*Weight Control*

# "Eat Healthy, Stay Active!": A Coordinated Intervention to Improve Nutrition and Physical Activity Among Head Start Parents, Staff, and Children

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***Abstract***

***Purpose.*** *Examine the effectiveness of the "Eat Healthy, Stay Active!" pilot program, a multisite, 6-month educational intervention to promote healthy nutrition and physical activity among Head Start staff, parents, and children.*

***Design.*** *Comparison of within-group preintervention and postintervention knowledge and behavior, along with anthropomorphic measurements.*

***Setting.*** *The study was conducted in a convenience sample of six large Head Start agencies in five states.*

***Subjects.*** *Participants included 496 staff, 438 parents, and 112 preschool children.*

***Intervention.*** *The 6-month intervention consisted of core trainings and reinforcing activities for staff and parents that aligned with children's curricula.*

***Measures.*** *Pre-post questionnaires and anthropometric measurements examined changes in body mass index (BMI), knowledge, and behaviors related to nutrition and physical activity.*

***Analysis.*** *Paired t-tests to compare preintervention and postintervention weights and BMI; multiple regression analyses to examine associations between weight changes and other covariates, including knowledge and behavior changes, controlling for sociodemographic variables.*

***Results.*** *Each group of participants demonstrated significant reductions in BMI (mean = 30.1 to 29.2; $p < .001$ in adults and 17.0 to 16.6; $p < 0.001$ in children) and in the proportion of obese children (30% to 21%; $p < .001$) and adults (45% to 40%; $p < .001$). Child weight changes correlated with parent weight changes.*

***Conclusion.*** *This intervention showed promising initial results, with potential effectiveness as an intervention to promote healthier behaviors among adults and children in Head Start settings. (Am J Health Promot 2012;27[1]:e27–e36.)*

***Key Words:*** Head Start, Health Education, Health Promotion, Nutrition, Obesity Prevention, Physical Activity, Preschool, Prevention Research. Manuscript format: research; Research purpose: program evaluation; Study design: nonexperimental, pre/post comparison; Outcome measure: biometric; Setting: school; Health focus: weight control; Strategy: education; Target population age: youth/adults; Target population circumstances: education/income level, race/ethnicity

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## PURPOSE

The increasing prevalence of childhood obesity throughout the United States has led policy makers to rank it as a critical public health threat.[1] The obesity epidemic in the United States is affecting preschool-aged children and has nearly tripled over the past 3 decades, from 5% to 14%.[2–6] Obesity is most prevalent among children who are socially and economically disadvantaged.[7] Because young children spend more and more time in child care and early childhood education programs, focusing on these settings is critical to a comprehensive approach to reducing obesity.[8]

Unfortunately, evidence on what works for preschool populations is limited, particularly when the focus is on the vulnerable families bearing a disproportionate burden of obesity. Systematic reviews have suggested there are insufficient numbers of methodologically strong studies upon which to base recommendations. Existing research is heterogeneous in design, end points, and populations studied.[9–13]

Some of the studies in these reviews, however, are informative. High 5 for Kids,[14] a parent-focused home visit–based study, revealed that simple changes in parents' intake of fruits and vegetables significantly predicted a child's change in the eating of fruits and vegetables, thus linking the children's eating behavior to that of their parents. The study was limited, however, by its use of self-reported heights and weights, making the determination of obesity outcomes less than ideal.

LAUNCH,[15] a small (n = 18) 6-month pediatric clinic/home-based program for obese children aged 2 to 5 years, compared intensive educational and behavioral interventions led by psychologists and dieticians in multiple settings, with pediatrician counseling according to current pediatric society recommendations. The intensive-treatment group achieved improvements in measured body mass index (BMI) and weight in children and parents, maintained through month 12. Meanwhile, the lower-intensity intervention of pediatrician counseling as currently recommended did not result in BMI change. The intensive intervention, however, cost $1100/child more than the pediatrician care ($150/child).

Head Start is the largest federally funded early childhood education program in the country, providing services to nearly one million low-income preschool children.[16] Head Start is charged with promoting school readiness for low-income children by enhancing the social, cognitive, and emotional development of children through the provision of educational, health, nutritional, social, and other services to enrolled children and families based on family needs assessments.

In 2006, almost 90% of Head Start families had an income <185% of the federal poverty threshold; the median annual household income was $18,292.[17] According to a 2010 report, the Head Start population is highly diverse and represents different languages and cultures. With respect to ethnicity, 36% are Hispanic/Latino. With respect to race, 40% are white, 30% are black/African-American, 4% are American Indian/Alaska Native, 2% are Asian or Hawaiian/Pacific Islander, 8% are biracial/multiracial, and 17% are unspecified/other.[18]

About one in every three children entering Head Start is overweight or obese, with a BMI ≥85th percentile.[19] But limited data are available to assess Head Start's efforts to deal with the problem. Because many obese children and adolescents become obese adults, obesity in early childhood may have substantial long-term health consequences.[20,21] Given the unfavorable trajectory for obesity, many have argued for significant societal investment in high-quality research and programs in early childhood health promotion.[9]

A 2008 survey of program directors undertaken to describe Head Start obesity prevention activities (n = 1810 programs; 87% response rate) showed obesity to be a concern for Head Start. This survey revealed that 60% of programs held at least some type of training (written handouts, videos, or limited verbal instruction) for new staff about feeding children, and 84% offered some form of parent training on preparing and shopping for healthy foods. However, content details and effectiveness of these programs were not examined. The survey showed that program directors faced difficulty in implementing policies and practices to address obesity prevention and identified the key barriers as lack of time, money, and knowledge. Also, parents and staff sometimes shared cultural beliefs that were inconsistent with preventing obesity, such as the belief that heavier children are healthier.[22,23] Minimizing those barriers will require federal resources to increase staff training and technical assistance, develop staff wellness programs, and provide healthy meals and snacks.

In order to address the known challenge of obesity in the Head Start population, we developed an obesity prevention intervention model that emphasized parental behavior change, parental involvement, moderate- to high-intensity activities, and repetition of themes. We used both Head Start facilities and Head Start personnel as a potentially cost-effective and replicable way of reaching a large number of vulnerable families. A multicomponent program using more than one strategy, using a variety of settings, and involving parents and teachers is aligned with the Institute of Medicine recommendations that pediatric obesity prevention should be multifaceted.[1]

Many features of ''Eat Healthy, Stay Active!'' are aligned with principles of community-based participatory research[24]: our Head Start community partners identified the need to address poor health literacy and obesity; we sought active community participation to build agency capacity and empower participants; and the community assisted in data collection and sharing. We developed a bidirectional relationship with the community by providing technical assistance but also by learning from the community and implementing best practices from the various community partners. The program also drew upon social learning theory[25] and evidence-based theories of communication and empowerment. These theories promote positive behavior change through trusting relationships and open dialogue, in which parents gain the knowledge and self-confidence to improve health practices for their families in their own homes. With enhanced self-efficacy, they are activated to undertake behavior change. Collective efficacy and community relationships, in turn, create positive social norms to support good health. This engagement was a critical step in the design and implementation of this intervention.

The purpose of our study, a pilot evaluation of the ''Eat Healthy, Stay Active!'' program, was to examine the impact of an innovative 6-month educational intervention designed with and delivered in a selected group of Head Start programs to promote healthier nutrition and increased physical activity among parents, staff, and children.

## METHODS

### Design

Six Head Start agencies in Pennsylvania, Texas, Arizona, Rhode Island, and New York (representing 75 Head Start sites) requested to participate in the ''Eat Healthy, Stay Active!'' program. Program content was delivered to parents and children at each site by their staff. The intervention was evaluated using presurveys, postsurveys, and physical measurements for a sample of staff and parents.

### Sample

All staff (including part-time employees and volunteers) and parents were invited to participate in the program. Across all six Head Start agencies, a total of 579 staff (76%) and 472 parents (86%) attended the core curriculum training session created by UCLA/Johnson & Johnson Health Care Institute (HCI). The sample was

**Table 1**
**Demographic Characteristics of Adult Study Participants**

| Participant Characteristic | Overall Sample, No. (% of Total) | Staff, No. (% of Subsample) | Parents, No. (% of Subsample) |
|---|---|---|---|
| Total number (adults) | 934 (100) | 496 (53 [of total]) | 438 (47 [of total]) |
| Mean age, y (SD) | 37.2 (12.4) | 40.1 (12.7) | 33.9 (11.2) |
| Gender, No. (%) | | | |
| Male | 77 (8.2) | 12 (2.4) | 65 (14.8) |
| Female | 845 (90.5) | 476 (96) | 369 (84.3) |
| Missing data | 12 (1.3) | 8 (1.6) | 4 (0.9) |
| Race/ethnicity, No. (%) | | | |
| White | 424 (45.4) | 278 (56) | 146 (33.3) |
| Hispanic/Latino | 229 (24.5) | 87 (17.5) | 142 (32.4) |
| African-American | 136 (14.6) | 71 (14.3) | 65 (14.8) |
| Asian/Pacific Islander | 12 (1.3) | 7 (1.4) | 5 (1) |
| Native American | 57 (6) | 18 (3.6) | 39 (9) |
| Other | 23 (2.5) | 12 (2.4) | 11 (2.5) |
| Missing | 53 (5.7) | 23 (4.6) | 30 (7) |
| Level of education, No. (%) | | | |
| Less than high school | 78 (8.4) | 7 (1.4) | 71 (16.2) |
| High school graduate or GED* | 252 (27) | 75 (15) | 177 (40.4) |
| Associate degree | 116 (12.4) | 84 (17) | 32 (7.3) |
| Bachelor's degree | 476 (51) | 322 (65) | 154 (35.2) |
| Don't know, missing | 12 (1.3) | 8 (1.6) | 4 (0.9) |
| Marital status, No. (%) | | | |
| Married | 524 (56) | 300 (60.5) | 224 (51) |
| Single (including divorced/ widowed) | 247 (26) | 141 (28) | 106 (24) |
| Living with partner | 115 (12) | 38 (8) | 77 (18) |
| Don't know, missing | 48 (5) | 17 (3) | 31 (7) |
| Employment, No. (%) | | | |
| Full time | 96 (10) | 20 (4) | 76 (17) |
| Part time | 577 (62) | 450 (91) | 127 (29) |
| Unemployed | 206 (22) | 0 | 206 (47) |
| Missing data | 55 (6) | 26 (5) | 29 (7) |

* GED indicates general equivalency diploma.

then restricted to an analytic sample consisting of the 496 staff and 438 parents (89% of adult participants) who completed at least one questionnaire (baseline and/or follow-up). Baseline weights were collected for 673 adults (72% of adults in the analytic sample), and follow-up weights were obtained for 412 of those adults, resulting in a baseline to follow-up attrition rate of 39%. In addition, 112 children were measured for height and weight. Informed consent was obtained from all adult participants, and the UCLA Institutional Review Board approved the protocol.

Table 1 describes the sample size and demographic characteristics. The sample was predominantly female and white, with a mean age of approximately 37 years. Parents were more likely to be younger (mean age = 33 years compared with 40 years for staff), to be Hispanic/Latino (33% for parents compared with 17.5% for staff), and to have lower levels of education.

### Measures

All agencies were trained to collect and collate anthropometric data using a standardized method to avoid discrepancies related to clothing or other measurement variation. Measurements were collected by Head Start staff for each consenting participant at the beginning and end of the 6-month intervention period and were used to calculate BMI using the standard formula. In addition to these anthropomorphic measurements, adult participants (staff and parents) completed a questionnaire developed by the study team specifically for low-literacy audiences to measure diet- and physical activity–related knowledge and behavior. Although no formal validity testing was performed, these questionnaires were previously piloted with convenience samples purposely selected to resemble typical, often low-literacy parents and Head Start staff. Iterative debriefing was used to informally assess and maximize content validity.

Participants completed the same questionnaire at baseline and follow-up. Data from questionnaires and body measurements were entered by each agency into Excel spreadsheets, which investigators cleaned, coded, and merged into one data set.

The primary outcomes of interest were individual changes in weight, knowledge, and behavior among adult participants and changes in the proportion of obese individuals among all participating adults and children. Weight change was calculated using follow-up weight minus the starting weight for each participant. Weight change outliers (at the highest and lowest extremes) were investigated by contacting the Head Start agency for verification. If the weight change could be verified, it was used in the analysis. If an agency could not verify the weight change, the participant was dropped from the analyses; if an agency verified data entry error, the correct values were entered. If an extreme weight gain or loss was attributable to a known pregnancy during the intervention period, the participant was dropped from the analyses. Ultimately, only 1% of participants were excluded; those who were excluded did not differ from those who were included with respect to basic demographics.

Calculations of change in weight and BMI, as well as analyses using weight change as the main outcome variable, were limited to those participants for whom both baseline and follow-up weights were measured. Therefore, the sample sizes for these analyses were smaller than for the total sample. For adult participants, we compared the

baseline weights and demographics of participants who had both baseline and follow-up data with those who had baseline data only and found them to be similar, reducing the likelihood that systematic biases or differential dropouts were driving the weight change results. For children, our analytic sample was limited because of inconsistent reporting within and across Head Start agencies. Only children measured at both baseline and follow-up were included in the analysis sample. Because variables other than height and weight were not reported for children, we were not able to examine differences between included and excluded children.

Although children's dates of birth were not reported, all were enrolled in Head Start, and based on aggregate enrollment data from the sites, were assumed to be 4 years old (with a range of 3 to 5 years). Based on standard distributions for this age range, child participants were categorized as obese if BMI $\geq$ 18 kg/m$^2$ or not obese if BMI $<$ 18 kg/m$^2$, which corresponds very closely to the 95th percentile for both boys and girls in the 3- to 5-year age range. Adults were classified as overweight for BMI $\geq$ 25 kg/m$^2$ but $<$ 30 kg/m$^2$ or obese for BMI $\geq$ 30 kg/m$^2$.

Survey items were grouped into subscales based on the items' intended content. The subscales included knowledge of food groups, knowledge of healthful food choices, health consequences of obesity, shopping behaviors, eating behaviors, and physical activity intensity and frequency. Participants were assigned a score for each of these subscales, calculated as percent of the items correctly answered for the food group knowledge, healthful food choices knowledge, and health knowledge. For the shopping, eating, and physical activity subscales, a numeric score was given to each item, with a score of 1 assigned for each response indicating the least desirable behavior or lowest level of physical activity and a score of 4 assigned for the most desirable responses. Raw subscale scores were then scaled to a maximum of 100% desirable behavior. The change in score was calculated for each participant who had completed both baseline and follow-up surveys, equal to the follow-up score minus the baseline score. These change scores were used as continuous variables in the subsequent analyses.

Several of the questionnaire items contained missing observations ($<$10% of observations). Because these items were summed into scales, there was substantial potential for bias caused by item nonresponse. To reduce this potential bias while preserving error structures, we imputed missing values using multiple imputations by chained equations. Sensitivity analyses were completed by running analyses with and without imputed items to verify that the results were similar. Factor analysis (using the principal-factor method) was conducted to confirm that the subscales identified distinct domains as predicted. Using all of the questionnaire items, three distinct domains emerged: knowledge (food groups, healthy food choices, and health knowledge), diet behaviors (eating and shopping behavior), and physical activity. Within domains, Cronbach $\alpha$ was used to construct scales for analysis—.68 for knowledge, .78 for diet behaviors, and .56 for physical activity. Because the $\alpha$ for physical activity was low, we conducted sensitivity analyses using individual physical activity items, which confirmed our scale findings.

**Intervention: Overview**

HCI created a low-health literacy training program for obesity prevention. The goal was to increase knowledge and awareness of important factors in obesity and chronic disease prevention among Head Start staff, parents, and children and to assist in translating those skills into action. Low-literacy materials covering basic concepts such as My Pyramid, food groups, portion control, shopping on a budget, and integrating physical activity into daily life were developed by HCI and then reviewed by the California Family Health Council (http://www.healthed.org/consulting). The materials were presented separately to parents and staff. The children's curriculum included Head Start–appropriate activities that helped children learn the food groups and the importance of healthy eating and exercise. The program design facilitated mutual reinforcement of nutrition and physical activity learning among staff, parents, and children. Figure 1 depicts the logic model of the program.

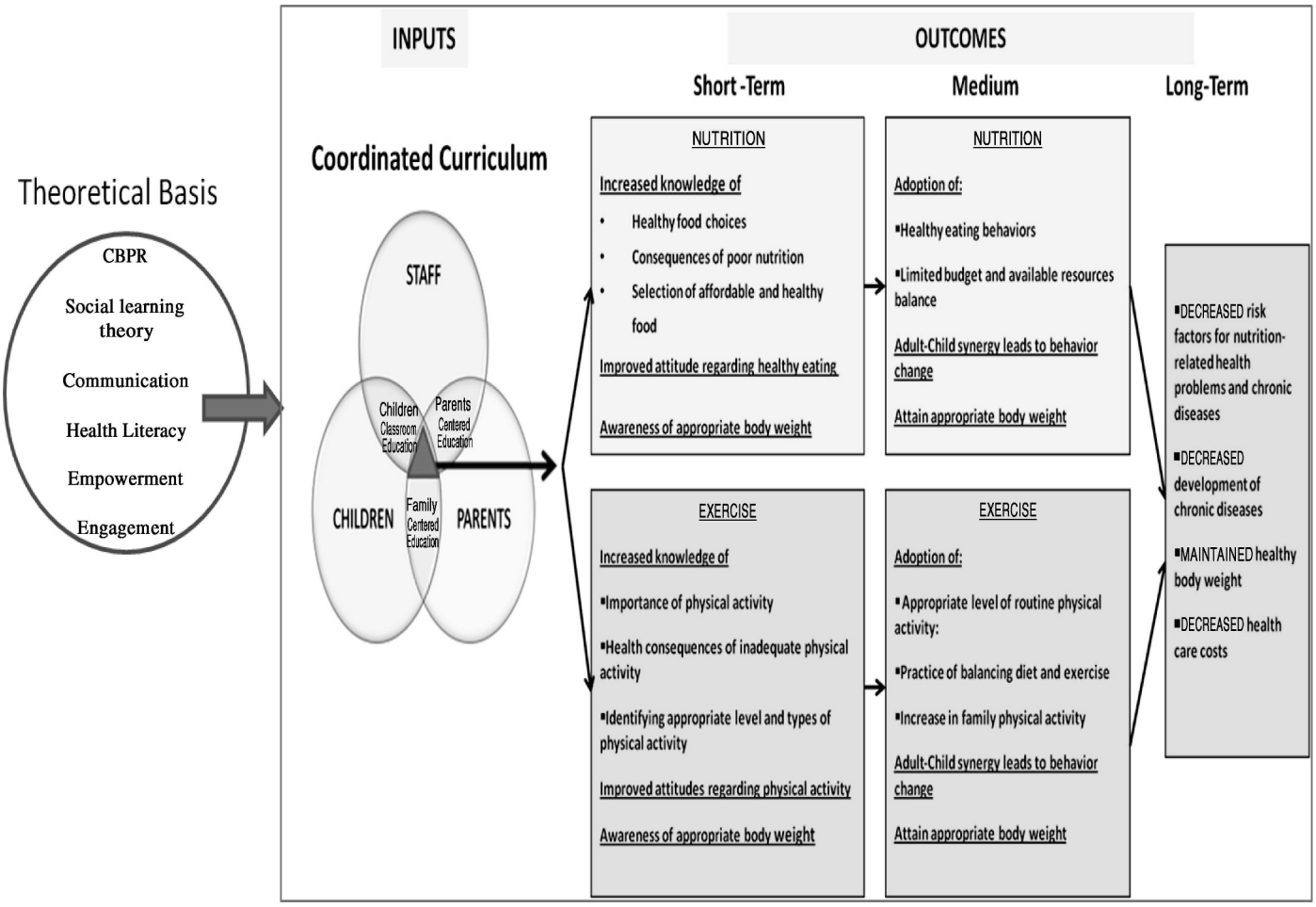
The cornerstone of HCI is the Health Improvement Project, a strategic model for development and delivery of health promotion programs.[26,27] All six participating agencies were introduced to this model during a prior HCI Train the Trainer program. This methodology trained the agencies to draft goals, objectives, marketing strategy, and plans for training and evaluation before implementing a health education project. Furthermore, it required each agency to designate a team consisting of key site leadership and staff responsible for nutrition and health services to oversee the project.

Figure 2 describes the project timeline. A standard but flexible structure was used across sites to ensure that all parents, staff, and children participating in the intervention received the same dose of core educational content while also receiving a choice of opportunities for program reinforcement. The ''Eat Healthy, Stay Active!'' core curriculum was provided, and the UCLA-based leadership team trained Head Start staff using three webinars over a 6-month intervention period and provided technical assistance for the agencies. UCLA conducted some site visits to ensure implementation of the core curriculum, but no additional management training was provided. During the intervention, staff, parents, and children were trained using the same core curriculum. All preschool children were exposed to a minimum of one activity per day. During this same period, all parents were exposed to a minimum of 6 hours of activities. The three common core elements of the intervention included:

- Staying healthy: diabetes awareness and obesity prevention
- Nutrition education and physical activity
- Healthy eating and smart shopping on a budget

Staff members were trained first, and then they conducted parent education sessions on evenings or weekends during the initial 3 months. An in-classroom curriculum was developed by the study team for teaching the

**Figure 1**
**Conceptual Model for Intervention Inputs and Outcomes**




CBPR indicates principles of community-based participatory research.

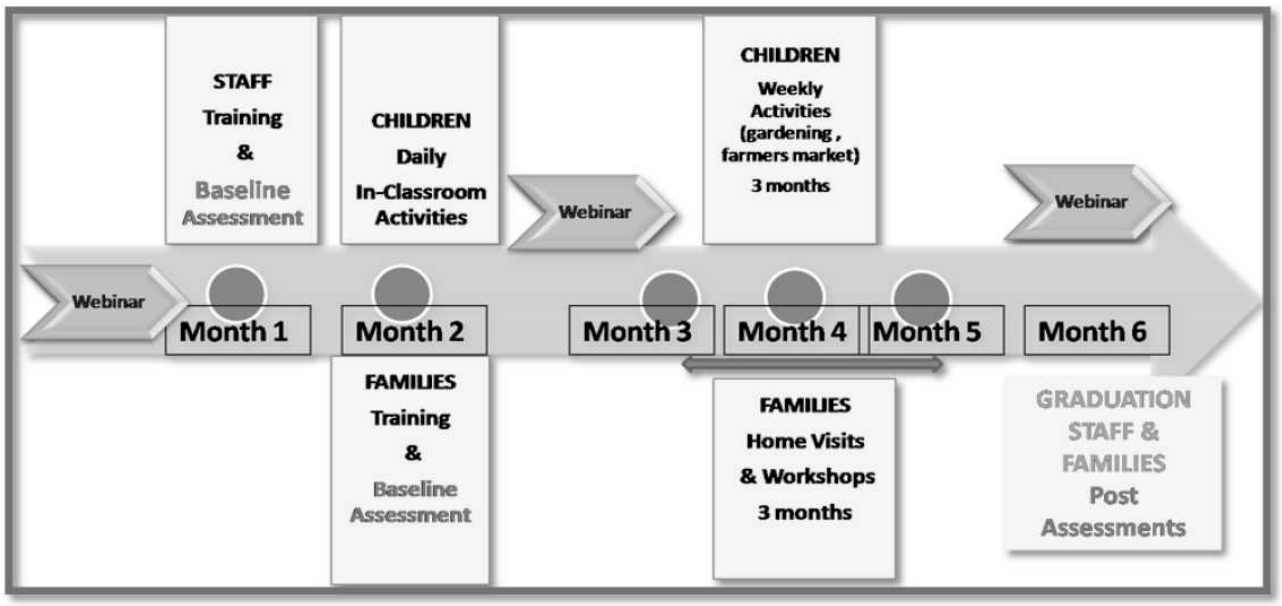
content to children; classroom lessons were aligned by topic with the parent lessons and conducted concurrently. Agencies were sent materials for follow-up activities (e.g., reinforcement challenges, workshop descriptions, low-literacy newsletters). Over the final 3-month period, sites developed activities that addressed specific interests and needs of their populations, often utilizing local community resources. Culminating celebrations were held for staff and families to acknowledge their achievements in the program. A small stipend for the agency supported project implementation during the 6-month intervention and was supplemented with community financial backing and donations in kind.

**Intervention: Staff and Parents**

The staff, which included directors, teachers, and administrators, was the first group to receive the ''Eat Healthy, Stay Active!'' curriculum. This occurred during a scheduled staff training day to maximize participation. Following staff training, intervention sites developed a series of events to deliver the program to parents. The educational content, available in English and Spanish, was separated into modules that could be delivered on weekday evenings or weekend mornings within a month's time span. To optimize parent attendance, agencies had flexibility to decide on the delivery format best suited to their community and often provided childcare and transportation. HCI provided all core educational materials and worked with agencies to provide additional incentives for the parents (e.g., measuring cups, grocery store gift cards). The participating agencies performed the height and weight measurements. During posttraining follow-up, staff received ongoing support at their work sites to initiate physical activity for themselves; they, in turn, encouraged families to increase their daily physical activities. Parents were offered additional workshops or special events that focused on one or more of the following areas:

- Cooking demonstrations focused on preparing healthy meals

**Figure 2**
**Intervention Timeline**




- Making substitutions for commonly eaten foods, and introducing children to fruits and vegetables; discussions led by nutritionists
- Tips about healthy shopping on a budget
- Exercising using common kitchen items
- Balancing energy intake with exercise

Family service advocates, who provide case management as well as family development support, followed up with parents between the preassessments and postassessments to reinforce skill development and overall learning. They reviewed easy changes that families could make to integrate healthy eating and physical activity into their lifestyles. Family service advocates then helped families set one goal that they could achieve by the end of the program.

**Intervention: Children**

An in-classroom activity guide provided nutrition and physical activity information that is consistent with Head Start's interactive learning curricula. Lessons were ordered to coincide with the food groups being discussed at the weekly parent sessions. Books, food pyramids, and other materials were provided to supplement lesson plans.

Teachers developed a customized plan that reflected the unique personalities and needs of the children in their classrooms. They introduced My Pyramid (a graphic of federal recommendations for nutrition and physical activity) in the classroom and used books and existing classroom materials to integrate lessons on nutrition and exercise into daily activities to promote healthy living. Innovative activities in the classroom included growing beanstalks and creating fruit kebabs.

Additionally, sites organized field trips to the farmers market or grocery store to reinforce classroom lessons on healthy eating. One site created an in-school farmers market, using fruits and vegetables donated by a local farmers market. The children selected and purchased their own food selections with play money, and teachers then incorporated the food into a variety of lessons in shapes, colors, counting, and other skills. Another popular idea was the creation of an on-site fruit and vegetable garden. The children chose the fruits and vegetables they wanted to grow, planted the garden with help from teachers and parent volunteers, and then ate the fruits of their labor. Teachers used these activities to reinforce ''Eat Healthy, Stay Active!'' principles while creating learning opportunities in math, science, art, and other areas.

**Analysis**

All data analyses were completed using STATA statistical software. Descriptive statistics were generated for the knowledge, behavior, and physical activity subscales, including the mean score and SDs for each subscale in the baseline and follow-up measurements. The mean and SDs for the changes in scores, with statistics for both the overall sample and a stratified sample with staff and parent subsamples, were also generated.

Paired *t*-tests were used to compare the difference in BMI for both children and adults in the before- and after-intervention measurements, the Fisher exact test was used to compare proportions of obese and not obese, and linear regressions were used to investigate the correlation between weight changes in children and their parents.

For investigation of the relationships between adult weight change and

**Table 2**
**Changes in BMI for Adult and Child Study Participants**

| Group | Baseline BMI† (kg/m$^2$), Mean (SD) | Follow-up BMI (kg/m$^2$), Mean (SD) | Pre/Post Difference‡, Mean (95% CI) |
|---|---|---|---|
| Overall | 30.1 (7.3) | 29.2 (6.8) | −0.9 (−1.1, −0.8)*** |
| Staff | 29.5 (7.4) | 28.7 (6.7) | −0.8 (−1.0, −0.6)*** |
| Parents | 31.2 (7.1) | 30.1 (6.7) | −1.2 (−1.4, −0.9)*** |
| Children | 17.0 (2.4) | 16.6 (2.2) | −0.4 (−0.6, −0.2)*** |
| | **% Obese, Baseline** | **% Obese, Follow-up** | **Pre/Post Difference§, Percentage Points** |
| Overall | 45.1 | 39.8 | −5.3*** |
| Staff | 41.4 | 36.8 | −4.6*** |
| Parents | 51.7 | 45.0 | −6.7*** |
| Children | 30.4 | 20.5 | −9.9*** |

† BMI indicates body mass index; CI, confidence interval.
‡ Statistical significance determined using a two-tailed *t*-test: *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$.
§ Statistical significance determined by the Fisher exact test: *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$.

changes in knowledge and behavior, linear regressions (clustered by Head Start agency) were performed using adult weight change as the outcome of interest and survey subscale scores as predictors (baseline, follow-up, and change scores), controlling for covariates including demographic characteristics and whether the individual was a Head Start parent or staff. We used similar linear regressions to investigate the association between weight changes in children and their parents. In our regressions, we initially included each Head Start agency as a covariate to control for possible unmeasured variation due to potential differences in intervention dose or curricular content. However, because inclusion of the agencies did not alter the main results or improve model fit, we dropped them from the final model.

## RESULTS

Adult participants (parents and staff) lost an average of 5.5 pounds over the study period, with a range of 55 pounds lost to 16 pounds gained, and an SD of 8.1 pounds. Table 2 describes the BMI values for the overall sample, staff and parent subsamples, and children, including baseline, follow-up, and change of BMI, along with paired *t*-test results to test for statistical significance of changes. All groups showed a statistically significant loss of mean BMI. Large proportions of each group were classified as obese based on their initial BMI, and all groups demonstrated a statistically significant decrease in the proportion considered to be obese at follow-up. To confirm that this decrease in proportion of participants who were obese was due to an actual change in individual BMI rather than a differential dropout among obese and nonobese participants, cross-tabulations were performed to determine the percentage of those considered obese at baseline who moved to the nonobese classification at follow-up. The results of this analysis demonstrated that 14.4% of adult participants classified as obese at baseline were no longer obese at follow-up, whereas only 2.2% of adults not obese at baseline became obese. Likewise, 38.2% of children considered obese at baseline were no longer obese at follow-up, and only 2.5% of children not obese at baseline became obese. These differences in proportion were statistically significant ($p < .001$), based on the Fisher exact test.

Table 3 summarizes the results of the baseline and follow-up questionnaires to measure nutrition and health knowledge and behaviors. Although some scores at baseline were quite high and some changes were modest at follow-up, participants showed statistically significant improvements in knowledge and behaviors from baseline to follow-up. The change in physical activity scores represented an increase in exercise frequency and duration for nearly all of the study participants.

To understand the direction, magnitude, and statistical significance of association between these knowledge and behavior scale scores (baseline, follow-up, and change scores) with weight changes, we conducted linear regressions using weight change as the dependent variable and survey subscale scores as the independent variables. We also included in these regression analyses an investigation into the association between weight changes in parents and those in their children. This analysis revealed a positive and statistically significant association between weight change in parents and weight change in children—a weight change of 1 pound in a child was associated with a weight change of 2 pounds (in the same direction) in the parent ($p = .01$). However, this association did not reach significance for parental and child BMI changes.

Table 4 shows the multivariate regression analysis of demographic and behavioral change variables conceptually related to weight changes. There were

**Table 3**
**Knowledge and Self-Reported Behavior Among Adult Participants**

| | Baseline Scores, Mean (SD) | Follow-up Scores, Mean (SD) | Pre/Post Difference,† Mean |
|---|---|---|---|
| Knowledge (% correct) | 93.7 (7.0) | 94.6 (5.8) | −0.9*** |
| Diet behaviors (scaled to 100) | 74.0 (9.8) | 76.2 (9.3) | 2.2*** |
| Exercise (scaled to 100) | 47.0 (19.0) | 70.5 (17.4) | 23.5*** |

† Statistical significance determined using two-tailed *t*-test: ***$p \leq 0.001$.

**Table 4**
**Multivariate Regression Analysis: Effects of Knowledge and Behavior Changes, Baseline Obesity, and Demographic Variables on Weight Change†**

| Independent Variable | Coefficient Estimate (Weight Change, Pounds) | 95% CI | *p* Value |
|---|---|---|---|
| Obese at baseline | −7.66 | −9.11, −6.21 | <0.001 |
| Parent (vs. staff) | −1.29 | −2.98, 0.39 | 0.10 |
| Age | −0.05 | −0.16, 0.05 | 0.20 |
| Male (vs. female) | −3.70 | −6.71, −0.68 | 0.03 |
| Race/ethnicity (white is reference group) | | | |
| African-American | −2.00 | −3.91, −0.09 | 0.04 |
| Latino | −0.25 | −2.17, 1.66 | 0.73 |
| Asian | 2.28 | −0.07, 4.63 | 0.05 |
| Native American | −1.69 | −2.67, 0.7 | 0.01 |
| Other | 3.66 | 1.62, 5.70 | 0.01 |
| Education: (less than high school is reference group) | | | |
| High school diploma | −1.54 | −5.54, 2.46 | 0.35 |
| Associate degree | −2.12 | −3.35, −0.89 | 0.01 |
| Bachelor's degree | −1.60 | −4.44, 1.24 | 0.19 |
| Employment: (full time is reference group) | | | |
| Employed part time | −0.33 | −5.05, 4.38 | 0.85 |
| Unemployed | −0.83 | −7.84, 6.17 | 0.76 |
| Change scores, knowledge | −5.66 | −20.59, 9.26 | 0.35 |
| Diet behaviors | −13.19 | −18.43, −7.96 | 0.002 |
| Physical activity | 2.26 | −1.76, 6.29 | 0.19 |

† n = 357; $R^2$ for model is 0.32; 95% confidence intervals (CI) and *p* values adjusted for clustering by agency.

statistically significant associations between weight loss and the following predictors: being obese at baseline (associated with a 7.7-pound weight loss, on average, compared with those not obese at baseline); being male (compared with female); being African-American, Native American, or other race/ethnicity, compared with white; having an associate degree (compared with not having graduated from high school); and improvement in eating behaviors and shopping behaviors, controlling for the other variables in the model. The model accounted for 32% of the variation in weight changes for our sample.

## DISCUSSION

In this multisite, multistate pilot study, we demonstrated preliminary evidence suggesting that a new, replicable family obesity prevention program (''Eat Healthy, Stay Active!'') conducted at Head Start sites may be effective. Six-month outcomes showed significant decreases in BMI and obesity among staff, parents, and children and significant improvements in nutrition knowledge and behaviors and physical activity. Moreover, weight change in parents was associated with weight change in children, suggesting more than just an undifferentiated secular trend and highlighting the potential importance of addressing behavior change for the whole family. Finally, multivariate regressions showed that changes in adult weight were associated with changes in their eating and shopping behaviors even after controlling for other variables, suggesting a possible causal link between weight loss and behavior change motivated by the program. These pilot results indicate that our intervention may have the potential to reduce obesity and improve behaviors in a large, high-risk population.

''Eat Healthy, Stay Active!'' used strategic management principles, readily taught through a ''train the trainer'' model, that allowed regular staff in Head Start schools to effectively implement the program and achieve measurable results and community activation across 75 sites nationwide. We believe that our structured implementation combined with our active encouragement of local innovation may have added significantly to the success of the health promotion effort. The HCI methodology actively engages directors in the project from the very beginning, and the momentum builds as the families get involved. Therefore, the awareness of the importance of fighting obesity grows during the process and helps break down barriers.

The systematic approach helped assure that the program was replicable and scalable, and community activation helped assure responsiveness to local community resources and needs. The direct costs were modest, and future research should include a rigorous cost-benefit analysis.

A coordinated and synchronized multilevel approach to pediatric obesity prevention is relatively rare in the literature; our data help confirm the impression of others that mutual reinforcement of learning between parents and their children may be important. This very challenging population of low-income parents with low average literacy from multiethnic backgrounds readily engaged when provided with an interactive, multicomponent program in a trusted school setting that taught healthier lifestyles in an understandable, actionable, low-literacy format. A review by Berry et al.[28] supports a link between parents and children in successful programs.[29] Qualitative comments from program participants (not included) further supported the richness of the interaction between parents and children and the staff's commitment to set a strong example.

Head Start's structure and holistic approach to families serves as an excellent setting for this type of approach. Head Start has program performance standards for health services as well as nutrition programs and parent outreach and home visits. Parents are involved in policy councils and governance. Serving 900,000 children annually, a significant public health impact on pediatric obesity prevention could be achieved with a successful intervention. Additionally, Early Head Start (ages 0–3 years) provides further opportunity for expansion of healthy

nutrition in pregnancy and for establishment of healthier family eating habits from birth. During the preschool years through age 5 years, there is opportunity for reinforcement and continuity of follow-up. Head Start is clearly an ideal site for sustained efforts for prevention of pediatric obesity and improved family healthy lifestyle patterns in very high-risk populations. New standards can be established with national impact where pediatric obesity prevention can become a high priority that is actionable with proper investment.

This pilot study has several limitations. A major limitation is its simple pre-post design. Without a concurrent control group, we could not formally assess whether changes in weight were due to the program or to non–program-related secular trends. This study is also subject to potential selection and attrition bias; given that response rates were relatively low and attrition relatively high, those who participated and remained in the study may have been those most motivated to change their behaviors. Furthermore, the agencies self-selected to participate in the program; therefore, we do not know whether results would be similar in a nationwide intervention. Nevertheless, the fact that (1) changes in program-related behaviors were linked with changes in adult weight and (2) individual parent weight change was linked with individual child weight change argues indirectly in favor of program effects. With respect to racial/ethnic differences, cultural sensitivity was an important component of the community-engaged intervention design process; we did not, however, include cultural sensitivity measurements in our evaluation and are therefore hesitant to draw strong conclusions about racial/ethnic differences. Likewise, with respect to children, data collection among children was too limited to make strong assertions about how well children in the data set represent children in the overall sampling frame. Finally, because the survey measures used were developed for this study rather than previously validated, the conclusions about the associations between weight loss and changes in knowledge and behavior must be viewed with caution. Future large-scale evaluations should include a control group, include validated measures of knowledge and behaviors, and examine ways of collecting data at Head Start centers more efficiently and effectively. Longer follow-up would also be beneficial, as would a formal cost-effectiveness assessment and further refinement of the survey subscales.

Despite these limitations, the study presented here provides important preliminary evidence that ''Eat Healthy, Stay Active!'' is potentially effective in reducing and preventing obesity in children and adults together and in promoting behavior changes to improve long-term health outcomes. Early child care and education settings are important venues to explore further as sites for prevention and health promotion activities for children, parents, and staff. Future research is needed to establish the value and cost effectiveness of this intervention and to determine whether it could be successfully disseminated to wider groups of Head Start agencies and to other programs outside of Head Start. If successful, an engaging, coordinated prevention and health promotion initiative like this one could become an important contributor to child and family health.

**SO WHAT? Implications for Health Promotion Practitioners and Researchers**

**What is already known on this topic?**

Studies have shown that preventing obesity in infants and young children can reverse the epidemic of childhood and adulthood obesity. However, limited comprehensive evidence on effective strategies to prevent obesity in preschool children exists. Interventions directed at children, families, and program staff have not previously been reported. Promising literature around family interventions exist; however, there is little information about underserved, multicultural populations who carry a disproportionate burden of obesity.

**What does this article add?**

This research offers encouraging findings from a national quasi-experimental pilot study of a preschool-based intervention using low-literacy tools, family engagement, empowerment, and skill building. Our coordinated design allows for low-cost replication and scalability.

**What are the implications for health promotion practice or research?**

Based on our findings, our ecologic approach to health promotion in fighting obesity can lead to promising results. Empowered staff leads to empowered parents who in turn can promote early healthy lifestyles for their children.

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