Dance and Reducing Television Viewing to Prevent Weight Gain in African-American Girls: The Stanford GEMS Pilot Study

Thomas N. Robinson, MD, MPH; Joel D. Killen, PhD; Helena C. Kraemer, PhD; Darrell M. Wilson, MD; Donna M. Matheson, PhD; William L. Haskell, PhD; Leslie A. Pruitt, PhD; Tiffany M. Powell, MPH; Ayisha S. Owens, BA; Nikko S. Thompson, MPhil; Natasha M. Flint-Moore; GeAndra J. Davis; Kara A. Emig; Rebecca T. Brown; James Rochon, PhD; Sarah Green; Ann Varady, MS

Objective: To test the feasibility, acceptability, and potential efficacy of after-school dance classes and a family-based intervention to reduce television viewing, thereby reducing weight gain, among African-American girls.

Design: Twelve-week, 2-arm parallel group, randomized controlled trial.

Setting: Low-income neighborhoods.

Participants: Sixty-one 8–10-year-old African-American girls and their parents/guardians.

Interventions: The treatment intervention consisted of after-school dance classes at 3 community centers, and a 5-lesson intervention, delivered in participants' homes, and designed to reduce television, videotape, and video game use. The active control intervention consisted of disseminating newsletters and delivering health education lectures.

Main Outcome Measures: Implementation and process measures, body mass index, waist circumference, physical activity measured by accelerometry, self-reported media use, and meals eaten with TV.

Results: Recruitment and retention goals were exceeded. High rates of participation were achieved for assessments and intervention activities, except where transportation was lacking. All interventions received high satisfaction ratings. At follow up, girls in the treatment group, as compared to the control group, exhibited trends toward lower body mass index (adjusted difference=−.32 kg/m^2, 95% confidence interval [CI] −.77, .12; Cohen's d=.38 standard deviation units) and waist circumference (adjusted difference=−.63 cm, 95% CI −1.92, .67; d=.25); increased after-school physical activity (adjusted difference=55.1 counts/minute, 95% CI −115.6, 225.8; d=.21); and reduced television, videotape, and video game use (adjusted difference=−4.96 hours/week, 95% CI −11.41, 1.49; d=.40). The treatment group reported significantly reduced household television viewing (d=.73, *P*=.007) and fewer dinners eaten while watching TV (adjusted difference=−1.60 meals/week, 95% CI −2.99, −.21; d=.59; *P*=.03). Treatment group girls also reported less concern about weight (d=.60; *P*=.03), and a trend toward improved school grades (d=.51; *P*=.07).

Conclusions: This study confirmed the feasibility, acceptability, and potential efficacy of using dance classes and a family-based intervention to reduce television viewing, thereby reducing weight gain, in African-American girls. (*Ethn Dis*. 2003;13[suppl1]:S1-65–S1-77)

Key Words: Obesity, Primary Prevention, Blacks, Female, Child, Family, Television, Dance Therapy, Exercise, Diet

Introduction

The United States has experienced dramatic increases in obesity among both children and adults.[1,2] Some of the greatest increases have occurred among African-American girls.[1,3–5] The body mass index (BMI) difference between White and African-American girls is already present prior to the age of 6, significantly widens as girls age, and is independent of socioeconomic status.[6] The rise in obesity is also blamed for an emerging epidemic of type 2 diabetes in children and adolescents [7–10] that disproportionately affects girls and African Americans.[7–9,11] This rise in the prevalence rates of obesity, and its attendant diseases, highlights the acute need to develop effective programs designed to prevent obesity among African-American girls.

In designing an intervention to prevent excessive weight gain among African-American girls, we felt it was important to address 2 important potential barriers to preventive interventions. First, conventional prevention programs that specifically focus on reducing fat and calorie intake, and increasing physical activity, have failed, for the most part, to produce changes in body fat.[12–15] The results of these studies suggest that obesity may be more difficult to prevent than other cardiovascular disease risk factors.[13] Second, past research has indicated that African-American women and girls may, in general, be less pre-occupied with a thin body shape, compared to women and girls from other racial and ethnic groups. As a result, an intervention focusing on weight control through diet and exercise might not be highly motivating to African-American girls and their families. African-American women report heavier ideal/desired weights, more positive body image, less body dissatisfaction, and fewer eating disorders symptoms, than do

From the Division of General Pediatrics (TNR) and Division of Pediatric Endocrinology (DMW), Department of Pediatrics, The Stanford Center for Research in Disease Prevention, (TNR, JDK, DMM, LAP, WLH, TMP, ASO, NST, NMF, GJD, KAE, RTB, SG, AV); Division of Cardiovascular Medicine (WLH), Department of Medicine, and the Department of Psychiatry (HCK), Stanford University School of Medicine, and the Biostatistics Center, George Washington University (JR).

Address correspondence and reprint requests to Thomas N. Robinson, MD, MPH; Assistant Professor of Pediatrics and of Medicine; Division of General Pediatrics and Center for Research in Disease Prevention; 1000 Welch Road; Palo Alto, CA 94304; 650-723-5331; 650-725-6906 (fax); tom.robinson@stanford.edu

White women.[16–23] In addition, African-American women report that family and friends support maintenance of a larger body size,[24] and husbands and boyfriends offer only moderate support for dieting or weight loss efforts.[22] Compared to White girls, African-American adolescent girls are less likely to perceive themselves as overweight,[25] are less dissatisfied with their body weight, have fewer thoughts about dieting, are less fearful of weight gain, have a less negative perception of overeating, and are less likely to engage in weight reduction behaviors.[26] African-American adolescent girls describe more flexible conceptions of beauty, suggesting that personality traits, rather than physical appearance, determine attractiveness; ie, beauty is "making what you've got work for you," and is based more on "how one moves," than on what one weighs. These girls also report receiving far more positive feedback from family, friends, and even casual acquaintances about their looks, and that African-American boys like girls who are shapely, full-figured, or "thick."[27]

To overcome these potential barriers, we considered intervention components that would have proximal intrinsic incentive value to the participants, above and beyond their potential weight and health benefits. Theory and our prior research suggested that introducing the girls to culturally-specific dance, while reducing their television viewing, would be feasible, acceptable, and potentially efficacious strategies to reduce weight gain in African-American girls.

Why Dance? Dance classes provide opportunities for immediate positive consequences (such as having fun, belonging to a group, opportunities for young adult mentorship, discovering cultural meaning, acquiring parental approval, etc.) Dance also provides sustained bouts of moderate-to-vigorous physical activity. We believe that offering a physical activity that girls like, and in which they will participate (regardless of whether it is perceived of as a "physical activity" or good for their health), provides the greatest opportunity to promote long-term physical activity and weight control. We demonstrated the potential efficacy of dance for preventing weight gain in an earlier pilot study among low-income African-American and Latino seventh graders.[28] Children were randomized to either a hip-hop aerobic dance class, or their standard PE class, for three 40–50 minute periods per week for 12 weeks. Compared to girls in regular PE, girls in the dance classes significantly reduced their BMI and resting heart rates.

A dance intervention was also chosen to tap into the social, cultural, and historical importance of dance in African-American communities. Dance is one of the features of African culture that survived transplantation to the United States, slavery, and social oppression. Many of the African dance traditions have carried over into contemporary times.[29] Dance styles and moves have shown strong historical continuity, being passed down through generations of African-American families and communities, and many popular dances have their origins in traditional African dance.[30] As a result, dance is considered an important part of heritage and cultural identity in the African-American community.[31,32]

Dance continues to play an important part in the lives of African-American youth, especially in urban and low-income communities. Dancing ability is particularly salient during adolescence and young adulthood, when identity issues are critical.[33,34] Dance also provides a means of demonstrating participation in, and affiliation with, the African-American community. It has been suggested that popular dance is an arena in which African-American expertise and dominance are generally unchallenged by the majority, which is a source of cultural pride.[30]

Finally, dance classes represent an especially practical and adaptable environmental strategy for promoting physical activity in girls. Many schools and community centers already offer after-school programs. Dance classes require no special equipment, may take place in almost any empty room, promote peer interaction, allow an efficient instructor-to-girl ratio, and offer a built-in opportunity for adult supervision and mentoring. In addition, while also providing regular physical activity, an attractive after-school program like dance removes children from their usual environment of televisions, VCRs/DVDs, video games and computers, as well as from their refrigerators, junk food, and fast food, during the largest discretionary time block of their days.

Why Television?

Television viewing is often considered one of the most modifiable causes of obesity in children.[35,36] Children spend a substantial part of their lives in front of the television set. Recent data indicate that 8–13-year-old children in the United States average 5 hours per day watching television and videotapes, and playing video games,[37] which is equivalent to spending approximately one third of their waking hours in front of a television set.[36] Furthermore, girls, African Americans, and children from families of lower socioeconomic status, tend to watch the most television.[37–39]

Three potential mechanisms have been suggested to link television viewing and obesity:[36] 1) reduced energy expenditure due to television viewing displacing physical activity; 2) increased dietary energy intake, either from eating during viewing or from the effects of food advertising; and 3) decreased resting metabolic rate during viewing. A substantial number of epidemiological studies have found an association between television viewing and childhood obesity.[36] One study estimated that up to 60% of overweight incidence (attributable risk) could be linked to excess television viewing.[40] Experimental data also support this link. Two recent studies demonstrated that reducing sedentary behaviors, including

television viewing, promoted weight loss among overweight children participating in a behavioral weight control program.[41,42] In another recent study, a school-based intervention focusing on decreasing television viewing, improving diet, and increasing physical activity, significantly decreased the prevalence of obesity among middle-school-aged girls.[43] Another randomized, controlled, school-based study was specifically designed to test the effects of reducing television, videotape, and video game use, alone, on obesity prevention. Over a single school year, the intervention significantly decreased children's television viewing, BMI, triceps skinfold thicknesses, waist circumferences, and waist-to-hip ratios, compared to controls.[44]

Finally, reducing television, videotape, and video game use, may be particularly motivating to the families of African-American girls, for reasons other than potential effects on diet, activity, and body fatness. The potential negative effects of these media on aggressive behavior, tolerance and dulled sensitivity for aggression and violence, attitudes toward the victimization and degradation of girls and women, gender and ethnic stereotyping, consumer-oriented values and behaviors, reduced attention span, lower reading ability, and poor school performance, are well publicized. As a result, an intervention to reduce family television viewing would be expected to produce greater "buy-in" among African-American families, than would an intervention more directly targeting diet and activity behaviors. The feasibility of reducing television viewing among low-income African-American families was also confirmed in another recent pilot study performed as one of the Stanford GEMS formative studies.[45]

Therefore, we hypothesized that an intervention including after-school dance classes, and reducing television viewing, would be a feasible, acceptable, efficacious, and potentially adaptable strategy to prevent excessive weight gain among low-income African-American girls.

METHODS

An overview of methods common to the 4 GEMS field centers is included elsewhere in this issue.[46] Here, we present the methods and results specific to the Stanford GEMS Pilot Study, a 12-week, 2-arm parallel group, randomized controlled trial. The study protocol was approved by the Stanford University Administrative Panel on Human Subjects in Medical Research.

Participants

Girls were recruited for the study through community centers and after-school programs; by community youth leaders; through presentations at schools; at community events and churches; and by posting fliers, as described in detail elsewhere in this issue.[47] To recruit low-income families, recruitment activities and intervention sites focused on low-income neighborhoods of Oakland, and East Palo Alto, Calif, with high proportions of African Americans. Eligible girls were 8, 9, or 10 years of age and identified as "African-American or Black" by their parent or guardian. To enrich the sample for girls at higher risk of subsequent obesity,[48] girls were also required to have a BMI $\geq$50th percentile for age (2000 CDC growth charts), and/or at least one overweight parent/guardian (BMI $\geq$25 kg/m^2).[49] Because the intervention was designed as a community-based prevention program, the eligibility criteria were kept liberal to maximize the generalizability of the results. To enhance internal validity, however, girls were not eligible if they had been diagnosed with a medical condition affecting their growth, were taking medications affecting growth, had a condition limiting their participation in the interventions or the assessments, or if they were homeless, or planning to move from the San Francisco Bay Area within the next 3 months.

After completing all baseline measures, girls were randomized to one of 2 treatment groups by the coordinating center.[46] To enhance feasibility and generalizability, eligible sisters, or girls who shared the same household, were allowed to participate in all elements of the study, but were assigned to the same intervention condition (based on the first girl randomized from that family/household), and only one of the girls from each family/household was randomly selected *a priori* to be included in the analysis. All staff who had contact with participants remained blinded to which girl was selected from each family/household. To compensate families for the time required for participation, families were paid $25 after completing the baseline measures, and $75 after completing the follow-up measures.

The treatment and control interventions were developed through extensive formative research, including focus groups with girls; focus groups with parents/guardians; written questionnaires; interviews of community youth workers and community leaders; and testing the feasibility of the dance classes and TV reduction lessons with small groups of girls and individual families.[50]

The Treatment Intervention

Bandura's social cognitive model[51] served as the foundation for intervention design, attending to the interplay of personal, behavioral, and environmental factors. The social cognitive model suggests that 4 processes are important in learning and adopting new behaviors: Attention, Retention, Production, and Motivation.[51] Intervention development and implementation were organized around these 4 processes. Attention regulates exploration and perception, and is highly influenced by factors such as salience, conspicuousness, functional value, affective valence, and attractiveness. Retention, or memory, is influenced by the processes of symbolic coding, organization of information, cognitive or imagined rehearsal, and active rehearsal. Production is the conver-

sion of conceptual representations into actions, and is influenced by immediate intrinsic and extrinsic feedback. Motivation is strongly influenced by external, vicarious, and internal incentives.

GEMS Jewels dance classes were offered 5 days per week at 3 community centers in the target neighborhoods (one in East Palo Alto and 2 in Oakland). Girls were encouraged to attend the dance classes as often as possible for their entire 3-month study enrollment, but they were not forced or coerced to attend any minimum number of days. Each daily session lasted for up to 2.5 hours (3:30–6:00 PM), starting with a healthful snack (a motivating and necessary feature for the girls) and an hour-long homework period, which was a motivating feature for parents and community centers, as well as for some of the girls, and provided the additional benefit of allowing time for girls to arrive from different schools. This hour was followed by 45–60 minutes of moderate-to-vigorous dance. The sessions ended with 30-minute GEMS talks exploring the meaning of dance in the girls' lives, and the importance of dance in the African-American community and culture. Classes were led by female African-American college students and recent college graduates, recruited from dance organizations/troupes at nearby universities and in local communities. Dance instructors were trained in appropriate warm-up exercises and teaching routines and techniques, as well as in safety procedures and first aid. Three styles of dance were taught: traditional African dance, Hip-Hop, and Step. The classes were structured, and steps chosen, to provide sustained moderate-to-vigorous activity. Occasional activities also included creating costumes, videotaping, and performing for families and friends.

The START (Sisters Taking Action to Reduce Television) intervention consisted of 5 lessons to be delivered during home visits with participating families over 12 weeks. An optional sixth follow-up home visit was also offered at the end of the study. A female African-American intervention specialist scheduled lesson times with each family, and then delivered the intervention to the participating girl and any other available family members. Her role was to act as a behavior change partner, as well as being an additional adult female role model for the participating girls. The strategies promoted for reducing television viewing included non-selective reductions in total hours and/or access to television, selective reductions by day, time, context or content, and replacing viewing time with other activities (eg, dance). The specific behavioral goals were based on our prior television reduction research, and included self-monitoring, a 2-week TV-turnoff, budgeting viewing hours, and "intelligent viewing."[44] African and African-American history and cultural themes were integrated into the lessons. Families were also given electronic TV time managers to help with budgeting (TV Allowance, Miami, Fla), and 5 newsletters were mailed to parents/guardians to reinforce the lessons and to communicate updates on dance class activities.

To incorporate the complexity of African-American culture, we designed the intervention to address both surface structure (culturally matched models, music, language), and deep structure (values, and social and historical influences).[52] Surface structure in Stanford GEMS is addressed through culturally matched providers (eg, female African-American dance instructors, home visitors, and data collectors), using music chosen by the participants, and by the selection of dance. To appropriately address deep structure, cultural values, norms, attitudes, and expectancies are integrated into the goals and strategies of the intervention,[53] as described above. We attempted to account for a number of unique elements associated with African-American culture, such as collectivism, importance of family, present orientation, importance of religiosity, sense of historical racism and prejudice, and use of social support as a coping strategy.[54–61] As a part of this regard for deep structure, the intervention did not focus on obesity prevention, for the reasons noted above. Instead, the results of formative research guided us to emphasize such aspects as a holistic concept of health that includes high self-esteem, spirituality, and cultural awareness, as well as physical health; a community atmosphere and social support, involving extended families; and freeing oneself from the majority of commercial influences that drive media content. As described above, the importance of dance in African and African-American cultures is highlighted in dance classes, and girls are introduced to notable African-American females by their college student or college graduate role-models during the TV reduction lessons.

The "Active" Control Intervention

The control intervention was designed to be a state-of-the-art information-based health education program to promote healthful diet and activity patterns. It included presenting monthly community health lectures, delivered by volunteers from the African-American task forces of the local chapters of the American Heart Association and the American Diabetes Association, and mailing newsletters: 5 to parents (the Stanford GEMS Health Report), and 11 to girls (Felicia's Healthy News Flash). The content of the newsletters focused on reducing risks, especially among African Americans, for obesity, heart disease, stroke, hypertension, and diabetes, and included age-appropriate and culturally targeted educational materials from federal health agencies.

We invested substantial effort to design an appropriate control group. Some past abuse of research subjects in the pursuit of questionable scientific objec-

tives has led many individuals, particularly those of racial/ethnic minorities, to be suspicious of medical research. This sentiment was clearly demonstrated in some of our focus groups. Failure to consider and attend to these attitudes can seriously jeopardize a trial's success. Although a no-treatment control condition might be preferable at this early stage of research, our past experiences convinced us that a no-treatment comparison would generate community ill will, hampering recruitment, and facilitating contamination.[62] Perhaps the most desirable second choice, a wait list control condition, was problematic for similar reasons. Therefore, we chose a condition which has been referred to as an "active placebo" condition.[63,64] The active placebo condition contains certain "active" ingredients that may influence behavior, but these ingredients differ from the conceptually relevant ingredients of concern to the investigators.[63,64]

Measures

Assessments were performed at baseline (just prior to randomization), and again 12-weeks after randomization (follow up), by trained female data collectors blinded to the treatment assignments of the participants. We performed assessments in participants' homes, during mornings, evenings, and weekends, to facilitate greater participation by the lowest-income and highest risk families by removing barriers to their participation (eg, transportation to a clinical research facility, time away from work or school). Further rationale and descriptions of GEMS collaborative measures, central training, and quality control, are included elsewhere in this issue.[46] Measures unique to the Stanford GEMS field center are noted below as "Stanford only."

Body mass index (BMI, defined as weight in kilograms divided by the square of height in meters) was chosen as the primary measure of body fatness in GEMS.[65] Height was measured with subjects barefoot, using a direct reading stadiometer (Shorr Productions, Olney, Md) with methods to account for hair; and weight was measured with subjects barefoot and wearing light clothing, using an electronic scale (SECA Model 770, Seca Corporation, Culver City, Calif).

Waist circumference was measured against the skin at the level of the umbilicus with a non-elastic metal tape measure, according to standard methods.[66] Abdominal adiposity is related to metabolic risk factors in children.[67–69]

Sexual Maturation was measured by self-assessment, using drawings and descriptions of the 5 standard pubertal stages of breast and pubic hair development.[70,71]

Blood samples were collected and initially processed in participants' homes after a minimum 8-hour fast. Phlebotomists (African-American females who completed State of California phlebotomy certification) scheduled visits for weekend mornings, or before school, to allow fasting. Plasma samples were separated within 30 minutes, placed on dry ice in the field, and then stored frozen at −70C. Assays were performed at CDC standardized laboratories at the University of Minnesota (insulin and glucose), and Stanford University (total cholesterol, HDL-cholesterol, triglycerides, and calculated LDL-cholesterol).

Reported media use behaviors (Stanford only) were assessed with previously validated instruments.[44,72] Girls reported their own television viewing, videotape viewing, and video game use, and parents reported overall household television viewing.[44,73] Because eating meals with the television on was a potential mediating behavior targeted for reduction, girls were also asked to report their past week's frequencies of eating breakfast and dinner in a room with the television turned on.[44,72]

Overall dietary intake was assessed with two 24-hour dietary recalls on non-consecutive days, including one weekday and one weekend day. The 2 recalls were averaged for nutrients. Recalls were collected by dietitians using the Minnesota Nutrition Data System for Research (NDS-R) from the University of Minnesota's Nutrition Coordinating Center (NCC). NCC provided standardized protocols, training, and interviewer certification. The primary dietary variables of interest in the Stanford GEMS pilot study were average total daily energy (kcal/day) consumed, and the percent of energy from fat.

Physical activity was assessed at baseline and follow up with 3 consecutive days of monitoring, using the Computer Sciences and Applications (CSA) accelerometer. Average daily counts per minute, and average counts per minute between noon and 6 PM, were calculated. To be comparable with other field centers, follow-up physical activity monitoring occurred *after* girls had completed their 12-weeks of dance classes at Stanford. Previous-day and usual physical activity was self-reported by girls using the GEMS Activity Questionnaire (GAQ).[46] Preferences ("liking") for a similar selection of physical activities, and the numbers of those activities ever tried, were also self-reported by girls, using a measure developed for prior studies at Stanford (T. N. Robinson, unpublished data).

The Overconcerns with Weight and Shape subscale of the McKnight Risk Factor Survey[74] was used to assess risk factors for eating disorders. Perceived current body shape and desired body shape were assessed with African-American pre-adolescent female body figure silhouettes ranging from underweight to overweight. Discrepancies in a girl's perceived current body shape, in contrast with her ideal preference, define a measure of body dissatisfaction.

Self-esteem (Stanford only) was assessed with the 10-item Rosenberg self-esteem scale (RSE).[75–77] School performance (Stanford only) was self-reported by girls on a 10-point scale of "most recent school grades" ranging from mostly As (1) to mostly Fs (9).

Demographic variables, including each girl's race and ethnicity, age (date of birth), parent/guardian education levels, total household income, and household membership information, were assessed at baseline from reports by parents or guardians, for the purpose of describing the sample.

Injuries and all adverse events (any medical illnesses or injuries requiring a visit to a medical care provider or institution) during the prior 3 months were formally assessed in both groups at the baseline and follow-up assessments. Adverse events were also monitored continuously, between assessments, as staff became aware of them.

Process measures were included to assess the success of intervention implementation, including participation/attendance rates for each component of the interventions (Stanford only), and ratings of participant and intervention staff satisfaction (GEMS collaborative measures).

Statistical Analysis

Treatment and control groups were compared at baseline using the Wilcoxon-Mann-Whitney test for continuous variables, the Fisher exact test for binary variables, and Pearson, chi-square, and Mantel-Haenszel tests for ordinal data. Intervention effects were assessed by comparing the follow-up values of treatment and control groups with analysis of covariance (ANCOVA), with the baseline value of the outcome, centered at its sample mean, as a covariate.[46] Because we *a priori* anticipated greater magnitude effects on body composition outcomes (BMI and waist circumference) for girls with higher baseline values of those measures, the interaction between treatment assignment and the centered baseline value of the outcome was also included in those analyses, to produce a more accurate and unbiased estimate of the effect size. All outcome analyses were performed according to intention-to-treat principles.[46] To allow comparisons of effect sizes across different measures and studies, standardized effect size (Cohen's d), as expressed in standard deviation multiples, was calculated as the adjusted difference between treatment and control groups, divided by the pooled within-group standard deviation.[78] Treatment vs control group comparisons were evaluated using a 2-tailed alpha=.05 for statistical significance. Because this study was designed as a short-term pilot and feasibility trial, it was not powered sufficiently to detect all clinically significant differences between groups. This sample size of approximately 30 girls per group had 80% power to detect a magnitude difference between groups that is commonly considered a large effect (Cohen's d=.80 SD), only about 45% power to detect a difference commonly considered a medium effect (Cohen's d=0.5), and only about 12% power to detect a difference commonly considered a small effect (Cohen's d=0.2).[78]

RESULTS

The purpose of the pilot study was to test the 12-week intervention and associated measurements for feasibility, as well as the program's potential for efficacy in a randomized controlled trial. The pilot study was not designed to have sufficient power to test for between-group differences in changes in body mass index, which would be the primary outcome in a full-scale trial, or in other outcome measures. The evaluation of the pilot study, therefore, is based on the success of study implementation, intervention process measures, and trends in key physical, behavioral, and psycho-social measures.

Over a 10-week period from mid-January–March 2001, we successfully recruited, screened, assessed, and randomized 61 8–10-year-old African-American girls, exceeding our initial participation goal of 50 girls. All randomized girls met all eligibility criteria. By being visible and recruiting in low-income neighborhoods, involving community leaders in planning, and performing all data collection in participants' homes, instead of requiring them to visit a clinical research center, we were very successful in enrolling a low-income sample: 31% of participating families reported total household incomes of less than $20,000 per year, and 72% reported total household incomes less than $40,000 per year; less than 20% owned their own homes; 56% of girls lived in female-headed households; and only 21% of households included an adult who had graduated from college. Twenty-eight girls were randomized to the treatment group, and 33 girls were randomized to the active control group. Baseline demographic characteristics and fasting blood measures for the treatment and control groups are presented in Table 1, and baseline values of the major outcome measures are presented in Table 2. There were no significant differences between groups at baseline.

Despite the low-income, high-risk status of the sample, our methods also resulted in a high retention rate. One participant (1.6%) who was assigned to the treatment group was lost-to-follow up. Another participant's follow-up height measure could not be used in the analysis, due to a measurement error discovered during data analysis. All other anthropometric measures, 24-hour dietary recalls, and surveys of girls and parents/guardians were obtained from all 60 remaining participants, at both baseline and follow-up. Baseline and follow-up physical activity monitoring data were each obtained from 59 girls (97%), and adequate fasting blood samples were successfully obtained from 52 girls (85%): 25 girls in the treatment group and 27 in the control group, with only 4 unsuccessful attempts and only 5 refusals.

Implementation of Interventions and Process Outcomes

As a pilot and feasibility trial, implementation and process measures were

Table 1. Baseline characteristics of pilot study sample

	Treatment	Control
Number	28	33
Age in years, mean (SD)	9.5 (0.8)	9.5 (0.9)
Number (%) pubertal (≥stage 2 breast or pubic hair)	4 (14.3%)	9 (27.3%)
Girls with a TV in bedroom, *N* (%)	20 (71.4%)	27 (81.8%)
Mean (SD) fasting blood measures (mg/dl)		
Total cholesterol	163.7 (31.9)	164.3 (29.6)
HDL-cholesterol	51.6 (10.9)	55.7 (13.2)
LDL-cholesterol	98.4 (26.6)	94.7 (28.1)
Triglycerides	68.4 (17.0)	69.6 (24.9)
Glucose	89.5 (5.5)	89.9 (6.7)
Insulin	12.1 (8.4)	13.1 (9.4)
At least one parent/caregiver BMI ≥25, *N* (%)	22 (78.6%)	26 (81.3%)
Highest parent/caregiver level of education, *N* (%)		
Some high school	0 (0%)	3 (9.1%)
High school graduate or GED	8 (28.6%)	6 (18.2%)
Some college or technical school	15 (53.5%)	17 (51.6%)
College graduate	5 (17.9%)	7 (21.3%)
Total household income, *N* (%)		
Less than $10,000	3 (10.7%)	6 (18.2%)
$10,000–$19,999	6 (21.4%)	4 (12.1%)
$20,000–$39,999	11 (39.3%)	14 (42.5%)
$40,000+	8 (28.5%)	9 (27.3%)
Families who own their home, *N* (%)	4 (14.3%)	8 (24.2%)
One adult households, *N* (%)	10 (35.7%)	12 (36.4%)
Female headed households, *N* (%)	12 (42.9%)	15 (45.5%)
Age in years of primary caregiver, mean (SD)	38.1 (10.3)	37.2 (11.2)

included to evaluate our intervention approaches. For the treatment intervention, 82% of treatment group families received all 5 START lessons, plus an additional optional follow-up visit. Only 2 families did not participate in START lessons. At follow-up, 82% and 36% of parents/guardians reported receiving and reading all 5 newsletters, respectively (61% reported reading 3 or more). All families that received the 5 lessons hooked up at least one electronic television time manager. On a scale of 1 (very helpful) to 4 (not at all helpful), girls rated the value of the START program an average of 1.9, and parents, 1.4. Girls' suggestions about how to change the GEMS START program ranged from "Let us watch more TV," to "Instead of two weeks of no TV, I would change it into four weeks of no TV," "I would not change the GEMS START Program, because it was fun," and "I liked it." Parents were almost uniformly positive in their suggestions: "No, keep it the way it is. I learned a lot about my kids and how they think about TV and how it effect [sic] the way they react in everyday activities," "I actually thought the program was great . . . I wish that I was more available for the program," and "The program really made me realize how much [time] my child spends watching TV. I don't think you need to change anything."

GEMS Jewels dance classes were offered after school at 3 neighborhood community centers (2 in Oakland, and 1 in East Palo Alto), and continued for the entire 12 weeks for each girl. Dance classes were conducted on 96.6% of the days on which they could have occurred (5 days per week × 12 weeks per girl, excluding school holidays). Overall, 46% of treatment group girls attended our *a priori* predicted average of at least 2 days per week. However, there were large differences across the 2 communities. In East Palo Alto, where the city provides daily after-school buses from the schools to the community centers, 70% attended an average of at least 2 days per week, and 20% attended every single day for their entire 12 weeks. In contrast, Oakland does not provide transportation from schools to community centers, and only 33% attended an average of at least 2 days per week. The barrier of transportation became even more obvious in that 21% of treatment girls (almost all in Oakland) did not attend any of the dance classes. The importance of transportation was also evident in the feedback we received at the end of the program. Many girls expressed disappointment that they could not attend more often, and when parents were asked for suggestions for improving the program, transportation was a frequent theme: "Maybe providing transportation for those who don't have any," "Provide transportation," and "There should be a bus to transport the girls to the dance class when their parents are still at work." The dance classes were highly popular among the participating girls. On a scale of 1 (very fun) to 4 (not at all fun), girls rated the hip-hop classes an average of 1.5, the step classes, 1.7, and the African dance classes, 1.5. Girls also reported practicing dance an average of 3.9 days per week outside of class. When asked about their favorite part of the dance class, girls reported enjoying all aspects of dance: "When we did dance routines," "The music," "Learning how to dance," "Making new steps," "When everyone was dancing," "Everything," and even "When we had a snack." Parents also praised the program: ". . . the kids loved it. It made her feel like she could do something that she felt she could do. She learned that if she put time and effort into something, that she could do it," "The dance class is very excellent," and "Great to have something special for our girls." When asked how they would change it, girls suggested: "Have performance," "I would make it longer," "I would like more time to practice dance," and "Want to dance more in order to learn more steps."

Table 2. Baseline, follow-up, and treatment and control group changes in primary and secondary outcome measures

	Baseline		Follow-up*		Adjusted T-C Difference (95% CI)†	Effect Size‡ (Cohen's d)	*P* Value
	Treatment Mean (SD)	Control Mean (SD)	Treatment Mean (SD)	Control Mean (SD)			
Body mass index (kg/m^2)	20.95 (5.39)	21.57 (5.26)	21.45 (5.49)	22.28 (5.65)	−.32 (−.77, .12)	.38	.16
Waist circumference (cm)	71.00 (13.99)	71.04 (13.15)	71.62 (14.43)	72.12 (13.38)	−.63 (−1.92, .67)	.25	.35
Physical activity noon–6 PM (average CSA counts/min)	721.6 (298.4)	810.3 (329.7)	744.9 (239.2)	750.8 (437.7)	55.1 (−115.6, 225.8)	.21	.53
Moderate-to-vigorous physical activity noon–6 PM (average minutes)	113.0 (53.1)	133.9 (68.1)	102.1 (41.1)	106.6 (70.5)	7.3 (−25.8, 40.4)	.14	.67
Self-reported previous day moderate-to-vigorous physical activity (minutes)	88.9 (64.4)	80.5 (35.9)	87.1 (35.4)	75.5 (45.6)	9.2 (−11.2, 29.6)	.23	.38
TV, videotape and video game use (hrs/week)	18.20 (12.72)	20.66 (13.46)	15.34 (11.66)	21.33 (14.32)	−4.96 (−11.41, 1.49)	.40	.14
Total household TV use (0–4 scale)	2.22 (0.92)	2.27 (1.15)	1.85 (0.90)	2.41 (1.11)	−.56 (−.95, −.17)	.73	.007
Ate breakfast with the TV on (days/week)	1.64 (2.13)	1.12 (1.96)	2.31 (2.71)	2.33 (2.72)	−.09 (−1.52, 1.34)	.03	.90
Ate dinner with TV on (days/week)	2.93 (2.79)	3.36 (3.19)	2.27 (2.57)	3.97 (2.90)	−1.60 (−2.99, −.21)	.59	.03
Total dietary calorie intake per day (kcal)	1561.5 (473.9)	1627.8 (671.0)	1601.4 (718.6)	1545.0 (502.6)	84.3 (−201.5, 370.1)	.15	.57
Percent of dietary kilocalories from fat (%)	33.7 (7.3)	36.2 (5.2)	34.1 (5.2)	35.1 (7.5)	−0.3 (−3.6, 3.0)	.05	.84
Physical activity liking (0–2 scale)	1.23 (.32)	1.13 (.25)	1.26 (.32)	1.16 (.24)	.05 (−.06, .17)	.21	.44
Number of physical activities ever tried	23.21 (3.22)	22.79 (3.29)	23.77 (3.18)	23.15 (3.02)	.44 (−.97, 1.85)	.16	.55
Overconcerns with weight and body shape	2.1 (0.5)	1.9 (0.6)	1.6 (0.5)	1.3 (0.6)	−.26 (−.48, −.04)	.60	.03
Body shape dissatisfaction	1.61 (1.73)	1.03 (1.65)	1.27 (1.61)	1.03 (1.51)	−.10 (−.69, .49)	.09	.73
Most recent school grades (1=mostly A's to 9=mostly F's)	2.63 (1.45)	3.41 (1.97)	2.35 (1.02)	3.06 (1.30)	−.56 (−1.15, .03)	.51	.07
Self-esteem (10=high to 40=low)	19.43 (5.65)	17.21 (4.7)	18.35 (5.01)	16.27 (3.97)	1.20 (−.86, 3.26)	.30	.26

* Unadjusted means and standard deviations.

† Follow-up treatment group minus control group difference adjusted for the baseline value of the dependent variable centered at the sample mean, by ANCOVA. For BMI and waist circumferences, also adjusted for the centered baseline value of the dependent variable by treatment group interaction.

‡ Standardized effect size (Cohen's d) expressed in standard deviation multiples to allow comparisons of effect sizes across different measures and studies, calculated as the adjusted difference between treatment and control groups divided by the pooled within group standard deviation.[78]

At follow-up, parents/guardians in the active control group reported receiving an average of 97%, and reading an average of 83%, of the 5 parent newsletters mailed to them, and girls reported receiving an average of 91%, and reading an average of 70%, of the 11 newsletters mailed to them (the majority of parents and girls reported reading 100%). Because of the well-known difficulties of motivating families to attend functions at schools or community centers, we did not expect high attendance at the community health lectures. We were pleasantly surprised, therefore, that 67% of parents, and 75% of girls, attended at least one of the health lectures, and 37% of parents, and 29% of girls, attended at least 3 (75%) of the 4 lectures offered to them. At follow-up, on a scale of 1 (liked a lot) to 4 (did not like), girls rated their newsletters and accompanying activities an average of 1.3. On a scale of 1 (very helpful) to 4 (not at all helpful), parents/guardians who attended the community health lectures rated them an average of 1.1 and girls rated the lectures an average of 1.4. On a scale of 1 (liked it a lot) to 4 (did not like it), parents gave the lectures an average rating of 1.3, and girls gave an average rating of 1.6. We also found that weeknight lectures were better attended than weekend day lectures.

A single common question was asked at follow up of girls from all 4 GEMS field centers to assess overall satisfaction: "I enjoyed participating in the Stanford GEMS project" (Yes, Not sure, No). Fifty-six (91.8%) of Stanford

GEMS participants answered "Yes." Similarly, at all 4 field centers, intervention staff were asked: "Overall, how satisfied would you say you were with your participation in the Stanford GEMS project?" (1=very satisfied, 2=satisfied, 3=dissatisfied, 4=very dissatisfied). At Stanford, all responses were anonymous. One hundred percent of Stanford GEMS intervention staff responded positively, with 6 of 8 being "very satisfied," and 2 being "satisfied." Additional site-specific questions also were asked about staff's enjoyment of delivering each component of the intervention (1=enjoyed it a lot, 2=enjoyed it a little, 3=didn't enjoy it). Both START intervention staff members "enjoyed it a lot," the 5 dance instructors "enjoyed it a lot," and 1 of 3 staff members who attended community health lectures "enjoyed it a lot," while the other 2 "enjoyed it a little." No staff members responded that they did not enjoy any single component of the program.

Physical and Behavioral Outcomes

The Stanford GEMS pilot and feasibility trial was not designed to have sufficient statistical power to test the efficacy of the treatment intervention, as compared to the control intervention, for any of the outcome variables measured. The results, however, as shown in Table 2, are highly promising.

BMI and Waist Circumference

Compared to girls in the active control group, girls in the treatment group tended to have both lower BMI and lower waist circumference. Although the treatment by baseline BMI interactions, and the treatment by baseline waist circumference interactions were not of statistical significance when associated with their follow-up measures, the power to detect these relationships was limited. As expected, however, there was evidence of somewhat greater treatment effects among participants with greater baseline values. For example, while the standardized effect size (Cohen's d) for BMI was .38 SD units at the mean value of BMI in the sample (as reported in Table 2), it ranged from about −0.2 at the lowest baseline BMI level in the sample, to about 1.7 at the upper extreme of baseline BMI in the sample.

Physical Activity

The investigators predicted, *a priori,* that girls in the treatment group would increase their after-school physical activity by 20% more, compared to girls in the control group, as measured by accelerometer counts. To be comparable with other field centers, however, follow-up physical activity monitoring occurred *after* girls had completed their 12 weeks of dance classes. Although the girls were no longer participating in dance classes at follow up, both the average counts per minute of physical activity, and minutes of moderate-to-vigorous physical activity occurring between noon and 6 PM, increased by about 7% in the intervention group, relative to the control group (Table 2). Analysis of the 3–6 PM time interval demonstrated an approximate 13% relative difference, favoring the intervention group (adjusted difference between groups, Treatment minus Control [T−C]=91.2 counts/min [95% CI=−65.8, 248.3], P=.25). Consistent with these results, treatment group girls self-reported approximately 12% more total minutes of moderate-to-vigorous physical activity on the previous day, relative to controls, on the GEMS Activity Questionnaire. To assess changes while the dance classes were still meeting, 10 treatment group girls wore accelerometers for 4 days, including at least one weekend day during the intervention period. They exhibited an average increase of 54.4±SD 112.9 counts/min per day, and 35.7±SD 221.0 counts/min from 3–6 PM, compared to their baseline values.

Television Viewing and Meals with TV

We also predicted that, compared to the control group, the treatment group would report 20% fewer hours of television, videotape, and video game use, and 10% fewer meals eaten with the television on. As shown in Table 2, at follow up, the treatment group reported 23% less media use, relative to controls (−4.96/21.33), and a statistically significant decrease in total household television use, relative to controls. In terms of meals eaten in front of the television, the treatment group reported 4% fewer (−.09/2.33) breakfasts eaten with the TV on, and a statistically significant 40% decrease (−1.6/3.97) in dinners eaten with the TV on, relative to controls (P=.03).

Twenty-four-hour Dietary Recalls

With such a small sample and an active control intervention that included education about nutrition, we did not predict treatment group improvements in reported macro-nutrient intake on the 24-hour diet recalls. We found a small, non-significant difference in total calorie intake per day, favoring the control group, and a small, non-significant difference in percent of calories derived from fat, favoring the treatment group (Table 2).

Psycho-social Measures

We also assessed a number of self-reported psycho-social outcomes that were considered potentially sensitive to change in response to the treatment intervention. As shown in Table 2, compared to controls, girls in the treatment group demonstrated trends toward greater preference ("liking") for physical activities, and a greater number of different physical activities tried. In addition, treatment group girls demonstrated a statistically significant decrease in their weight concerns on the McKnight Risk Factor Study's Overconcerns with Weight and Shape sub-scale, and a trend toward decreased body dissatisfaction, compared to controls. Treatment group girls also reported a trend toward improvement in their most recent school grades (P=.07), relative to controls. Finally, there was a non-significant trend

toward greater improvement of self-esteem in the control group.

Adverse Events

Adverse events were rare. Over the course of the 12-week pilot study, injuries were reported by 2 girls (7.4%) in the treatment group, and 3 girls (9.1%) in the active control group. Other adverse events (problems requiring a visit to a medical care provider) were reported by 4 girls (14.8%) in the treatment group, and 6 girls (18.2%) in the active control group. One injury in the treatment group was judged to be related to participation in the study (a broken finger). All other injuries and other adverse events in both groups were judged to be unrelated to study participation.

DISCUSSION

The results of the Stanford GEMS Pilot Study are highly promising. This study demonstrates the feasibility, acceptability, and potential efficacy of using after-school dance classes, and a family-based television reduction program, to prevent excess weight gain in 8–10-year-old African-American girls. Although only a 12-week pilot study, GEMS was designed to maximize both internal validity and generalizability, to help inform the design of a full-scale Phase 2 trial, and other subsequent research.

Integrating the project into the community, and designing assessment and intervention methods to meet the needs of participants, led to highly successful recruitment and retention of a low-income, high-risk sample of girls and their families. Only one family was lost-to-follow-up, and completion rates in assessments and participation rates in intervention activities were very high. Participating girls and their parents/guardians rated both the treatment intervention and the active control intervention very highly. Finally, although the pilot study was primarily intended to test feasibility, and was not powered to demonstrate efficacy, there were substantial trends toward effects on body mass index and waist circumference in only 12 weeks. The average BMI and waist circumference increased by about half as much in the treatment group compared to the active control group. In addition, we observed positive trends, and some statistically significant treatment vs control differences, in hypothesized mediators of weight change (amount of television viewing, number of meals eaten in front of the TV, and level of physical activity), in potential psycho-social mediators (physical activity preferences), and in secondary outcomes (weight concerns and school grades).

The Stanford GEMS pilot study was informed by extensive formative research and pilot testing in our study communities.[50] Focus groups and small feasibility trials were conducted in the same neighborhoods that were used for recruitment and, in some cases, pilot study intervention delivery. We believe this contributed to our successful and rapid recruitment of eligible girls and families, and the outstanding retention rate over the 3-month study. Focus groups and small feasibility trials also enabled us to identify specific potential benefits that would motivate both girls and their parents/guardians to participate in the assessments and the proposed intervention activities. Focus groups were not equally informative, however, for all aspects of the study. In particular, focus group feedback suggested that girls would be resistant to fasting blood tests, regardless of the protocols used. However, when phlebotomy was performed by trained and certified female African-American research assistants at the girls' own homes in the mornings, enabling them to fast overnight, only 8% of girls refused, and satisfactory fasting samples were obtained from 85% of the total sample. This result highlights the importance of pilot testing protocols when there is uncertainty about their feasibility.

Intervention delivery was also highly successful, with girls, parents, and intervention staff rating both the treatment and the active control interventions very positively. The major barrier identified was transportation to the after-school dance classes. In areas where transportation from schools to community centers was available, 70% of treatment group girls attended dance classes an average of at least 2 days per week, and 20% attended every day for their entire 12 weeks. In contrast, in areas without transportation from schools to community centers, only 33% of treatment group girls attended dance classes an average of at least 2 days per week. In the Phase 2 full-scale Stanford GEMS trial, we have proposed that the study will provide transportation from schools to community centers in Oakland. Many communities and/or community center-based programs serving low-income neighborhoods do provide transportation for participants. In addition, many after-school programs are now being implemented at school sites, themselves. However, it appears that transportation is an important factor for program planners to consider when evaluating the suitability of particular neighborhoods, and/or community sites, for implementing after-school dance classes.

Some of the results in outcome measures appear particularly promising. Although not definitive, standardized effect sizes of .38 for BMI and .25 for waist circumference over 12 weeks are arguably of clinical importance. These effect sizes are not substantially smaller than those found in 2 prior successful obesity prevention studies.[28,44] In addition, these effects were achieved relative to an active control intervention that included information on altering diet and activity behaviors to prevent obesity, and they emerge in a context in which most past preventive interventions have

had little effect, if any, on body composition.[13,14] Effects on the hypothesized mediating behaviors were also quite promising. The intervention resulted in reductions of more than 20% in television, videotape, and video game use among the treatment group girls, and statistically significant reductions in both reported household television viewing, and the number of dinners eaten while watching television, as compared to controls. Rates of after-school physical activity, as measured by accelerometers, did not increase as much as predicted, in comparison to controls, but the changes were in the expected direction, along with increases in self-reported activity and activity preferences.

Effects on psycho-social outcomes are also of interest. The treatment intervention produced a statistically significant reduction in weight concerns. The clinical implications of this effect are unknown, but this finding argues against suggestions that an obesity prevention intervention for young girls might promote disordered eating attitudes, and/or eating disorders. Finally, treatment group girls reported a near statistically significant improvement in school grades, compared to control group girls. This result is consistent with providing a supervised homework period as part of the dance classes, reducing television, videotape, and video game use, and providing college-educated female African-American role models as dance class instructors and START providers. A health-promoting intervention that also improves school performance would be highly valued by parents/guardians and community leaders.

Our goal was to faithfully apply the principles of social cognitive theory[51] by attending more closely to factors found to be salient among our intended audience. After identifying several potential barriers to directly promoting diet changes and physical activity, we proposed alternative behavioral targets to influence energy balance. We attempted to indirectly influence energy intake by providing after-school activities and by reducing exposure to television, and directly increase energy expenditure by providing opportunities for a highly motivating activity, and by limiting inactivity. We compared this to the more direct, information-based health education approach of our control group. The evidence from this pilot study suggests that this strategy may be efficacious, and warrants further testing in a full-scale clinical trial.

ACKNOWLEDGMENTS

We thank the Stanford GEMS participants and their families, and the community members and community center directors and staff who helped make this study possible. We also thank the other GEMS investigators for their valuable input, which allowed us to improve our study. This research was funded by a grant from the National Heart, Lung, and Blood Institute, NIH (U01 HL62663), and a Robert Wood Johnson Foundation Generalist Physician Faculty Scholar Award.

REFERENCES

1. Centers for Disease Control and Prevention. Update: prevalence of overweight among children, adolescents, and adults—United States, 1988–1994. *MMWR.* 1997;46:199–202.
2. Mokdad AH, Bowman BA, Ford ES, Vinicor F, Marks JS, Koplan JP. The continuing epidemics of obesity and diabetes in the United States. *JAMA.* 2001;286(10):1195–1200.
3. Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM, Johnson CL. Overweight prevalence and trends for children and adolescents: the National Health and Nutrition Examination Surveys, 1963 to 1991. *Arch Pediatr Adolesc Med.* 1995;149:1085–1091.
4. Troiano RP, Flegal KM. Overweight children and adolescents: description, epidemiology, and demographics. *Pediatrics.* 1998;101:497–504.
5. Strauss RS, Pollack HA. Epidemic increase in childhood overweight, 1986–1998. *JAMA.* 2001;286(22):2845–2848.
6. Winkleby MA, Robinson TN, Sundquist J, Kraemer HC. Ethnic variation in cardiovascular disease risk factors among children and young adults: findings from the Third National Health and Nutrition Examination Survey, 1988–1994. *JAMA.* 1999;281(11):1006–1013.
7. Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P. Increased incidence of non-insulin dependent diabetes mellitus among adolescents. *J Pediatr.* 1996;128:608–615.
8. Scott CR, Smith JM, Cradock MM, Pihoker C. Characteristics of youth-onset noninsulin-dependent diabetes mellitus and insulin-dependent diabetes mellitus at diagnosis. *Pediatrics.* 1997;100(1):84–91.
9. Rosenbloom AL, Joe JR, Young RS, Winter WE. Emerging epidemic of type 2 diabetes in youth. *Diabetes Care.* 1999;22(2):345–354.
10. American Diabetes Association. Type 2 diabetes in children and adolescents. *Diabetes Care.* 2000;23(3):381–389.
11. Dabelea D, Pettitt DJ, Jones KL, Arslanian SA. Type 2 diabetes mellitus in minority children and adolescents. *Endocrinol Metab Clin North Am.* 1999;28(4):709–729.
12. Resnicow K. School-based obesity prevention. Population versus high-risk interventions. *Ann N Y Acad Sci.* 1993;699:154–166.
13. Resnicow K, Robinson TN. School-based cardiovascular disease prevention studies: review and synthesis. *Ann Epidemiol.* 1997;suppl 7:S14–S31.
14. Robinson TN, Killen JD. Obesity prevention for children and adolescents. In: Thompson JK, Smolak L, eds. *Body Image, Eating Disorders, and Obesity in Children and Adolescents: Assessment, Prevention, and Treatment.* Washington, DC: American Psychological Association; 2001:261–292.
15. Robinson TN. Population-based obesity prevention for children and adolescents. In: Johnston FE, Foster GD, eds. *Obesity, Growth and Development.* London, UK: Smith-Gordon and Company Ltd; 2001:129–141.
16. Rucker CE, Cash T. Body images, body size perceptions, and eating behaviors among African-American and White college women. *Int J Eat Disord.* 1992;12:291–299.
17. Gray J, Ford K, Kelly L. The prevalence of bulimia in a Black college population. *Int J Eat Disord.* 1987;6:733–740.
18. Akan GE, Grilo CM. Sociocultural influences on eating attitudes and behaviors, body image, and psychological functioning: a comparison of African-American, Asian-American, and Caucasian college women. *Int J Eat Disord.* 1995;18:181–187.
19. Abrams K, Allen L, Gray J. Disordered eating attitudes and behaviors, psychological adjustment and ethnic identity: a comparison of Black and White female college students. *Int J Eat Disord.* 1992;14:49–57.
20. Altabe M. Ethnicity and body image: quantitative and qualitative analysis. *Int J Eat Disord.* 1998;23:153–159.
21. Rand C, Kuldau J. The epidemiology of obesity and self-defined weight problems in the general population: gender, race, age, and social class. *Int J Eat Disord.* 1990;9:329–343.
22. Kumanyika S, Wilson J, Guilford-Davenport M. Weight-related attitudes and behaviors of

Black women. *J Am Diet Assoc.* 1993;93:416–422.
23. Kumanyika SK, Morssink C, Angus T. Models for dietary and weight change in African-American women: identifying cultural components. *Ethn Dis.* 1992;2:166–175.
24. Allan JD, Mayo K, Michel Y. Body size values of White and Black women. *Res Nurs Health.* 1993;16:323–333.
25. Centers for Disease Control. Body weight perceptions and selected weight management goals and practices of high school students—United States, 1990. *MMWR.* 1991;40:741–750.
26. Casper RC, Offer D. Weight and dieting concerns in adolescents: fashion or symptom? *Pediatrics.* 1990;86:384–390.
27. Parker S, Nichter M, Nichter M, Vuckovic N, Sims C, Ritenbaugh C. Body image and weight concerns among African-American and White adolescent females: differences that make a difference. *Hum Organ.* 1995;54: 103–114.
28. Flores R. Dance for health: improving fitness in African-American and Hispanic adolescents. *Public Health Rep.* 1995;110:189–193.
29. Kofsy F. Afro-American innovation and the folk treatment of jazz: their historical significance. *Ethn Stud.* 1979;7:1–12.
30. Hazzard-Gordon K. African-American vernacular dance: core culture and meaning operatives. *J Black Stud.* 1985;15:427–445.
31. Emery LF. *Black Dance in the United States from 1619 to 1970.* Palo Alto, Calif: National Press Books; 1972.
32. Hazzard-Gordon K. *Jookin': The Rise of Social Dance Formations in African-American Culture.* Philadelphia, Pa: Temple University Press; 1990.
33. Hanna JL. Moving messages: identity and desire in popular music and social dance. In: Lull J, ed. *Popular Music and Communication.* 2nd ed. Newbury Park, Calif: Sage Publications, Inc; 1992:175–195.
34. Farr M. The role of dance/movement therapy in treating at-risk African-American adolescents. *Arts Psychother.* 1997;24:183–191.
35. Robinson TN. Does television cause childhood obesity? *JAMA.* 1998;279:959–960.
36. Robinson TN. Television viewing and childhood obesity. *Pediatr Clin North Am.* 2001; 48(4):1017–1025.
37. Roberts DF, Foehr UG, Rideout VJ, Brodie M. *Kids & Media at the New Millenium: A Comprehensive National Analysis of Children's Media Use.* Menlo Park, Calif: The Henry J. Kaiser Family Foundation; 1999.
38. Robinson TN, Killen JD. Ethnic and gender differences in the relationships between television viewing and obesity, physical activity, and dietary fat intake. *J Health Educ.* 1995; 26:S91–S98.
39. Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: results from the third National Health and Nutrition Examination Survey. *JAMA.* 1998;279:938–942.
40. Gortmaker SL, Must A, Sobol AM, Peterson K, Colditz GA, Dietz WH. Television viewing as a cause of increasing obesity among children in the United States, 1986–1990. *Arch Pediatr Adolesc Med.* 1996;150:356–362.
41. Epstein LH, Valoski AM, Vara LS, et al. Effects of decreasing sedentary behavior and increasing activity on weight change in obese children. *Health Psychol.* 1995;14:109–115.
42. Epstein LH, Paluch RA, Gordy CC, Dorn J. Decreasing sedentary behaviors in treating pediatric obesity. *Arch Pediatr Adolesc Med.* 2000;154:220–226.
43. Gortmaker SL, Peterson K, Wiecha J, et al. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. *Arch Pediatr Adolesc Med.* 1999;153: 409–418.
44. Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. *JAMA.* 1999;282:1561–1567.
45. Ford BS, McDonald TE, Owens AS, Robinson TN. Primary care interventions to reduce television viewing in African-American children. *Am J Prev Med.* 2002;22(2):106–109.
46. Rochon J. Common design elements of the girls health enrichment multi-site studies. *Ethn Dis.* 2003:S1-6–S1-14.
47. Story M. Recruitment of African-American pre-adolescent girls into an obesity prevention trial: the GEMS pilot studies. *Ethn Dis.* 2003: S1-78–S1-87.
48. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med.* 1997;337:869–873.
49. NIH Expert Panel on the Identification Evaluation and Treatment of Overweight and Obesity in Adults. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults.* Bethesda, Md: Obesity Education Initiative, National Heart, Lung, and Blood Institute, National Institutes of Health; 1998.
50. Kumanyika S. Collaborative planning for formative assessment and cultural appropriateness in the girls health enrichment multi-site studies (GEMS): a retrospection. *Ethn Dis.* 2003:S1-15–S1-29.
51. Bandura A. *Social Foundations of Thought and Action.* Englewood Cliffs, NJ: Prentice-Hall; 1986.
52. Resnicow K, Baranowski T, Ahluwalia JS, Braithwaite RL. Cultural sensitivity in public health: defined and demystified. *Ethn Dis.* 1999;9(1):10–21.
53. Marin G. Defining culturally appropriate community interventions: Hispanics as a case study. *Community Psychol.* 1993;21:149–161.
54. Anderson LP. Acculturative stress: a theory of relevance to Black Americans. *Clin Psychol Rev.* 1991;11:685–702.
55. Anderson NB, Armstead CA. Toward understanding the association of socioeconomic status and health: a new challenge for the biopsychosocial approach. *Psychosom Med.* 1995; 57:213–225.
56. Gaines SO, Marelich WD, Bledsoe KL, et al. Links between race/ethnicity and cultural values as mediated by race/ethnicity identity and moderated by gender. *J Pers Soc Psychol.* 1997; 72:1460–1476.
57. Harrison AO, Wilson MN, Pine CJ, Chan SQ, Buriel R. Family ecologies of ethnic minority children. *Child Dev.* 1990;61:347–362.
58. Helms J. Review of racial identity terminology: Black and White racial identity development models. In: Helms J, ed. *Black and White Racial Identity: Theory, Research, and Practice*. Westport, Conn: Greenwood Press; 1990.
59. Jackson JS, Brown TN, Williams DR, Torres M, Sellers SL, Brown K. Racism and the physical and mental health status of African Americans: a thirteen year national panel study. *Ethn Dis.* 1996;6:132–147.
60. Levin SJ, Taylor RJ, Chatters LM. Race and gender differences in religiosity among older adults: findings from four national surveys. *J Gerontol.* 1994;49:S137–S145.
61. Resnicow K, Braithwaite RL, Kuo J. Interpersonal interventions for minority adolescents. In: Wilson DK, Rodrigue JR, Taylor WC, eds. *Health Promoting and Health Compromising Behaviors Among Minority Adolescents.* Washington, DC: American Psychological Association; 1997.
62. Cook TD, Campbell DT. *Quasi-Experimentation. Design & Analysis Issues for Field Settings.* Boston, Mass: Houghton Mifflin Company; 1979.
63. Kazdin AE, Wicoxon LA. Systematic desensitization and non-specific treatment effects: a methodological evaluation. *Psychol Bull.* 1976;83:729–758.
64. Shapiro AK, Morris LA. The placebo effect in medical and psychological therapies. In: Garfield SL, Bergin AE, eds. *Handbook of Psychotherapy and Behavior Change.* New York, NY: John Wiley & Sons; 1978:369–410.
65. Dietz WH, Robinson TN. Use of the body mass index (BMI) as a measure of overweight in children and adolescents. *J Pediatr.* 1998; 132:191–193.
66. Lohman TG, Roche AF, Martorell R. *Anthropometric Standardization Reference Manual.* Champaign, Ill: Human Kinetics Publishers; 1988.
67. Caprio S, Hyman LD, Limb C, et al. Central adiposity and its metabolic correlates in obese adolescent girls. *Am J Physiol Endocrinol Metab.* 1995;269:E118–E126.
68. Caprio S, Hyman LD, McCarthy S, Lange R, Bronson M, Tamborlane WV. Fat distribu-

tion and cardiovascular risk factors in obese adolescent girls: importance of the intra-abdominal fat depot. *Am J Clin Nutr.* 1996;64: 12–17.
69. Freedman DS, Serdula MK, Srinivasan SR, Berenson GS. Relation of circumferences and skinfold thicknesses to lipid and insulin concentrations in children and adolescents: The Bogalusa Heart Study. *Am J Clin Nutr.* 1999; 69:308–317.
70. Morris NM, Udry JR. Validation of a self-administered instrument to assess stage of adolescent development. *J Youth Adolesc.* 1980; 9:271–280.
71. Tanner JM. *Growth at Adolescence.* 2nd ed. Oxford, England: Blackwell Scientific Publications; 1962.
72. Borzekowski DLG, Robinson TN. Viewing the viewers: 10 video case studies of children's television viewing behaviors. *J Broadcasting Electron Media.* 1999;43:506–528.
73. Medrich EA. Constant television: a background to daily life. *J Commun.* 1979;29: 171–176.
74. Shisslak CM, Rneger R, Sharpe T, et al. Development and evaluation of the McKnight Risk Factor Survey for assessing potential risk factors for disordered eating in preadolescent girls. *Int J Eat Disord.* 1999;25:195–214.
75. Silber E, Tippett J. Self-esteem: clinical assessment and measurement validation. *Psychol Rep.* 1965;16:1017–1071.
76. Rosenberg M. *Society and the Adolescent Self-Image.* Princeton, NJ: Princeton University Press; 1965.
77. Rosenberg M. *Conceiving the Self.* New York, NY: Basic Books; 1979.
78. Cohen J. *Statistical Power Analysis for the Behavioral Sciences.* 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Assoc; 1988.