's choice (eg, sports ball, hula hoop) • Child growth records	• Sharing obstacles and successes • Reviewing past sessions

*Written handouts were targeted to 3rd- to 5th-grade reading levels.

Baseline and follow-up measurements occurred approximately 10 weeks apart. Child and parent height and weight and child blood pressure were taken by the same trained research assistant. Height was measured without shoes or obstructive hairstyles to the nearest 0.1 cm in the standing position specified in NHANES[25] using the 420 Measure-All Portable Measuring Board (KWS Medical Supplies, North Bend, Wash). Height was measured up to 3 times if the first 2 measures did not agree within 0.5 cm. Weight without shoes or outer clothing after emptying pockets was measured to the nearest 0.1 kg using the Tanita BWB 800 digital scale (Tanita Corporation of America, Arlington Heights, Ill). Blood pressure was measured using the Welch Allyn Spot vital monitor (Welch Allyn Inc, Skaneateles Falls, NY). Eight-hour fasting blood was collected by venipuncture.

Projected net income was calculated on the basis of 2014 revenues and costs for a 10-family AHF series in Contra Costa FQHCs. A mean attendance of 3.5 sessions, observed in this study, was assumed. Revenue comprised Medi-Cal/Medicaid physician reimbursements for physician visits. Costs comprised the sum of salaries, benefits, overhead, and program supplies, determined by administrative data. Table 3 details staff time used to determine staffing costs.

Statistical Analysis

Two-sample t-tests and linear regression models adjusting for clinic were used to assess differences at baseline between intervention and control groups and between those with and without follow-up data.

To evaluate the intervention's impact on child outcomes, multivariate linear regression models adjusting for clinic, age, sex, and baseline outcome values were used to compare pre and post changes between intervention groups. Fixed effects regression was implemented to account for clinic because randomization was stratified by clinic, and participants within the same clinic may have correlated outcomes. This method is appropriate for multicenter trials[26] and recommended when the number of centers is very small.[27] Outcomes were modeled using change scores. Using an intention-to-treat approach, all participants with outcome data were included in analyses, regardless of attendance.

To determine if results varied by clinic, we added to the model a cross-product of indicators for clinic and intervention allocation. Analyses were conducted by Stata IC 11 (Stata Corp, College Station, Tex).

Results

The Figure displays participant recruitment, enrollment, and flow. At baseline, there were no significant differences in BMI z score, blood pressure, fasting lipids, glucose, insulin, or HOMA-IR between AHF and control groups. Among the 28 families randomized to AHF, the mean number of sessions attended was 3.5 $\pm$ 2.0 (range, 0–5), and 71% attended $\geq$4 sessions. Data were not available at follow-up from 7 participants in both the AHF and control groups (75% retention rate). Among those with follow-up data, glucose, insulin, and/or HbA1C were not available for 4 intervention and 5 control children (Figure). There were no significant or clinically meaningful differences at baseline between those with and without follow-up data.

Table 4 presents family characteristics. Children were aged 8.9 $\pm$ 1.8 years, and 87% had a BMI in the 95th

Table 2. Active and Healthy Families Program Sample Lesson Plan: Session 2 Outline

Session Component	Component Details	Lead Triad Member(s)	Participant
Registration	• Medical assistant measures child blood pressure, height, and weight and collects pedometer tracking forms	Medical assistant	Child and parent
	• Physician meets one-on-one with each family	Physician	Child and parent
Welcome	• Discussion about who sets the rules at home	Promotora	Child and parent
	• Sharing action plan successes and challenges and reviewing number of steps reported on pedometer tracking forms	Physician	Child and parent
Role-play activity	• Parent and child role-play buying healthier cereals • Group feedback and modeling by triad members • Nutritionist teaches families about choosing healthy cereals, portion control, and using the right-size bowl	Nutritionist and physician	Child and parent
	• Parent and child role play negotiating screen time limits • Group feedback and modeling by triad members • Physician reviews AAP recommendations for screen time and importance of physical activity	Promotora and physician	Child and parent
Physical activity	• Outdoor play	Physician and medical assistant	Child
Discussion with parents	• Discussion on setting limits at home and ways of initiating changes at home • Group shares successes and challenges of initiating changes	Nutritionist and promotora	Parent
Snacks	• Healthy snacks (eg, fruit) are provided	All	
Action plans	• Families review and develop action plan for the next 2 weeks	Physician	Child and parent
Giveaways	• Appropriate-size cereal bowls are distributed to families	Nutritionist and promotora	Child and parent

AAP indicates American Academy of Pediatrics.

percentile or higher. Eighty-six percent of children were of Mexican ancestry. The majority of participating parents were female (94%), first generation in the United States (67%), overweight or obese (88% had a BMI $\geq$ 25 kg/m^2), and had less than a high school education (73%).

Outcomes are reported in Table 5. At 10 weeks, child BMI (kg/m^2) decreased (−0.50) in the AHF group and increased (+0.32) in the control group, yielding an adjusted difference in change of −0.78 (95% confidence interval [CI] −1.28, −0.27; P = .004). This difference was marginally attenuated compared to results not adjusted for age, sex, and baseline BMI: 0.80 (−1.27, −0.33; P = .002). The AHF group essentially maintained their weight (+0.08 kg), while those in the control group gained weight (+1.4 kg), resulting in an adjusted difference in change of −1.34 kg (95% CI −2.41, −0.27; P = .02). Both the AHF and control groups increased in height (+1.57 cm and +1.27 cm, respectively); these changes were not significantly different.

Children assigned to AHF exhibited relative improvements in BMI z score (−0.10; 95% CI −0.19, −0.02; P = .02) and triglycerides (−26.8 mg/dL; 95% CI −50.1, −3.6; P = .03) compared with controls, but no group differences were observed for other fasting blood measures or blood pressure (Table 5). Results did not vary by clinic. Seventeen of 28 intervention and 7 of 27 control children experienced a reduction or stabilization in BMI (ie, ≤0 kg/m^2 change). Thus, in an intention-to-treat analysis in which we assumed those lost to follow-up did not stabilize or reduce BMI, the risk difference was 0.35 (P < .01 in χ^2 analysis), and 3 children would need to be treated for 1 child to experience improvement in BMI change.

Among the 38 parents (19 per group) with weight data, no significant change in parent weight was observed in either the AHF (−0.01 kg; 95% CI −0.8, 0.8; P = .99) or control group (−0.6 kg; 95% CI −2.8, 1.5; P = .56), nor was there a significant difference in change between groups.

Table 6 presents projected costs and income for a 10-family AHF series in 2014. An initial series was estimated to generate $4974 in net income, with subsequent series generating more ($5334) because of not having to pay one-time costs of posters.

DISCUSSION

In this RCT of AHF, a culturally tailored, group medical appointment intervention resulted in clinically meaningful improvements in child BMI, weight, BMI z score, and triglycerides. Group sessions involved both parent and child, were delivered in Spanish by a multidisciplinary team, and were offered in the family's medical home.

This trial makes an important contribution by addressing the US Preventive Services Task Force's call for studies that 1) address weight management in minority children and 2) investigate efficient, primary care–feasible interventions using allied health professionals (eg, dietitians and promotoras).[4] Promotoras were included in the provider triad to help families overcome barriers pertaining to language and acculturation that hinder health care access and utilization for many Latinos.[28] As culturally congruent members of the community, AHF promotoras were in a unique position to address these barriers, engage families in behavior change in a culturally relevant manner, and facilitate understanding. AHF's use of promotoras could serve as a model for other clinics as they work to integrate allied health

Table 3. Staff Time Required for the Active and Healthy Families Program

Staff Member	Activity	Hours Per Activity	Hours Per Session	Hours Per Series
Medical assistant	Setup	0.5		
	Session	2.0		
	Make appointments for next session	0.5		
	Total		3.0	15.0
Promotora	Setup	1.0		
	Session	2.0		
	Cleanup	0.5		
	Shopping for and preparation of session snacks	1.0		
	Follow-up calls on action plans and pedometer steps	2.0		
	Reminder call before next session	1.0		
	Total		7.5	37.5
Dietitian	Preparation of session materials	2.5		
	Setup	1.0		
	Session	2.0		
	Cleanup	0.5		
	Updates to BMI charts and calls to high-risk patients on action plans	3.0		
	Review and inventory of materials, updates to curriculum, coordination with team	1.0		
	Total		10.0	50.0
Physician	Review of medical records before session	1.0		
	Preparation for session facilitation	1.0		
	Session	2.0		
	Charting after session	1.0		
	Total		5.0	25.0

BMI indicates body mass index.

professionals into obesity prevention and treatment efforts. Additionally, unlike many interventions that are funded by one-time grants, AHF is feasible and financially sustainable for FQHCs due to income from physician reimbursements. For the FQHCs in Contra Costa County, AHF has generated a positive net-income.

Table 4. Baseline Characteristics of Participants Overall and by Intervention Assignment*

Characteristic	All (n = 53)	Intervention (n = 26)	Control (n = 27)
Child			
Female sex	27 (51)	13 (50)	14 (52)
Age, y	8.9 ± 1.8	9.2 ± 1.9	8.7 ± 1.6
Hispanic	53 (100)	26 (100)	27 (100)
Height, cm	136 ± 13	138 ± 13	134 ± 12
Weight, kg	46.5 ± 14.6	49.9 ± 16.9	43.3 ± 11.3
BMI, kg/m^2	24.4 ± 3.9	25.3 ± 4.8	23.6 ± 2.7
BMI *z* score	2.0 ± 0.4	2.0 ± 0.4	2.0 ± 0.3
BMI ≥85th to <95th percentile (overweight)	7 (13)	4 (15)	3 (11)
BMI ≥95th percentile (obese)	46 (87)	22 (85)	24 (89)
Parent†			
Female sex	50 (94)	25 (96)	25 (93)
Age, y	36.6 ± 6.4	36.0 ± 5.9	37.2 ± 7.0
BMI, kg/m^2	30.8 ± 6.2	31.4 ± 6.7	30.3 ± 5.8
First generation in United States	32 (67)	18 (75)	14 (58)
Years lived in the United States	13.8 ± 6.3	15.8 ± 6.7	12.1 ± 5.6
Education achieved			
Less than high school	36 (73)	19 (79)	17 (68)
High school graduate	6 (12)	2 (8)	4 (16)
Some college or more	7 (14)	3 (13)	4 (16)
Agree that neighborhood is safe‡	19 (39)	10 (42)	9 (36)
Household†			
Household size	5.0 ± 1.5	5.6 ± 1.5	4.5 ± 1.3
Food insecure§	39 (76)	18 (72)	21 (81)
Vehicles available to household	1.5 ± 0.9	1.5 ± 0.8	1.5 ± 0.9

BMI indicates body mass index.

*Data are presented as mean ± SD or n (%). At baseline, there were no significant differences in height, weight, BMI, or BMI *z* score between Active and Healthy Families and control groups. Data from 2 participants who withdrew from the study were excluded.

†Parents with missing data did not contribute to estimates of percentages.

‡Parent perception that the family's neighborhood is safe enough for a 10-year-old boy to walk around the block alone in the daytime.

§Assessed via the US Department of Agriculture 6-item US Household Food Security Survey Module.

Table 5. Change in Outcomes From Baseline to 10 Weeks by Intervention Assignment

Characteristic	Baseline, Mean (SD)	10 Weeks, Mean (SD)	Change, Mean (SD)	Adjusted Difference in Change (95% CI)*	*P*
Child BMI, kg/m^2					
Intervention	25.70 (4.97)	25.20 (4.94)	−0.50 (0.74)	−0.78 (−1.28, −0.27)	.004
Control	23.04 (2.47)	23.36 (2.65)	0.32 (0.72)		
Child BMI *z* score					
Intervention	2.02 (0.41)	1.92 (0.51)	−0.10 (0.04)	−0.10 (−0.19, −0.02)	.02
Control	1.98 (0.26)	1.98 (0.27)	0.00 (0.02)		
Weight, kg					
Intervention	51.74 (17.09)	51.82 (16.99)	0.08 (1.54)	−1.34 (−2.41, −0.27)	.02
Control	41.73 (11.80)	43.12 (12.18)	1.39 (1.56)		
SBP, mm Hg					
Intervention	116.33 (12.09)	114.43 (10.04)	−1.90 (11.98)	0.17 (−5.74, 6.08)	.95
Control	110.42 (9.58)	111.88 (8.46)	1.46 (9.55)		
DBP, mm Hg					
Intervention	67.05 (6.37)	66.57 (6.74)	−0.48 (6.33)	−0.74 (−4.08, 2.59)	.65
Control	67.37 (7.15)	68.21 (6.60)	0.84 (4.80)		
LDL cholesterol, mg/dL					
Intervention	90.67 (25.89)	93.38 (29.78)	2.71 (13.38)	2.06 (−9.13, 13.24)	.71
Control	97.05 (21.63)	97.80 (18.81)	0.75 (19.96)		
HDL cholesterol, mg/dL					
Intervention	46.62 (16.52)	44.43 (14.32)	−2.19 (7.78)	−0.78 (−4.81, 3.26)	.70
Control	49.80 (11.18)	48.05 (9.46)	−1.75 (6.52)		
Triglycerides, mg/dL					
Intervention	104.2 (60.8)	91.0 (61.2)	−13.1 (33.3)	−26.8 (−50.1, −3.6)	.03
Control	88.2 (42.3)	101.5 (41.7)	13.3 (41.3)		
Glucose, mg/dL					
Intervention	87.05 (4.72)	89.30 (5.09)	2.25 (5.04)	0.16 (−3.14, 3.46)	.92
Control	90.15 (5.56)	89.15 (5.59)	−1.00 (5.53)		
HOMA-IR					
Intervention	3.39 (1.73)	3.97 (2.44)	0.58 (1.47)	−0.10 (−0.99, 0.78)	.81
Control	3.80 (1.75)	4.30 (2.26)	0.50 (1.09)		
Hemoglobin A1C, %					
Intervention	5.07 (0.32)	5.19 (0.30)	0.12 (0.19)	0.06 (−0.09, 0.21)	.41
Control	5.15 (0.29)	5.14 (0.31)	−0.01 (0.21)		

BMI indicates body mass index; DBP, diastolic blood pressure; HDL, high-density lipoprotein; HOMA-IR, homeostatic model assessment estimate of insulin resistance; LDL, low-density lipoprotein; and SBP, systolic blood pressure.

*Linear regression models adjusted for clinic, age, sex, and baseline values for each outcome. The dependent variable was modeled as 10-week change scores (eg, 10-week BMI minus baseline BMI).

There is a dearth of RCTs examining programs in the primary care setting to address overweight and obesity among Latino children[29,30]; the present study is the first to date to show a significant impact on BMI. O'Connor and colleagues[29] conducted a feasibility RCT of Helping HAND, an intervention for overweight or obese 5- to 8-year-olds and their parents. The 6-month intervention, consisting of monthly individual sessions delivered by health promotion specialists, was tested among a predominantly Hispanic population. It did not result in significant improvements in BMI *z* score relative to the control group but was associated with screen time reductions. The second feasibility trial evaluated a culturally sensitive intervention consisting of family coaching and the Power Up curriculum, comprising 5 group sessions plus a reunion session among 9- to 12-year-old overweight or obese Latino children and their caregivers.[30] Sessions were delivered by a health educator, physical therapist, nutritionist, and primary care pediatrician and did not result in between-group differences in BMI *z* score. Other nonrandomized obesity interventions in primary care have been assessed among Latino youth with mixed results.[31–33]

Both these RCTs, which took important multidisciplinary approaches, were not necessarily powered to detect BMI or weight changes and were longer in duration than AHF, making it difficult to compare results. However, there were differences between these interventions and AHF with respect to design and participant characteristics. The Helping HAND intervention included individual, not group, sessions. It was not described as culturally tailored or as including within-session physical activity or giveaways (eg, pedometers). Sessions occurred monthly instead of every 2 weeks and were delivered by health advisors. The authors did not specify that it covered stress or included periodic height and weight measurements. Finally, while most participants were Hispanic/Latino, not all spoke Spanish, and children were younger than those in AHF.

In contrast, the Power Up intervention was like AHF in that it covered similar topics like stress, engaged parents and children, provided giveaways, and was delivered by a multidisciplinary team. It differed from AHF in that group sessions occurred weekly instead of every 2 weeks and were a half hour shorter. It is unclear if the members

Table 6. Calculations of Projected Costs, Revenues, and Income in 2014 for Contra Costa Health Services for a Single Series of Active and Healthy Families

Item						Grand Total	
Projected Revenues						**First Series**	**Later Series**
FQHC provider reimbursement	10 children × 3.5 sessions* × $390.91 reimbursement†					$13,681.85	$13,681.85
Projected Costs	**Total Hours**	**Salary Rate ($/h)‡**	**Salary (Rate × Hours)**	**Benefits§**	**Total Cost‖**		
Staffing							
Physician	25.00	$71.79	$1,794.75	$1,130.69	$2,925.44		
Dietitian	50.00	$28.32	$1,416.00	$892.08	$2,308.08		
Promotora	37.50	$16.49	$618.38	$389.58	$1,007.95		
Medical assistant	15.00	$20.19	$302.85	$190.80	$493.65		
Total staffing costs					$6,735.12		
FQHC overhead costs of 18%					$1,212.32		
Supplies	Quantity	Unit Cost			Total cost		
Snacks for all families	5	$30.00			$150.00		
Printing costs for handouts	50	$0.80			$40.00		
Water pitcher giveaway	10	$4.00			$40.00		
Cereal bowl giveaway	10	$2.00			$20.00		
Pedometer giveaway	25¶	$2.00			$50.00		
Physical activity item	10	$10.00			$100.00		
Total supplies costs					$400.00		
One-time cost: AHF posters	1	$360.00			$360.00		
Total costs						$8,707.44	$8,347.44#
Projected net income (revenues−costs)						$4,974.41	$5,334.41

AHF indicates Active and Healthy Families; FQHC, federally qualified health center.

*The mean attendance in this study was 3.5 of 5 sessions. Thus, average attendance of 3.5 sessions was used to estimate total provider reimbursements.

†Billing code 0001.

‡Based on midlevel salary steps: step 4 of 7 for the physician, step 3 of 5 for the dietitian and certified medical assistant, and step 2 of 3 for the promotora.

§Benefits rate is based on 63% of salaries.

||Total cost for each staff member is equal to the sum of their salary and benefits.

¶One pedometer for each child and parent plus 5 replacements.

#Does not include one-time cost of AHF posters.

of the intervention team were from the participants' community, if they were each involved in all sessions, or if children's heights and weights were measured each session. Giveaways appeared to be specific to physical activity. On average, parents in their sample had a higher educational attainment and were more likely to be second generation in the United States than parents in AHF. Last, their evaluation was limited by 37% loss to follow-up.

Multicomponent, culturally tailored interventions hold strong promise for reducing health disparities.[34] In comparison with previous interventions to address overweight/obesity among Latino youth, a unique feature of AHF is a specific focus on family stress due to immigration. Although it is not possible to disentangle the effect of integrating this topic into the AHF curriculum, its inclusion may have enhanced the intervention's impact by increasing families' ability to cope with stress-related influences on diet and weight. Furthermore, acknowledging the unique concerns and experiences of the population regarding immigration may have increased participants' receptivity to and identification with other AHF content. By providing a culturally tailored intervention specific to underserved Latinos, AHF helped address the Institute of Medicine's call for "targeted actions to reduce the inequitable distribution of health promotion resources … that contribute to health disparities in low-income, minority, and other disadvantaged populations."[5]

The current study takes advantage of an innovative group-visit model, which has important implications for resource-strapped clinics with a shortage of primary care providers. Standard care relies on short, one-on-one appointments with a provider that may be scheduled months apart. In contrast, group visits offer longer sessions—2 hours in the case of AHF—that can be scheduled at consistent times. AHF triad members each had a specific role to ensure efficiency, allowing for the delivery of enhanced education not otherwise feasible during one-on-one appointments. Participants may have also benefitted from questions and sharing of personal experiences by other participants. Additionally, although AHF is not limited to the FQHC setting, it was tested in FQHCs, which are publicly funded and mandated to provide care to underserved populations. In 2012, over one-third of FQHC participants were Latino—more than twice the proportion of Latinos in the US population.[35] Therefore, this trial supports the utility of AHF, specifically in settings most likely to reach low-income and Latino populations. Contra Costa Health Services has made available through its website

(http://cchealth.org/ahf/) AHF's curriculum, training materials, and handouts for clinics interested in replicating the program. Beyond utility, participant feedback on AHF was very positive. As one patient noted, "In some places, you don't have the courage to speak. [At AHF], we felt that we were in a trusting place. They gave us the confidence to express ourselves and ask anything."

In addition to a decrease in BMI, the intervention led to improvements in triglycerides, which are especially responsive to changes in adiposity, physical activity, and diet, particularly reduced intake of refined carbohydrates (eg, sugary beverages).[36] However, there were no significant between-group differences in blood pressure, cholesterol, glucose, HOMA-IR or HbA1C, which may take longer to respond to interventions of this intensity. These findings are consistent with other trials among Latino youth that have found intervention effects on measures of child adiposity but not for fasting laboratory assessments.[37,38] Analyses did not detect changes in parent weight. This may be due to a stronger focus on changing behaviors for the benefit of the child than on behaviors for personal weight loss.

This study has several limitations. First, AHF was designed for low-income, Latino families, in which most parents participating were first generation in the United States. Thus, results may not be generalizable to other racial/ethnic groups or to Latinos who are more acculturated, do not speak Spanish, or have higher incomes. Also, most participants were of Mexican ancestry. This would not constitute a major limitation to generalizability because 65% of US Hispanics are of Mexican background,[39] and the curriculum was not designed only for families of Mexican origin. However, it is possible that AHF's impact may vary by ancestry. Replication of AHF in clinics serving predominantly Latinos of non-Mexican origin should explore the need for further tailoring to different ethnic heritages and immigration histories. Second, follow-up height and weight measures could not be obtained from 15 participants; however, a similar number of participants were missing height and weight from both the intervention and control groups (7 and 8 participants, respectively), and no significant or clinically meaningful differences at baseline were detected between those missing and not missing BMI. Third, not all laboratory values could be obtained from all participants, limiting the ability to assess impact on blood glucose, HOMA-IR, and HbA1C. Fourth, outcomes were ascertained immediately after the intervention; thus, the long-term impact of the intervention has yet to be determined. Last, net income figures were limited to Contra Costa FQHCs; future studies should examine costs across various clinic settings, including opportunity costs of group appointments compared with individual appointments.

CONCLUSIONS

This trial provides preliminary evidence that AHF was efficacious in reducing child BMI over a 10-week period and fills a critical need for targeted interventions to address childhood overweight and obesity among Latinos, who suffer disproportionately from excess adiposity and related complications. Additionally, the efficiency of its group medical appointment model makes AHF a particularly attractive option for resource-strapped health centers. However, the intervention should be replicated and tested in additional clinics, and future studies with a longer follow-up are needed to examine weight maintenance and long-term health impact.

ACKNOWLEDGMENTS

Supported in part by grant 033728 from the Safeway Foundation. JF's work was additionally supported by the American Heart Association Postdoctoral Fellowship (14POST20140055). Neither organization had any role in the study design; collection, analysis, or interpretation of data; writing of the manuscript; or the decision to submit the article for publication. The authors would like to thank the families who participated in the study and the members of the provider triads, especially the promotoras, who bridged the families and the clinics.

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