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A Randomized controlled trial of culturally-tailored dance and reducing screen time to prevent weight gain in low-Income African-American girls: Stanford GEMS

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Abstract

Objective—To test a 2-year community- and family-based obesity prevention intervention for low-income African-American girls.

Design—Randomized controlled trial with follow-up measures scheduled at 6, 12, 18 and 24 months.

Setting—Low-income areas of Oakland, CA.

Participants—261 8–10 year old African-American girls and their parents/caregivers.

Interventions—Families were randomized to two-year, culturally-tailored interventions: (1) after school Hip-Hop, African and Step dance classes and a home/family-based intervention to reduce screen media use or (2) information-based health education.

Main Outcome Measure—Body mass index (BMI) change.

Results—Changes in BMI did not differ between groups (adjusted mean difference [95% confidence interval] = 0.04 [−.18, .27] kg/m^2 per year). Among secondary outcomes, fasting total cholesterol (−3.49 [−5.28, −1.70] mg/dL per year), LDL-cholesterol (−3.02 [−4.74, −1.31] mg/dL per year), incidence of hyperinsulinemia (Relative Risk 0.35 [0.13, 0.93]), and depressive symptoms (−0.21 [−0.42, −0.001] per year) fell more among girls in the dance and screen time reduction intervention. In exploratory moderator analysis, the dance and screen time reduction intervention slowed BMI gain more than health education among girls who watched more television at baseline (P=.02) and/or those whose parents/guardians were unmarried (P<.01).

Conclusions—A culturally-tailored after-school dance and screen time reduction intervention for low-income, preadolescent African-American girls did not significantly reduce BMI gain compared to health education, but produced potentially clinically important reductions in lipids,

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hyperinsulinemia, and depressive symptoms. There was also evidence for greater effectiveness in high-risk subgroups of girls.

Keywords

obesity prevention; children; girls; diet; physical activity; television; sedentary behavior; cholesterol; hyperinsulinemia; health disparities; randomized controlled trial; African-American; black

INTRODUCTION

Child and adolescent obesity have more than tripled among African-American girls since the 1960's, with the greatest increases since 1980.[1–3] Body mass index (BMI) differences between white and black girls are present before age six years, significantly widen in older age groups, and are independent of socioeconomic status.[4] Reviews of cardiovascular disease and cancer risk reduction studies in children and adolescents suggest that body weight may be more difficult to change than other risk factors.[5–7] Few studies have tested intervention strategies specifically designed for African-American girls and their families.[8–13]

Girls' health Enrichment Multi-site Studies (GEMS) was a National, Heart, Lung, and Blood Institute (NHLBI)-sponsored collaborative effort to develop and test interventions to reduce weight gain in African-American preadolescent girls.[8–13] This paper describes the outcomes of the Stanford GEMS trial, a 2-arm parallel group, randomized controlled trial to test the efficacy of a culturally-tailored after school dance program and a family-based intervention to reduce television, videotape and video game use to reduce body mass index gain among lower socioeconomic status (SES) African-American pre-adolescent girls. Participants were randomized to the dance and television reduction intervention versus an information-based health education intervention for 2 years.

METHODS

The design, methods and baseline sample characteristics were previously described in detail.[14] Community members were extensively involved in designing the study. The study and protocols were approved by the Stanford University Administrative Panel on Human Subjects in Medical Research and the National Heart, Lung, and Blood Institute. A six-member, independent Data & Safety Monitoring Board (DSMB) was selected by NHLBI and met 1–2 times per year to approve the protocol and review trial progress and safety.

Participant Recruitment

To enroll a representative sample of lower SES African-American girls, we recruited from schools, community centers, churches and community events in low- income, predominantly African-American neighborhoods in Oakland, CA, and performed all assessments in participants' homes; eliminating the need for families to come to a clinical research center.

Eligibility criteria and exclusions

Eligible girls were identified as "African-American or Black" by their parent/guardian, and age 8, 9, or 10 years on the date of randomization. To select a community-based group at higher risk, Girls were required to have a BMI ≥ 25th percentile for age and/or at least one overweight parent/guardian (BMI ≥ 25 kg/m^2).[15] Girls were excluded with BMI > 35 kg/m^2; if diagnosed with a medical condition or taking medications affecting growth; had a condition limiting their participation in the interventions or assessments; were unable to

understand or complete informed consent; planned to move from the area; were homeless; or had no television.[14]

Randomization

After completing baseline measures families/households were randomized by computer using Efron's biased coin randomization to produce similar sample sizes in each group.[16]

Interventions

The background and conceptual models for the Treatment and active-placebo Comparison interventions were described previously,[12, 14] and were shaped by extensive formative research and the Stanford GEMS pilot study.[12, 17]

The Dance and Screen Time Reduction Treatment Intervention was founded in Bandura's social cognitive model.[12, 14, 18, 19] To incorporate African-American culture into our intervention, we emphasized elements to address both surface structure (e.g., culturally matched models, music, language) and deep structure (e.g., values, social and historical influences).[20]

The GEMS Jewels After School Dance Intervention was offered five days per week, 12 months per year (excluding school holidays), at community centers in selected neighborhoods. Daily sessions lasted up to 2.5 hours and started with a one-hour homework period and small snack followed by 45–60 minutes of learning and practicing dance routines. Three styles of dance were taught: traditional African dance, Hip-Hop, and Step. Additional activities to maintain motivation included: "GEMS Jamboree" dance performances approximately every 8 weeks for families and friends, including awards for each girl based on Kwanzaa principles; videotaped feedback; allowing girls to teach each other and choreograph routines; opportunities for participant choice and control; and performances at public events. Dance classes were led by female African-American college students and/or recent graduates from the local community where possible, to serve as role models for dance, maintaining cultural identity, and educational achievement. Although individual girls were the unit of study, the dance intervention was considered an environmental intervention, with girls attending as often as they wish.

Sisters Taking Action to Reduce Television (START) is a home-based screen time reduction intervention designed to incorporate African or African-American history and culture,[12] including up to 24 lessons over two years. Young adult, African-American female "START mentors" met with families in their homes to deliver each lesson, following the screen time reduction model developed over several prior studies.[12, 21, 22]

The Active-Placebo[23, 24] *Health Education Comparison Intervention* was selected to address the possibility of resentful demoralization and/or compensatory rivalry.[14, 25] It consisted of state-of-the-art, culturally-tailored, authoritative, information-based health education on nutrition, physical activity, and reducing cardiovascular and cancer risk. It included 24 monthly newsletters for the girls (*Felicia's Healthy News Flash*) and their parents/guardians (*Stanford GEMS Health Report*), and quarterly community center health lectures (*Family Fun Nights*). The same monitoring and incentive schedules employed for our experimental Treatment condition were used.[14]

Assessments and measures

Data collection was scheduled every six-months in participants' homes by trained, female African-American research assistants, blinded to experimental assignment.[14] For test-retest

reliability a duplicate set of physical measures were prompted randomly for approximately 10% of participants throughout the study.

Primary outcome measure

Body mass index (BMI, weight in kilograms divided by the square of the height in meters) was chosen for its accessibility, reliability, measurement validity and clinical validity.[26, 27] Weight and height were measured indoors in lightweight clothing without shoes.[14] Test-retest reliability: weight = 1.00; height = .99.

Secondary outcome measures

Waist Circumference was measured to the nearest millimeter using a non-elastic metric tape at end-expiration using the umbilicus as a landmark.[14] Test-retest reliability = .99.

Triceps skinfold thickness was measured on the right arm.[14, 28] Test-retest reliability = .99.

Resting Blood Pressure and Resting Heart Rate were measured according to established protocols.[14]

Fasting Serum Insulin, Glucose, and Lipids were collected at baseline and the final follow-up visit after an overnight fast of at least 8 hours.[14] Assays were conducted by the Stanford University Hospital Clinical Laboratory, a participant in the Centers for Disease Control – NHLBI Lipid Standardization Program (with ≤5% intraassay precision and ≤6% interassay precision).

Additional secondary outcome measures and potential moderators and/or mediators of intervention effects

Physical Activity was assessed annually on three consecutive days, including a weekend day, using the Actigraph accelerometer (Manufacturing Technologies Inc., MTI, formerly, Computer Sciences and Applications, CSA) secured at the hip using an elastic belt.[14] We used previously validated methods to clean data and estimate average counts per minute and minutes of moderate-to-vigorous physical activity,[29] using published count thresholds from adolescent girls (≥ 3000 counts per minute).[30]

Physical Activity Preferences were assessed annually.[12, 31]

Television Viewing, Videotape Viewing, Video Game, and Computer Use were measured with a self-report instrument proved sensitive to change.[12, 21] Parents/guardians reported overall household television viewing.[21, 32]

Eating Meals with the Television on was reported by children using items previously validated[33] and sensitive to change.[12, 21]

Dietary Intake was assessed annually by 24-hour recalls on three nonconsecutive days, including one weekend day and two weekdays, using the University of Minnesota Nutrition Coordinating Center (NCC) Nutrition Data System for Research (NDS-R).[14] Data collectors were trained in NCC protocols and certified.[34]

Self-reported psychosocial measures were assessed annually, including *Overconcern with Weight and Shape*, using the McKnight Risk Factor Survey,[35, 36] *Self-Perceived body shape and body shape dissatisfaction* using African-American pre-adolescent female body figure silhouettes,[36] *Depressive symptoms* using the 10-item short form of the Children's

Depression Inventory (CDI),[37] *Self-Esteem* using the 10-item Rosenberg Self-esteem scale,[38, 39] and *School Performance*.[12]

To assess *African-American Ethnic/Cultural Identity,*[40] parents/caregivers completed measures of African-American family practices and values, preferences for things African-American, racial segregation,[41] and participation in African-American activities,[42] at baseline and the final follow-up visit

Sexual Maturation was self-reported at every measurement visit using drawings and descriptions of the pubertal stages[43] and age at menarche.

At baseline, parents/caregivers reported the girl's *race, ethnicity, date of birth,* and *household membership, parent/caregiver education levels,* and *total household income*.

Statistical Analysis

Baseline Treatment and Comparison group differences and baseline differences between those with and without follow-up data were assessed with Wilcoxon-Mann-Whitney U tests for scaled variables and Chi-Square tests for categorical variables. To use all of the prospective data collected, BMI measures (up to five per participant) defined individual trajectories of change over the entire two-year trial.[14] Using Random Regression Models (RRM)[44] trajectories of change in BMI were regressed on intervention group assignment (centered), with the baseline value of BMI (centered at its mean) and the Intervention x baseline BMI interaction as covariates.[45–49] RRM have advantages over other repeated measures analysis methods, accommodating differential lengths of follow-up, irregular measurement intervals and missing data.[44, 50] Analyses followed intention-to-treat principles. For 18 girls with no follow-up data, BMI trajectories were imputed using a multivariate linear regression model predicting BMI change from baseline measures for each group. The same RRM and imputation approaches were used for secondary outcome variables. The results did not change materially when repeating the analysis including only those girls with FU4 measures (completers analysis), so only the primary intent-to-treat analysis results are reported. We explored potential moderators of treatment effects defined *a priori* using the methods of Kraemer and colleagues.[51, 52]

For a two-sided 5% alpha level test, the planned sample size of 130 girls per group provided approximately 90% power to detect an intervention effect, Cohen's $d = 0.4$ or greater,[53, 54] equivalent to a difference of about 1 kg/m^2 at 24 months for a BMI SD = 5.5 and an estimated 0.90 correlation between baseline and 24-month follow-up BMI.[14]

RESULTS

Participant recruitment, enrollment, and flow are displayed in Figure 1. Baseline characteristics and comparisons are reported in Tables 1 and 2. Only 18 girls were lost-to-follow-up after baseline. 126 (94.0%) dance and screen time reduction Treatment girls and 117 (92.1%) health education Comparison girls completed at least one follow-up assessment ($P = .54$). Of all baseline measures, the 18 dropouts had smaller average waist circumferences (mean ± SD = 63.3 ± 10.0 vs. 69.5 ± 12.8 cm; $P = .03$), triceps skinfold thicknesses (12.8 ± 5.1 vs. 17.8 ± 8.3 mm; $P = .01$), and triglyceride levels (n=13 versus n=195; 48.2 ± 17.0 vs. 65.5 ± 32.5 mg/dL; $P = .02$) than the 243 girls with follow-up data, but no other statistically significant differences. The mean ± SD length of follow-up was 25.7 ± 8.5 months (median 27.0, maximum = 40.6) for the Treatment girls and 25.2 ± 9.6 months (median = 27.0, maximum = 38.9) for Comparison girls ($P = .82$).

Intervention Implementation and Process Outcomes

The *a priori* goal mean attendance rate at dance classes was 0.6 or more (an average of 3 days per week). However, treatment group girls attended only mean ± SD = .21 ± .22 (median = .12, Interquartile [IQ] range = .02–.34, minimum 0, maximum .81) of possible dance classes, from randomization to their last assessment. 9 (7%), 73 (54%), 25 (19%), 17 (13%), and 10 (8%) girls attended an average of zero, less than one, one, two, and three or more days per week, respectively. Attendance rates fell over the course of the study (Figure 2). Two main challenges impacted dance class attendance. First, changes in community center leadership or episodes of violent crime at or near the community centers where dance classes were held necessitated changing intervention sites six times. Second, the local transportation vendor ended service abruptly early in the study. We eventually provided our own vans and drivers but attendance rates never fully recovered. At FU4 girls reported practicing dance outside of class a mean ± SD = 2.7 ± 2.6 days per week (45% on 3 or more days per week) for a mean ± SD = .83 ± .50 hours (37% for 1 hour or more) confirming the motivating aspect of the intervention.

We were able to deliver mean ± SD = 12.4 ± 6.3 (median = 13, IQ range = 7–18) out of 25 possible START lessons. 70% of families received at least the first seven lessons, defined as the basic skills portion of the intervention, 29% received 7–14 lessons, 34% received 15 – 20 lessons, and 7% received 21 or more. 77% hooked up at least one TV Allowance electronic TV time manager (12% two or more) and the mean ± SD reported weekly screen time budget goal was 10.0 ± 2.4 hours (median = 10, IQ range = 7.5–12).

All 24 educational newsletters were able to be sent to valid addresses for 94% of active placebo health education girls and parents/guardians. 87% of girls reported reading at least half of the Felicia's Healthy News Flash newsletters (66% almost all or all). Families attended 1.1 ± 1.4 (median = 1, IQ range = 0–2) of eight possible evening health education events. Additional Saturday summer Health Education Fairs were attended by 31% of 94 families enrolled by the summer of the first year and 14% of 127 families in the second summer of the study. 80% of parents/guardians reported reading at least half of the Stanford GEMS Health Report newsletters (54% almost all or all). All elements of the Treatment and Comparison interventions were rated highly for fun and helpfulness by girls and parents/guardians.

Primary and Secondary Outcomes

Outcomes are reported in Table 2. There was no statistically significant difference between groups for change in BMI, the primary outcome. Among pre-specified secondary outcomes, fasting total cholesterol and LDL-cholesterol, and depressive symptoms fell statistically significantly more among girls in the treatment group. Parents/guardians in the treatment group also reported significantly increased preferences for things African-American, compared to Comparison parents. Differences between groups were in the expected direction for most other secondary outcome measures but were not statistically significant. Incidences based on high-risk thresholds of categorical outcomes are reported in Table 3. These results suggest a significant Treatment group benefit in the incidence of marked hyperinsulinemia (≥ 30 mIU/ml) (Figure 3).

Moderator Analysis

We explored *a priori*-defined baseline (pre-randomization) measures as potential moderators of treatment effects on the primary outcome BMI, to identify subgroups that may have responded more or less to the intervention.[51, 52] Parent/guardian marital status (P<.01) and baseline hours of television viewing (P=.02) were statistically significant moderators of intervention effects (Figure 4).

Systematic monitoring of all injuries and other medical problems requiring a visit to a medical care provider, height growth velocity, and BMI loss[14] suggested no increased risk associated with participation in the study as a whole or between intervention groups (all $P \geq .20$). No injuries or illnesses were judged to be "probably" or "definitely" related study participation.

DISCUSSION

A culturally-tailored after school ethnic dance program and a home/family-based intervention to reduce screen time among low-income African-American pre-adolescent girls did not reduce BMI gain compared to health education. However, girls randomized to ethnic dance and screen time reduction significantly lowered their fasting total cholesterol and LDL-cholesterol, depressive symptoms, and the incidence of elevated fasting insulin levels, compared to girls randomized to health education. Changes of most other pre-specified secondary outcomes also favored the ethnic dance and screen time reduction intervention with small to medium effect sizes,[53] but were not statistically significant. Consistent with the cultural orientation of the intervention, Treatment group parents/guardians also significantly increased their preferences for African-American culture and activities. Exploratory moderator analysis also indicated that the experimental intervention reduced BMI gain more than health education among the subgroups of girls who had unmarried parent/guardians and/or watched more television at the start of the study.

The effects on total cholesterol, LDL- cholesterol, depressive symptoms, and the incidence of elevated fasting insulin, may represent reduced risks of future cardiovascular disease, diabetes and psychosocial problems. Changes in these important clinical parameters have rarely been achieved by population-based interventions for children.[55, 56] Total cholesterol and LDL-cholesterol levels fell an average of about 3.5 and 3.0 mg/dL per year more, respectively (or about 7.0 and 6.0 mg/dL over the two year course of the study) among girls randomized to ethnic dance and screen time reduction than to health education. The incidence of fasting insulin ≥ 30 uIU/ml was about 65% less in the dance and screen time reduction group over the course of the study, representing a relatively small NNT of 9. We believe these differences would be of clinical and policy significance when applied across the population. In addition, the results of the exploratory moderator analysis[51, 57] suggests the intervention might more effectively reduce BMI gain if targeted toward particular high-risk samples. We also found no evidence for increased weight concerns nor body dissatisfaction, consistent with prior findings[12] that interventions designed to prevent obesity have not put girls at higher risks of disordered eating problems.

It is possible that the overall BMI results indicate a failure of this intervention approach for obesity prevention. We do not believe that is necessarily the case. Previous clinical trials demonstrating the effects of reducing screen time on BMI[12, 21, 58, 59] and favorable trends in many of the measures of screen time, physical activity and energy intake behaviors, argue against a failure of the intervention model. Instead, we believe difficulties experienced in implementation, resulting in lower than projected intervention doses, represent the most likely explanation. Median attendance rates at dance classes were only 12%, one fifth of the goal rate, and the mean difference between groups in changes in screen time was 22 minutes per year, substantially less than prior studies,[12, 21, 58, 59] and age- and sex-standardized BMI change over the course of the study was weakly inversely associated with dance class attendance ($r = -0.04$) and number of TV lessons completed ($r = -0.12$) among Treatment girls. Another potential explanation is that the attention-placebo health education Comparison intervention produced greater effects than anticipated. The attention-placebo has many important practical and conceptual benefits but if it produces behavior change itself, it could make it more difficult to detect Treatment intervention effects. It is impossible

to determine whether this occurred, but the rate of increase in BMI in our health education group was substantially less than that observed in some other contemporary cohorts of African-American girls, including the control cohort in the Memphis GEMS trial[60] and the GEMS pilot studies,[10–12] among others.[61] We still believe the advantages of the attention-placebo control outweigh the potential risks in this study setting but it is important to balance these possibilities carefully when designing comparison conditions for future studies.

Other findings also deserve attention. We observed particularly high rates of cardiovascular disease and diabetes risk factors. At study entry, when only 8–10 years of age, nearly 1 in 5 girls in the sample had elevated levels of fasting cholesterol (≥ 200 mg/dL) and LDL cholesterol (≥130 mg/dL) and nearly 5% had markedly elevated fasting insulin (≥ 30 uIU/ml). Over the subsequent two years, we observed additional new onset of elevated total cholesterol, elevated LDL cholesterol, low HDL cholesterol, and elevated insulin of about 5%, 5%, 7%, and 11%, respectively, and about 1% incidence of diabetes mellitus (fasting glucose ≥ 126 mg/dL). Accelerometer measures indicated only about one half hour of moderate to vigorous physical activity per day at baseline, which decreased rapidly at an average rate of about 5 minutes per day per year over the two years of the study. Nearly 4 out of 5 girls reported having a television in her bedroom, exceeding the national average for girls this age,[62] girls ate about 2 breakfasts and 3 dinners per week in front of the television, and consumed about 35% of their energy intake from fat. These findings indicate a particularly high-risk population and reinforce the critical importance of additional research to find effective interventions to meet their needs.

Although we experienced a number of implementation barriers, it should not deter others from performing research, particularly RCTs, in this or similar low SES populations and settings. By involving community members in designing the study and formulating methods to address anticipated barriers, we still successfully recruited and retained a particularly high-risk sample. Less than 7% of the sample was lost to follow-up and more than 86% completed their final follow-up visit after 2 years of participation.

Few past diet and physical activity interventions have reduced body fat and weight gain,[5, 63] and few studies have tested obesity prevention interventions specifically designed to meet the needs of pre-adolescent African-American girls and their families, despite their increased rates of obesity and associated morbidities. Stanford GEMS was designed with particular attention to applying theory and experience to help address the paucity of research in this area. Despite implementation difficulties, an intervention applying Bandura's social cognitive model[18, 19] to a community-based urban setting with low-income, African-American girls and their families produced potentially clinically important changes in lipids, insulin and depressive symptoms, compared to health education. While there was no significant BMI difference between groups, the primary outcome, there was evidence for effects on BMI in subsets of higher risk girls, with unmarried parents/guardians and/or high baseline television viewing. These results are promising and suggest a need for continued solution-oriented research[64] to identify those approaches and methods that produce greater effects in population-based samples of children.

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full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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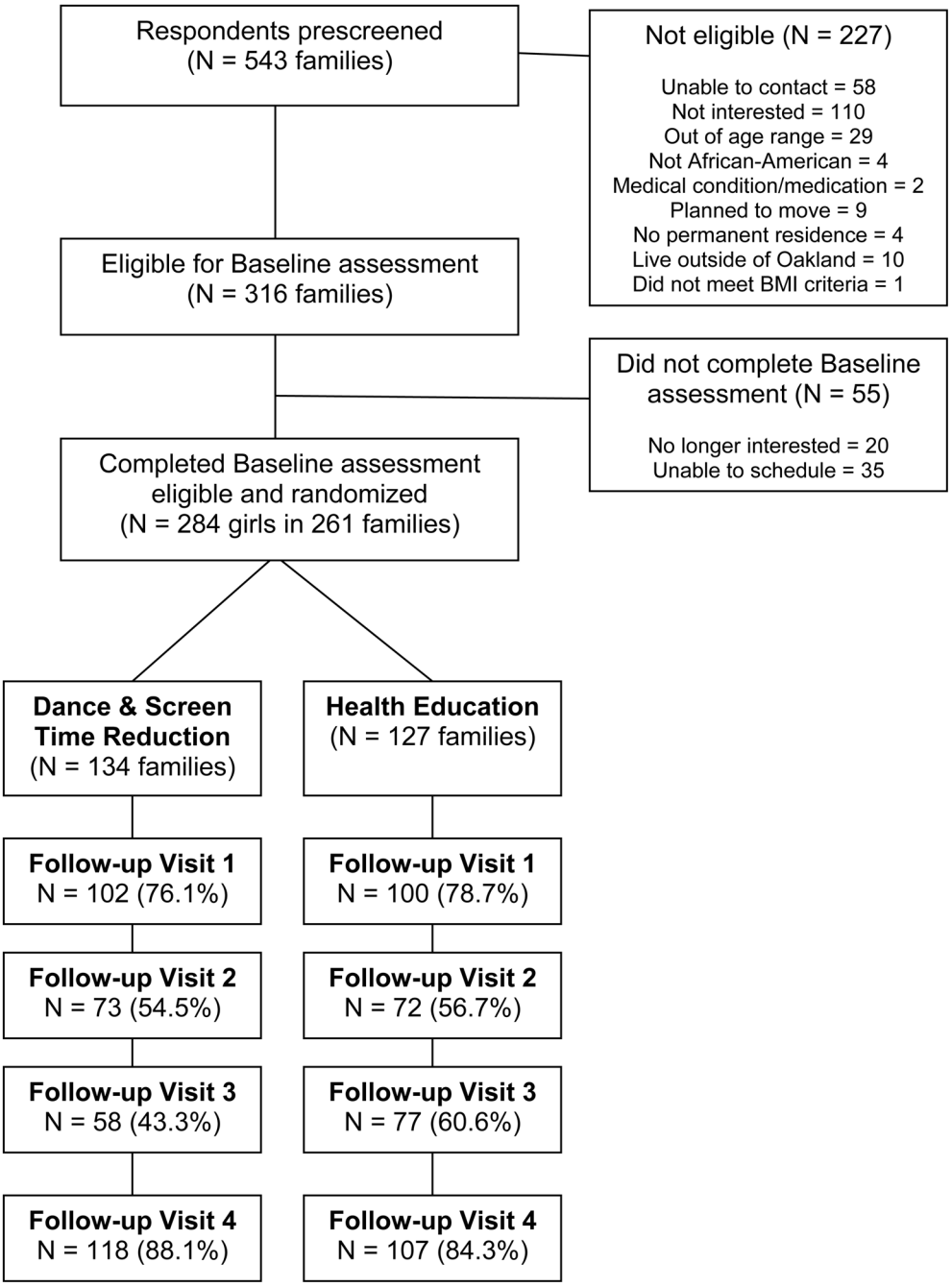

Figure 1. Participant Recruitment and Enrollment Flow Chart

261 families/households with 284 eligible girls were recruited, enrolled and randomized in the trial from October 2002 thru February 2004. In families/households with more than one eligible girl, one girl was randomly chosen for the analysis sample of 261 girls. The only statistically significant difference in follow-up rates between groups was at FU3 (P=.005). Sixteen (11.9%), 27 (20.2%), 51 (38.1%), and 32 (23.9%) Treatment group girls and 15 (11.8%), 14 (11.0%), 39 (30.7%), and 49 (38.6%) Comparison group girls completed a total of 1, 2, 3 or all 4 of the follow-up visits (P = .053). Personnel difficulties with data collectors resulted in larger rates of missing data at FU2 and FU3.

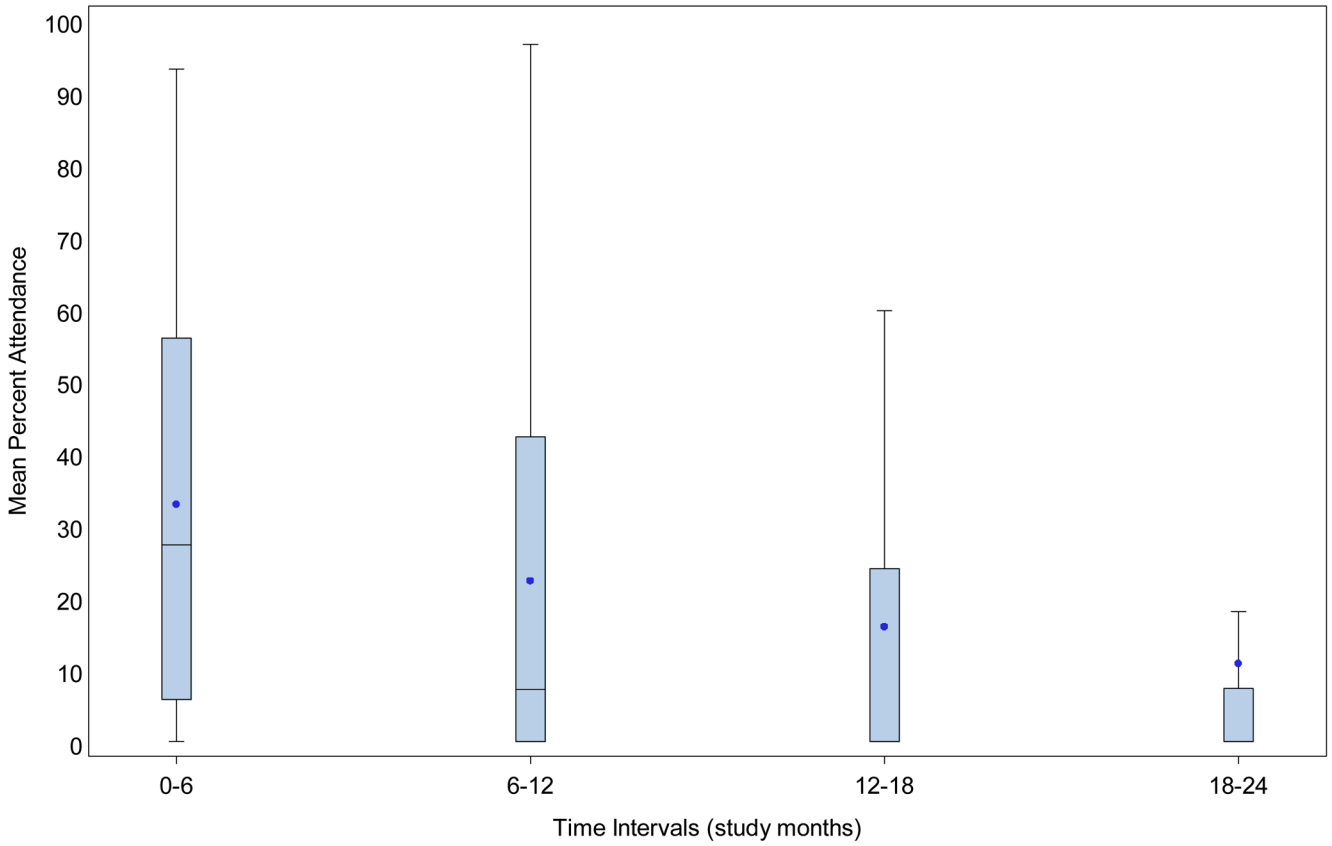

Figure 2. Dance Class Attendance Rates by Time Period

Attendance dropped substantially over the course of the study. Box-and-whisker plots of the girls' mean percent attendance of all possible dance classes during their first, second, third and fourth six months of participation in the study. Means are indicated by the point, medians are the central horizontal line, the box defines the 25th and 75th percentiles, and whiskers indicate 1.5 interquartile ranges beyond the 25th and 75th percentiles. In the third and fourth six month intervals, the median and 25th percentile overlap with a value of 0.

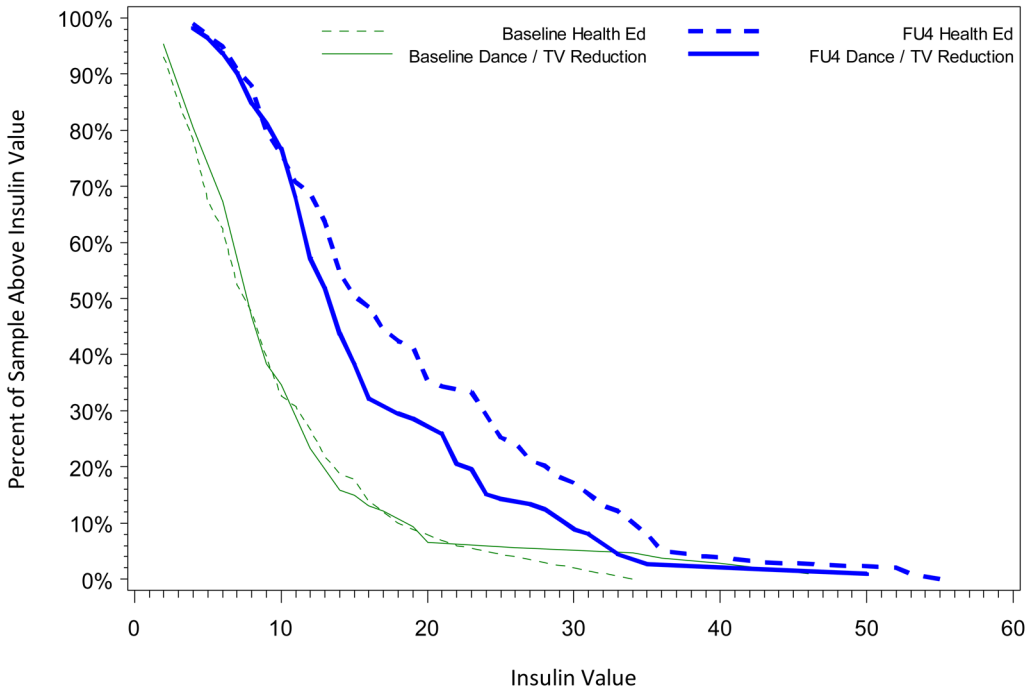

Figure 3.

Fasting Insulin Sample Distributions by Intervention Group at Baseline and Follow-Up. Percent of the dance and screen time reduction sample (baseline thin solid line, follow-up thick solid line) and the health education sample (baseline thin dashed line, follow-up thick dashed line) with fasting insulin above the corresponding threshold level on the horizontal axis (in uIU/ml). As shown, the distribution of fasting insulin levels shifted to the right (greater fasting insulin levels) among girls in the health education group compared to the girls in the dance and screen time reduction group, from baseline to FU4.

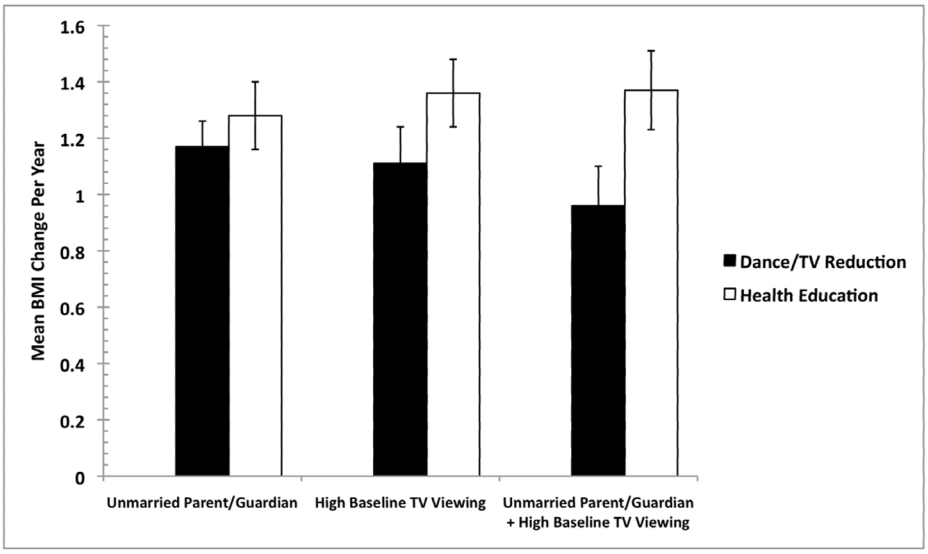

Figure 4. Baseline Parent/Guardian Marital Status and Girl's TV Viewing Time as Moderators of Intervention Effects on Body Mass Index

In the exploratory moderator analysis, the dance and screen time reduction intervention was significantly more effective than health education among those girls with an unmarried parent/guardian and among those who watched more than the mean amount of television at baseline. The figure illustrates the differences between the intervention groups in the mean ± se changes in BMI for the subgroup of girls with an unmarried parent/guardian, girls who watched greater than the mean of baseline television viewing, and girls with both an unmarried parent/guardian and high baseline television watching.

Table 1

Baseline demographic characteristics and follow-up participation rates

	All	Dance & Screen Time Reduction	Health Education
N	261	134	127
Age in years, mean (sd)	9.4 (0.9)	9.5 (0.9)	9.4 (0.8)
Number of adults living in the household, mean (sd)	1.9 (0.9)	1.9 (1.0)	1.9 (0.8)
Number of children living in the household, mean (sd)	2.9 (1.5)	2.9 (1.6)	2.9 (1.4)
Families who own their own home, n (%)	61(23%)	29 (22%)	32 (25%)
Parent/Caregiver marital status, n (%)			
Single-Never Married	122 (47%)	64 (48%)	58 (46%)
Divorced/Separated or Widowed	62 (23%)	30 (22%)	32 (25%)
Married	74 (28%)	38 (28%)	36 (28%)
Maximum household education level, n (%)			
High School graduate or less	71 (27%)	38 (28%)	33 (26%)
Some College/Technical School	122 (47%)	66 (49%)	56 (44%)
College graduate	68 (26%)	30 (22%)	38 (30%)
Annual total household income, n (%)			
Refusal to respond	4 (2%)	2 (1%)	2 (2%)
Less than $20,000	107 (41%)	50 (37%)	57 (45%)
$20,000–39,999	73 (28%)	38 (28%)	35 (28%)
$40,000–$59,999	48 (18%)	28 (21%)	20 (16%)
$60,000–$79,999	12 (5%)	7 (5%)	5 (4%)
$80,000 or more	17 (7%)	9 (7%)	8 (6%)
TV in the girl’s bedroom, n (%)	202 (77%)	101 (75%)	101 (80%)
Self-assessed breast maturation, n (%)			
Refused	3 (1%)	2 (1%)	1 (1%)
Stage 1	82 (31%)	43 (32%)	39 (31%)
Stage 2	86 (33%)	43 (32%)	43 (34%)
Stage 3	78 (30%)	37 (28%)	41 (32%)
Stage 4	9 (3%)	6 (4%)	3 (2%)
Stage 5	3 (1%)	3 (2%)	.
Self-assessed pubic hair maturation, n (%)			
Refused	2 (1%)	2 (1%)	.
Stage 1	111 (43%)	59 (44%)	52 (41%)
Stage 2	80 (31%)	41 (31%)	39 (31%)
Stage 3	40 (15%)	18 (13%)	22 (17%)
Stage 4	25 (10%)	12 (9%)	13 (10%
Stage 5	3 (1%)	2 (1%)	1 (1%)
Entered puberty (stage 2 or greater for breast and/or pubic hair), n (%)	201 (77%)	101 (75%)	100 (79%)

	All	Dance & Screen Time Reduction	Health Education
Menarche	8 (3%)	4 (3%)	4 (3%)
Body mass index percentile distribution[a], n (%)			
0–24th percentile	19 (7%)	8 (6%)	11 (9%)
25–49th percentile	33 (13%)	21 (16%)	12 (9%)
50–74th percentile	51 (20%)	27 (20%)	24 (19%)
75–84th percentile	25 (10%)	12 (9%)	13 (10%)
85–94th percentile	47 (18%)	22 (16%)	25 (20%)
≥ 95th percentile	86 (33%)	44 (33%)	42 (33%)
Reasons for missing Follow-up Visit 1 (FU1), n (%)			
Unable to contact	48 (18%)	25 (18%)	23 (18%)
Moved out of area	1 (0%)	1 (1%)	0 (0%)
Unable to schedule within the desired time interval	1 (0%)	1(1%)	0 (0%)
Refused assessments	9 (3%)	5 (4%)	4 (3%)
Reason for missing Follow-up Visit 2 (FU2), n (%)			
Unable to contact	64 (25%)	33 (25%)	31 (24%)
Moved out of area	3 (1%)	2 (1%)	1 (1%)
Unable to schedule within the desired time interval	38 (15%)	22 (16%)	16 (13%)
Refused assessments	10 (4%)	3 (2%)	7 (6%)
Reason for missing Follow-up Visit 3 (FU3), n (%)			
Unable to contact	56 (21%)	33 (25%)	23 (18%)
Moved out of area	1 (0%)	0 (0%)	1 (1%)
Unable to schedule within the desired time interval	63 (24%)	40 (30%)	23 (18%)
Refused assessments	5 (2%)	2 (1%)	3 (2%)
Reason for missing Follow-up Visit 4 (FU4), n 0(%)			
Unable to contact	21 (8%)	9 (7%)	12 (9%)
Moved out of area	9 (3%)	3 (2%)	6 (5%)
Unable to schedule within the desired time interval	0 (0%)	0 (0%)	0 (0%)
Refused assessments	1 (0%)	1 (1%)	0 (0%)
Withdrew from study	5 (2%)	3 (2%)	2 (2%)

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Table 2

Changes in primary and secondary outcome measures and group differences.

	Baseline, Mean (SD)		Change per year, Mean (SD)		Adjusted T-C difference in change per year (95% CI)[†]
	Dance & Screen Time Reduction	Health Education	Dance & Screen Time Reduction	Health Education	
Body Mass Index, BMI (kg/m^2)	20.70 (4.95)	20.68 (4.82)	1.28 (0.90)	1.24 (1.01)	0.04 (−0.18, 0.27)
BMI z-score	0.94 (1.07)	0.98 (1.07)	0.26 (0.19)	0.24 (0.19)	0.02 (−0.02, 0.06)
Waist Circumference (cm)	69.28 (13.23)	68.82 (12.27)	4.15 (2.21)	4.25 (2.54)	−0.11 (−0.69, 0.47)
Triceps Skinfold (mm)	17.20 (8.36)	17.75 (8.07)	1.49 (3.01)	1.93 (2.74)	−0.52 (−1.16, 0.13)
Systolic Blood Pressure (mmHg)	98.09 (9.30)	98.31 (10.62)	1.24 (4.74)	1.03 (4.71)	0.15 (−0.77, 1.06)
Diastolic Blood Pressure (mmHg)	55.95 (6.02)	56.19 (7.06)	−0.15 (3.43)	0.12 (2.76)	−0.33 (−0.98, 0.33)
Total Cholesterol (mg/dL)[††]	171.49 (30.50)	175.85 (31.17)	−7.35 (6.97)	−4.18 (6.88)	−3.49 (−5.28, −1.70)[**]
HDL-Cholesterol (mg/dL)[††]	54.15 (11.73)	57.05 (13.56)	−3.26 (3.21)	−3.28 (3.32)	−0.34 (−1.13, 0.45)
LDL-Cholesterol (mg/dL)[††]	103.94 (26.23)	106.42 (28.44)	−3.90 (7.20)	−1.06 (5.81)	−3.02 (−4.74, −1.31)[**]
Triglycerides (mg/dL)[††]	66.93 (37.06)	61.82 (25.40)	−1.73 (20.68)	1.01 (10.14)	−1.97 (−6.30, 2.37)
Glucose (mg/dL)[††]	84.99 (7.42)	84.88 (6.60)	1.81 (3.80)	1.53 (3.96)	0.32 (−0.62, 1.26)
Insulin (uIU/ml)[††]	10.97 (11.17)	9.77 (6.95)	1.61 (5.01)	2.83 (4.92)	−0.94 (−2.12, 0.24)
Resting Heart Rate (beats per minute)	79.81 (9.97)[*]	82.49 (9.81)	−0.79 (4.55)	−1.49 (4.38)	0.132 (−0.84, 1.10)
Weekday accelerometer counts per minute	630.01 (174.21)	597.33 (184.20)	−58.15 (73.08)	−53.91 (71.47)	3.18 (−11.56, 17.92)
Weekend accelerator counts per minute	702.28 (287.72)	694.17 (292.74)	−64.06 (113.56)	−66.96 (114.70)	4.54 (−19.37, 28.45)
Weekday minutes per day of moderate-to-vigorous physical activity (>3000 counts per minute)	38.59 (22.15)	33.04 (21.13)	−5.78 (9.30)	−4.88 (7.71)	0.41 (−1.26, 2.07)
Weekend minutes per day of moderate-to-vigorous physical activity (>3000 counts per minute)	28.55 (23.76)	26.19 (23.34)	−4.54 (10.25)	−4.43 (9.78)	0.51 (−1.42, 2.44)
After school accelerometer counts per minute	861.48 (371.53)	793.00 (355.90)	−87.68 (183.15)	−77.56 (155.64)	10.22 (−21.48, 41.92)
After school minutes of moderate-to-vigorous physical activity	11.37 (9.80)	8.80 (8.46)	−1.91 (4.45)	−1.21 (3.49)	0.04 (−0.67, 0.75)
Weekly hours of total screen time	18.88 (12.75)	22.69 (15.79)	−0.02 (10.92)	1.15 (13.98)	−2.65 (−5.42, 0.13)
Weekly hours of television viewing	13.15 (10.26)[*]	16.85 (12.45)	0.79 (8.26)	1.30 (8.18)	−1.64 (−3.49, 0.21)
Weekly hours of VCR/DVD viewing	4.70 (6.41)	4.84 (6.85)	−0.81 (6.96)	−0.13 (5.54)	−0.73 (−2.10, 0.63)

	Baseline, Mean (SD)		Change per year, Mean (SD)		Adjusted T-C difference in change per year (95% CI)†
	Dance & Screen Time Reduction	Health Education	Dance & Screen Time Reduction	Health Education	
Weekly hours of video game playing	1.022 (2.847)	1.002 (3.101)	−0.003 (1.667)	−0.001 (4.434)	0.012 (−0.580, 0.603)
Weekly hours of computer use	0.901 (2.466)	0.774 (2.062)	0.316 (1.711)	0.327 (1.642)	0.023 (−0.360, 0.406)
Total household TV use (0–4)	2.47 (1.02)	2.48 (1.15)	−0.09 (0.45)	−0.04 (0.45)	−0.06 (−0.15, 0.04)
Days per week ate breakfast with the TV on	1.49 (2.28)*	2.17 (2.71)	0.02 (1.53)	−0.37 (1.74)	0.15 (−0.20, 0.50)
Days per week ate dinner with the TV on	2.66 (2.80)	3.22 (2.93)	0.18 (1.50)	0.22 (1.69)	−0.21 (−0.53, 0.12)
Average total daily energy intake (Kcal)	1353.68 (459.98)	1360.11 (432.30)	−3.44 (239.27)	21.80 (209.14)	−27.31 (−69.62, 15.00)
Average percent of dietary energy from fat	35.44 (5.29)	35.44 (5.65)	0.29 (2.87)	0.42 (3.12)	−0.13 (−0.67, 0.40)
Physical Activity Preferences (liking)	1.52 (0.25)	1.52 (0.25)	−0.07 (0.12)	−0.10 (0.14)	0.01 (−0.02, 0.04)
Overconcern with weight and shape (0–100)	29.92 (27.43)	29.21 (27.85)	−1.58 (11.46)	−1.70 (11.38)	0.26 (−2.18, 2.71)
Body shape dissatisfaction	1.23 (1.85)	1.11 (1.78)	−0.22 (0.66)	−0.16 (0.62)	−0.04 (−0.15, 0.08)
School Performance (9 = mostly A's to 1 = mostly F's)	7.69 (1.26)	7.55 (1.47)	−0.38 (0.96)	−0.22 (1.28)	−0.10 (−0.35, 0.15)
Depressive Symptoms (0–20)	1.96 (2.74)	2.09 (2.74)	−0.49 (1.10)	−0.26 (1.38)	−0.21 (−0.42, −0.001)*
Self-Esteem (high = 10 to low = 40)	19.16 (3.87)	19.27 (4.00)	−0.90 (2.04)	−0.70 (2.16)	−0.22 (−0.66, 0.21)
Preferences for things African-American (1–7)	4.13 (1.31)	4.22 (1.42)	0.07 (0.54)	−0.06 (0.45)	0.11 (0.01, 0.22)*
African-American family practices and values (1–7)	5.55 (1.28)	5.61 (1.30)	0.08 (0.58)	0.02 (0.58)	0.04 (−0.07, 0.16)
Racial Segregation (1–7)	4.66 (1.59)	4.67 (1.73)	−0.16 (0.65)	−0.04 (0.69)	−0.12 (−0.26, 0.03)
African-American ethnic identity	4.73 (1.37)	4.75 (1.50)	0.11 (0.56)	0.01 (0.63)	0.09 (−0.03, 0.22)

*P < .05 between group differences.

**P ≤ .001 between group differences.

†Adjusted mean difference and 95% confidence interval between the dance & screen time reduction Treatment group (T) and the health education Comparison group (C) per year.

††Fasting blood results were obtained from 208 girls at baseline (107 [80%] Treatment and 101 [80%] Comparison), 211 girls at FU4 (112 [84%] Treatment and 99 [78%] Comparison), and 170 girls at both baseline and FU4 (90 [67%] Treatment and 80 [63%] Comparison). Girls with fasting blood results at baseline had statistically significantly lower heights than girls without blood results (P<.05), and girls with fasting blood results at FU4 and at both baseline and FU4 were more likely to be from a family that owned its own home (P=.03 and P=.03, respectively), but girls with and without blood results were not statistically significantly different on any other baseline measures.

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Table 3

Prevalences and incidences of categorical outcome measures and group differences

	Total Sample		Dance & Screen Time Reduction		Health Education		T vs. C Relative Risk (95% CI)**	Number Needed to Treat (NNT)***
	Baseline Prevalence	Follow-up Incidence*	Baseline Prevalence	Follow-up Incidence*	Baseline Prevalence	Follow-up Incidence*		
BMI ≥ 95th percentile	86 (33.0)	14 (8.8%)	44 (32.8)	6 (7.2%)	42 (33.1%)	8 (10.5%)	0.69 (0.25, 1.89)	30
Systolic BP ≥ 95th percentile	5 (1.9%)	1 (0.5%)	2 (1.5%)	0 (0%)	3 (2.4%)	1 (1.0%)	NA	NA
Diastolic BP ≥ 95th percentile	0 (0%)	1 (0.4%)	0 (0%)	1 (0.8%)	0 (0%)	0 (0%)	NA	NA
Total Cholesterol ≥ 200 mg/dL	41 (19.7%)	7 (5.2%)	18 (16.8%)	2 (2.7%)	23 (22.8%)	5 (8.1%)	0.34 (0.07, 1.67)	19
LDL-Cholesterol ≥ 130 mg/dL	38 (18.3%)	7 (5.1%)	14 (13.1%)	4 (5.2%)	24 (23.8%)	3 (4.9%)	1.06 (0.25, 4.54)	−361
HDL-Cholesterol < 35 mg/dL	5 (2.4%)	11 (6.7%)	2 (1.9%)	6 (6.8%)	3 (3.0%)	5 (6.5%)	1.05 (0.33, 3.31)	−308
Triglycerides ≥ 135 mg/dL	10 (4.8)	3 (1.9%)	8 (7.5%)	1 (1.2%)	2 (2.0%)	2 (2.6%)	0.47 (0.04, 5.08)	74
Glucose ≥ 126 mg/dL	0 (0%)	2 (1.2%)	0 (0%)	1 (1.1%)	0 (0%)	1 (1.3%)	0.89 (0.06, 13.98)	720
Insulin ≥ 30 uIU/ml	10 (4.8%)	18 (11.1%)	6 (5.6%)	5 (5.9%)	4 (4.0%)	13 (16.9%)	0.35 (0.13, 0.93)	9

*New clinical abnormalities identified during the follow-up period (not identified at baseline).

**Ratio of incidence rates in the Treatment and health education Comparison groups and 95% Confidence Interval (CI) during the follow-up period.

***NNT = Number Needed to Treat, the number of girls one would expect to treat with the Treatment intervention to produce one more success (to prevent one less clinical abnormality) than if the same number of girls were treated with the Comparison intervention.

NA = Not applicable because incidence rates too small.