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<https://escholarship.org/uc/item/Onb18514>

Journal

Journal of Racial and Ethnic Health Disparities, 7(4)

ISSN

2197-3792

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Publication Date

2020-08-01

DOI

10.1007/s40615-019-00694-6

Peer reviewed



Published in final edited form as:

*J Racial Ethn Health Disparities*. 2020 August ; 7(4): 643–649. doi:10.1007/s40615-019-00694-6.

## Impact of Race and Ethnicity on Weight-Loss Outcomes in Pediatric Family-Based Obesity Treatment

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### Abstract

**Introduction:** Minority children are disproportionately affected by obesity and little is known about how race/ethnicity impacts outcomes in pediatric weight-loss treatment. This study aimed to evaluate whether race/ethnicity affected weight-loss outcomes in a pediatric obesity intervention. Secondary aims included evaluating whether race/ethnicity was associated with energy intake, exercise, program adherence, acceptability and attendance.

**Methods:** 150 parent/child dyads (age 8–12 years, BMI% 85–99.9; 32% Hispanic, 24% Non-Hispanic, Non-White, 44% Non-Hispanic White) participated in a randomized control trial evaluating weight loss in family-based behavioral treatment with (FBT) or without child participation (i.e., Parent-Based Treatment; PBT). Assessments occurred at baseline, mid-treatment (month 3) post-treatment (month 6) and follow-up (month 12 and 24). Analyses included linear mixed effect models, linear models and a negative binomial model.

**Results:** Weight loss in Hispanic, Non-Hispanic White, and Non-Hispanic, Non-White children was not significantly different by race/ethnicity at month 6, 12, and 24 ( $p = .259$ ) and was similar across both treatments (FBT =  $-0.16$  BMIz; PBT =  $-0.21$  BMIz;  $p = .61$ ). There were no differences in energy intake, physical activity, acceptability ratings or adherence to treatment (as measured by a post-treatment survey) ( $p$ 's  $> .123$ ). However, Hispanic families attended fewer treatment visits than Non-Hispanic White families ( $p = .017$ ).

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Compliance with Ethical Standards

Conflict of Interest:

The authors declare that they have no conflict of interest.

**Ethical approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional review boards at University of California San Diego and Rady Children's Hospital, San Diego and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent:** Informed consent was obtained from all individual parents included in the study and individual assent was obtained from all individual children.

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**Conclusion:** On average, children lost weight participating in our pediatric obesity treatment and there was no statistical difference in weight loss between groups. Future research evaluating whether culturally-adapted treatments would be more effective for racial/ethnic minorities or whether the personalization inherent in family-based behavioral treatment may be sufficient is needed.

### Keywords

Childhood Obesity; Family Based Interventions; Ethnic Minorities; Family Based Treatment; Parent-Only Treatment; Hispanic; Behavioral Weight Loss

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## Introduction

Obesity disproportionately affects many minority communities, with the Hispanic and African American communities impacted at especially high rates, [1] even after controlling for socioeconomic status [2,3]. Among United States children surveyed in 2015–2016, more than one-in-four Hispanic children and more than one-in-five Non-Hispanic African American children ages 2–19 were classified as having obesity whereas about one-in-seven White children had obesity [4]. Further, Hispanic children (6.6%) and Non-Hispanic African American children (8.5%) have higher rates of severe obesity compared to White children (3.9%) [5]. With more than half of all Americans projected to belong to a minority group by 2060, [6] certifying obesity treatments for widespread dissemination will require examination of efficacy across racial/ethnic groups. Thus, given the growing minority population and the numerous health problems associated with obesity, [7,8] it is especially important to understand whether our current treatments for pediatric obesity are effective for minority children.

Minority enrollment in research is a widespread concern [9] and given low rates in obesity interventions for adults [10], it is unknown whether current findings are generalizable to minorities. Research from the Diabetes Prevention Program showed that Hispanic participants were more successful at meeting the physical activity goal of 150 minutes per week but less successful at losing 7% of body weight compared to White participants [11, 12]. Further, African American women lost significantly less weight than African American men, Hispanic and White men and women when they received a lifestyle intervention.[13] These results suggest that among adults, obesity interventions may not be equally effective across racial/ethnic groups.

Several systematic reviews have tried to evaluate the evidence of programs geared towards racial/ethnic minorities [14–17]; however, the number of studies remains relatively small and many are pilot studies or not of high quality[18]. Many interventions assessed in children have also been community or school-based. However, research suggests involving the family may be particularly important for minorities [15,16,18].

The currently recommended pediatric obesity treatment is Family-Based Behavioral Treatment (FBT) [19]. Given the importance of early intervention and growing rates of obesity among minority children, it is important to understand whether FBT is effective for minority children and their parents. To date, no known studies have compared efficacy of

FBT across racial/ethnic groups. The Family, Responsibility, Education, Support and Health (FRESH) study was originally designed to compare traditional FBT delivered to both parent and child to a parent-based treatment (PBT) which taught the same curriculum as FBT but only to parents [20]. The FRESH study found that PBT was non-inferior to FBT on child weight loss and other key outcomes [20]. The current study aimed to evaluate whether race/ethnicity impacted treatment response to the currently recommended FBT treatment and the parent-only variant of FBT (PBT). The primary outcome of interest was child weight loss. Secondary outcomes included changes in physical activity and dietary intake. Additionally, acceptability, adherence and attendance were evaluated to assess whether uptake of treatment was similar across race/ethnicity.

## Methods

The FRESH study randomized 150 parent/child dyads to six months of treatment in FBT or PBT. Parents and children were assessed at baseline, mid-treatment (month 3), post-treatment (month 6), 6 month-follow-up (month 12) and 18-month follow-up (month 24). As the FRESH study has previously been described, [20] and the CONSORT diagram has already been published,[20] only essential details are described below. All procedures were approved by the Institutional Review Boards of the University of California San Diego and Rady Children's Hospital, San Diego. All parents provided consent and children provided assent. The FRESH study was registered with [clinicaltrials.gov](https://clinicaltrials.gov) (NCT01197443).

## Participants

Parent/Child dyads (n=150) participated in 6 months of either a standard FBT treatment, where both parent and child participated or PBT, which was similar in content to FBT but only the parents participated in treatment. Briefly, eligibility requirements included that children were 8–12 years old and had a BMI of 85<sup>th</sup> - 99.9<sup>th</sup> percentile. The participating parent and child also needed to be able to understand and speak English. Greater detail on eligibility requirements are available elsewhere [20]. Three participants did not have race/ethnicity data and thus were not included in these analyses. The racial/ethnic breakdown of the sample (n=147) included: 32% Hispanic, 24% Non-Hispanic, Non-White and 44% Non-Hispanic White. The Non-Hispanic, Non-White group had the following breakdown: 11 African American, 10 Asian, 4 Hawaiian/Pacific Island, and 11 multiple races noted.

## Measures

**Anthropometrics**—At each time point, weight and height were measured in duplicate. The average value was used to calculate Body Mass Index (BMI) for parents (kg/m<sup>2</sup>) and standardized BMI (BMIz) for children [21].

**Demographics**—Parents reported on their child's race, ethnicity, age, gender, and family income level. Participants who identified as Hispanic were categorized as Hispanic regardless of their race, Non-Hispanic participants who endorsed any other race besides White were categorized as Non-Hispanic, Non-White (NHNW) and those only endorsing White as Non-Hispanic White (hereafter identified as White). To report family income level, parents selected from a set of 11 categories ranging from below \$9,999 to greater than

100,000, with categories representing a \$9,999 range (e.g., \$10,000-\$19,999). Responses were dichotomized at the median income level of San Diego [22] into those who reported household income < \$60,000 and ≥ \$60,000 to split families according to those who make approximately above and below the median income level of San Diego.

**Diet and Physical Activity**—Diet and physical activity measures were collected at baseline, post-treatment and 18-month follow-up. Total calorie intake, as measured in average kilocalories per day, was calculated by the Nutrition Data Systems for Research software from three 24-hour dietary recalls conducted over the telephone on non-consecutive days. Average minutes per day of moderate and vigorous intensity physical activity were calculated using ActiLife software after Actigraph accelerometers were worn for at least 4 of 7 days [20].

**Treatment Acceptability, Adherence and Attendance**—At the post-treatment assessment, parents responded to survey questions developed for the study to evaluate the acceptability of the treatment and adherence to specific program components. Liking of the treatment was assessed using a single item “How much did you like the group overall?” Responses used a 5-point scale ranging from 1 – Very Much Liked to 5 - Very Much Disliked. How helpful the treatment was to changing lifestyle behaviors was assessed with the question “How much did you feel that the group helped you change your family and your child’s lifestyle?” Responses included 1-Very Much, 2-Somewhat, 3-Neutral, and 4-Not Very Much. Whether parents would recommend the program to other families was assessed with the question “How much do you agree with the following? I would recommend the FRESH program to other families” Responses used a 5-point scale ranging from 1-Strongly Disagree to 5-Strongly Agree.

The helpfulness of the main treatment components (e.g., feedback from behavioral coach, manual, dietary advice, physical activity advice, positive parenting, behavioral management) were assessed by 11 questions. Response options included: 1-Very Helpful, 2-Somewhat helpful, or 3-No Impact. The mean response of these items was calculated to create an overall “Treatment Helpfulness” score. Cronbach alpha for this scale was 0.8. Adherence to the program was assessed by 24 questions that evaluated the frequency of behaviors recommended by treatment over the past month (e.g., daily family meetings, recording food intake, engaging in physical activity as a family, plan ahead for difficult events, reduce the frequency of eating out at restaurants). Responses were on a 5 –point scale ranging from 1- Never to 5-Always. The mean response of these items was calculated to create an overall “Treatment Adherence” score. Cronbach alpha for this scale was 0.95. Lastly, a count of the number of sessions attended provided an overall measure of attendance to treatment.

## Intervention

The content of the FBT and PBT interventions was the same with both focusing on improving diet (e.g., increasing fruits and vegetables, decreasing unhealthy food intake), increasing physical activity, and teaching parenting skills to help change behaviors. The only difference is that children did not attend treatment in PBT. Over the 6 months, parents in both PBT and FBT and children in FBT attended 20 one-hour group meetings. Both

interventions included 30-minute behavioral coaching sessions that individualized content to each family.

### Statistical Analyses

Analyses for this study were conducted using R-Studio with R version 3.22. This study used the intention-to treat population for the main study. Demographic differences between Hispanic, White and NHNW children were evaluated using Anovas and chi-square analyses as appropriate with significant differences followed up with pairwise contrasts to understand group differences.

To evaluate whether race/ethnicity impacted weight-loss results, baseline-adjusted Linear Mixed Effects (LME) Models of child BMIz were assessed at mid-treatment (3 months), post-treatment (6 months), 6-month follow-up (12 months) and 18-month follow-up (24 months). Planned covariates included baseline BMIz, child age, child sex, income level, and treatment condition. Race/Ethnicity (Hispanic, White or NHNW) was included in the model. When diet and physical activity were assessed as outcomes the respective baseline value was added as a covariate. Mean differences in outcomes from post-treatment assessments were assessed with dummy-coded contrasts with post-treatment as the reference category to indicate differences in outcome after finishing treatment. Model 1 evaluated a main effect of Race/Ethnicity to estimate the statistical significance of differences in outcome change across post-treatment assessments. Then Model 2 added a term for the Race/Ethnicity  $\times$  Treatment interaction to evaluate whether treatment effects on outcome differed for the three categories. Finally, in Model 3, a 3-way interaction term was added to the model to evaluate Race/Ethnicity  $\times$  Treatment  $\times$  Time to evaluate differences in response to treatment.

Linear models with planned covariates (child age, child sex, treatment, BMIz, and income level) were conducted to evaluate whether acceptance and adherence were different across racial/ethnic groups. A negative binomial regression was conducted to evaluate differences in counts of session attendance with planned adjustment for aforementioned covariates. Of note, differences in attendance between treatments were previously reported with participants in PBT attending fewer sessions [20].

## Results

As seen in Table 1, racial/ethnic groups did not differ on any of the child's demographic variables (age, sex, BMI/BMIz) or allocation to treatment condition ( $p$ 's  $> .05$ ). Notably, parents of Hispanic children were significantly younger than parents of White children ( $p < .001$ ). An overall difference of income was also found; however pairwise contrasts adjusted for multiple comparisons were not significant ( $p > .05$ ). There were no significant differences on parent sex or BMI. Table 2 displays the descriptive statistics for the main variables at each time point and effect size for change in value from baseline.

### Race/Ethnicity on Weight Loss

As previously reported in the main outcome paper, children lost an average of .2 BMIz units at the 18-month follow-up [20]. Although Hispanic children and NHNW children lost on average .08 and .04 BMIz units less respectively than White children at the 18-month

follow-up, results of the LME models showed that there was no main effect of Race/Ethnicity on child weight loss ( $F(2,126) = 1.365$ ,  $p = 0.259$  – see Figure 1). Further, neither the Race/Ethnicity  $\times$  Treatment interaction ( $F(2,124) = 0.331$ ,  $p = 0.719$ ) nor 3-way interaction between Race/Ethnicity  $\times$  Treatment  $\times$  Time ( $F(6,325) = 0.509$ ,  $p = 0.802$ ) were significant. These results suggest that neither the effect of FBT vs PBT nor the magnitude of any differences in weight change over assessments were different statistically among Hispanic, NHNW, and White participants.

### **Race/Ethnicity on Diet and Physical Activity**

Results of the LME model suggest there was no main effect of Race/Ethnicity on energy intake ( $F(2,107) = .378$ ,  $p = .687$  – see Table 3) nor was there a Race/Ethnicity  $\times$  Treatment interaction ( $F(2,105) = .536$ ,  $p = .587$ ) nor 3-way interaction ( $F(2, 89) = .614$ ,  $p = .544$ ). Similarly, results showed that there was no main effect of Race/Ethnicity on MVPA ( $F(2, 80) = 2.389$ ,  $p = .098$  – see Table 3). There was also no Race/Ethnicity  $\times$  Treatment interaction ( $F(2, 78) = 2.858$ ,  $p = .063$ ) or 3-way interaction ( $F(2, 48) = .0026$ ,  $p = .997$ ).

### **Race/Ethnicity on Treatment Acceptability, Adherence, and Attendance**

Overall, ratings were positive and reflected ‘Liking’ treatment elements with 91% (31/34) Hispanic parents, 93% (27/29) NHNW parents, and 91% (52/57) White parents endorsing liking the treatment somewhat or very much. Parents similarly felt treatment (somewhat/very much) helped change their family and child’s lifestyle (Hispanic 29/32 [91%] vs NHNW 28/29 [97%]) vs White 54/58 [93%], and similarly would recommend the program (agree/strongly agree) to others (Hispanic 31/35 [89%] vs NHNW 26/29 [90%], White 52/59 [88%]). Further, there were no differences on the mean ratings of helpfulness of the treatment (Hispanic = 1.41(.36); NHNW = 1.39(.23); White = 1.53(.34);  $F(2,120) = 2.34$ ;  $p = .101$ ) or adherence (Hispanic 3.33 (.69); NHNW = 3.3(.74) vs White = 3.55 (.68);  $F(2,119) = 1.72$ ;  $p = .184$ ) to program components. When examining attendance, a negative binomial regression of these counts suggested that number of sessions attended differed by Race/Ethnicity ( $F(2,137) = 6.10$ ,  $p = .047$ ). Hispanic participants attended significantly fewer sessions than White participants ( $B = -.245$  (-.45- -.04);  $SE = .102$ ;  $p = .017$ ) with medians of 13 and 16 sessions attended for Hispanic and White participants, respectively, whereas NHNW participants attended a median of 15 sessions.

## **Discussion**

This study examined the impact of race and ethnicity on child weight loss in a pediatric obesity treatment program in which over half of the sample identified as minority (Hispanic or NHNW). Results demonstrated that weight loss was not statistically different over the 6-month treatment program and 18-month follow-up period across racial/ethnic groups. Similarly, physical activity or energy intake did not change differentially across racial/ethnic groups. Further, there was no impact of race/ethnicity on weight loss depending on the type of family-based treatment (PBT vs FBT) received. Additionally, there were no statistical differences in self-reported ratings of acceptance and adherence between parents across racial/ethnic groups. However, Hispanic families attended significantly fewer treatment sessions than White families. The race/ethnicity finding was significant in addition to

previously published treatment condition effects on attendance with parent-only sessions having fewer sessions attended [20].

Together, these results suggest that FBT and PBT do not result in different weight loss in minority children. It is possible that FBT and PBT are acceptable interventions to minority populations due to the way the treatments incorporate family. These findings reflect previous research that suggested family-based treatment was important for minority populations [15,16]. By delivering a treatment program that recognizes the importance of family involvement, we may be delivering a program that resonates with these populations and therefore increases adherence to program materials. Even in PBT, when only parents attend, treatment recommendations include involving the child and other family members. Further, in addition to attending group treatment, each family had a personal coach they met with each week outside of group. This behavioral coaching session, which is part of traditional FBT, allows for personalization of the material so this may also help make standard curriculum more relevant for each individual family. Future studies should examine the participation of multiple family members or the extent to which information provided in FBT is shared among all adult caregivers and applied to all children in the household as well as the extent to which behavioral coaching incorporates culturally-specific information.

Although no statistically significant differences of weight loss occurred, examining the aggregated data across time points (Figure 1) shows that there are some nominal differences in BMIz change emerging at the post-treatment assessment. It is important to evaluate statistical findings in the realm of clinical meaning. Across the entire study, children lost an average of .2 BMIz units. Although Hispanic children and NHHW children lost on average .08 and .04 BMIz units less respectively than White children, given the negative consequences of obesity, any intervention that produces weight loss or even slows down weight gain can have a significant clinical impact. There is also significant variability in individual outcomes that are not captured in these statistics that are based on mean group responses. In general, there is a greater interest in the obesity field to examine individual differences in response to treatment [23] and thus studies should be designed to evaluate some of these phenotypes. Regardless, it is still impressive that despite attending fewer sessions and having lower income, Hispanic children overall achieved similar weight loss. Given the association often reported between attendance and income level [24], it is possible that Hispanic families with lower income may be a group that would benefit from a targeted, adapted intervention.

As with all studies, this study had strengths and limitations. It is important to emphasize that this study is unique in that over 50% of the sample was from a racial/ethnic minority, including 1/3 of the sample who identified as Hispanic, which allowed us to conduct such an analysis. Considering the average minority enrollment in adult behavioral weight loss studies is 7.7%, [10] our study was fairly diverse and representative of San Diego county [22]. Further, this study evaluates the currently recommended treatment without applying specific cultural adaptations. Limitations of the current study included that treatment was provided in English and eligibility requirements included that both the participating parent and child could read and speak English. Thus, this study may have self-selected families that may have been more acculturated, and these results may not be generalizable to the broader



minority population, especially non-English speaking families. Further, the NHNW group was fairly heterogeneous and the number of African Americans, another group at high-risk for obesity, was too small for separate analyses. A future study that is powered a priori to evaluate differences across race/ethnicity is warranted. Lastly, it would have been informative to know whether the race/ethnicity of the treatment providers had an impact on outcomes, but those data were not available.

## Conclusions

Overall, this study showed that race/ethnicity did not impact change in weight during the pediatric obesity family-based interventions. Change in energy intake and physical activity also were not impacted by race/ethnicity and all parents, regardless of race/ethnicity, reported similar levels of acceptability and adherence to the treatment components. However, attendance was less consistent among Hispanic families. Further exploration of how minority families respond to current weight-loss treatments for children is warranted and research evaluating whether culturally-adapted treatments would be more effective or whether the personalization inherent in FBT may be sufficient is needed.

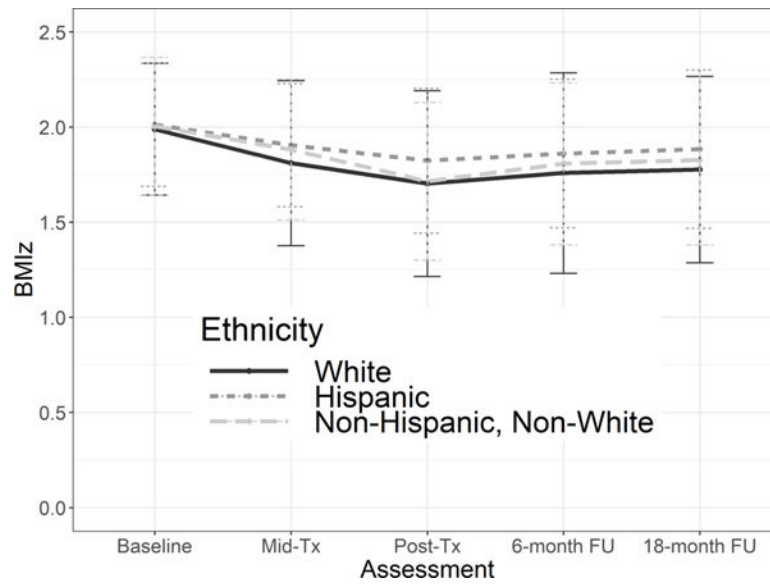
## Acknowledgements:

This study was supported by the National Institutes of Health under grants: R01DK075861 K23DK114480 & K02HL112042. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The authors would like to thank the families who participated in this research as well as the UCSD CHEAR staff members who made this all possible. Data will be made available summarized in this publication may be available in a deidentified format to investigators for research purposes following approval from the principal investigators.

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**Fig. 1.** Weight loss does not significantly differ across racial/ethnic groups who participated in pediatric family-based obesity treatment through 18-month follow-up

**Table 1:**

Demographic Characteristics of Hispanic, Non-Hispanic, Non-White and White Children

	Hispanic (N=47)	Non-Hispanic-Non-White (N=36)	White (N=64)	Test Statistic	p-value
Sex (female), <i>n</i> (%)	35 (74%)	25 (69%)	38 (59%)	2.94	.23
Age (years) <i>m</i> (SD)	10.65 (1.24)	10.18 (1.48)	10.39 (1.16)	1.42	.24
BMI (kg/m <sup>2</sup> ), <i>m</i> (SD)	26.83 (3.7)	26.09 (3.8)	26.14 (3.53)	.61	.55
BMIz, <i>m</i> (SD)	2.01 (.32)	2.00 (.36)	1.99 (.35)	.06	.94
Income Level (< \$60,000), <i>n</i> (%)	<b>20 (43%)</b>	<b>9 (25%)</b>	<b>13 (20%)</b>	<b>7.00</b>	<b>.03<sup>a</sup></b>
Treatment Condition (FBT), <i>n</i> (%)	26 (55%)	15 (42%)	33 (52%)	1.59	.45
Parent Sex (female), <i>n</i> (%)	43 (91%)	33 (92%)	52 (81%)	3.42	.18
Parent Age (years), <i>m</i> (SD)	<b>40.38 (6.37)</b>	<b>43.22(6.21)</b>	<b>44.72(6.09)</b>	<b>6.65</b>	<b>.002; W&gt;H</b>
Parent BMI (kg/m <sup>2</sup> ), <i>m</i> (SD)	32.68 (6.24)	32.56(6.32)	31.07(6.45)	1.09	.34
Dietary Intake (kcal/day), <i>m</i> (SD)	<b>1807.27 (454.39)</b>	<b>1577.05 (352.94)</b>	<b>1722.56 (398.86)</b>	<b>3.20</b>	<b>.04; NHN W&lt;H</b>
MVPA (minutes/day), <i>m</i> (SD)	182.17 (45.37)	190.36 (45.45)	177.93 (43.79)	.76	.47

BMI=Body Mass Index; kcal = average kilocalories/day reported in 24 hour dietary recall; MVPA = moderate to vigorous physical activity collected by accelerometer; W = White; NHNW = Non-Hispanic, Non-White; H = Hispanic

<sup>a</sup>Note: No pairwise comparisons were significant after correction for multiple comparisons was applied

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**Table 2:** Change in BMIz, Energy Intake, and Physical Activity from Baseline in Hispanic, Non-Hispanic, Non-White, and White Participants

M(SD)	Baseline			Mid Treatment			Post-Treatment			6-Month Follow-Up			18-Month Follow-Up		
	Hispanic	NHNW	White	Hispanic	NHNW	White	Hispanic	NHNW	White	Hispanic	NHNW	White	Hispanic	NHNW	White
BMIz	2.01 (.32)	2.00 (.36)	1.99 (.35)	1.91 (.32) d=.31	1.88 (.37) d=.33	1.81 (0.43) d=.46	1.82 (.38) d=.54	1.72 (.41) d=.73	1.70 (.49) d=.68	1.86 (0.39) d=.42	1.8 (0.42) d=.51	1.76 (0.53) d=.51	1.88 (.42) d=.34	1.83 (.46) d=.41	1.78 (.49) d=.49
Energy Intake (kcal/day)	1807.27 (454.39)	1577.05 (352.94)	1722.56 (398.86)	-	-	-	1428.17 (246.32) d=1.04	1393.3 (265.46) d=.59	1462.94 (366.71) d=.68	-	-	-	1607.99 (343.96) d=.49	1461.03 (333.41) d=.34	1623.26 (369.16) d=.24
MVPA (minutes/day)	182.17 (45.37)	190.36 (45.45)	177.93 (43.79)	-	-	-	158.64 (56.45) d=.46	182.24 (53.05) d=.16	161.62 (46.75) d=.36	-	-	-	148.77 (36.72) d=.81	168.21 (58.36) d=.42	142.28 (45.03) d=.80

kcal = average kilocalories/day reported in 24 hour dietary recall; MVPA = moderate to vigorous physical activity collected by accelerometer; NHNW = Non-Hispanic, Non-White;

**Table 3:**

Main Effect of Race/Ethnicity on BMIz, Energy Intake and MVPA

	Value <sup>a</sup>	95% CI	P Value
<b>BMIz</b>			
<b>Hispanic</b>	0.07	-0.02 - 0.15	0.12
<b>NHNW</b>	0.05	-0.04 - 0.14	0.25
<b>Energy Intake (kcal/day)<sup>b</sup></b>			
<b>Hispanic</b>	6.32	-109.97 - 122.61	0.91
<b>NHNW</b>	-49.86	-164.22 - 64.50	0.39
<b>MVPA (minutes/day)<sup>b</sup></b>			
<b>Hispanic</b>	-0.544	-18.79 - 17.70	0.95
<b>NHNW</b>	16.78	-1.67 - 35.22	0.07

kcal = average kilocalories/day reported in 24 hour dietary recall; MVPA = moderate to vigorous physical activity collected by accelerometer; NHNW = Non-Hispanic, Non-White

<sup>a</sup> Adjusted parameters from mixed effects regression models reflecting differences between groups across time periods adjusted for baseline BMIz, child age, child sex, income level, and treatment condition and baseline value of the outcome variable.

<sup>b</sup> Only assessed at baseline, post-treatment and 18-month follow-up assessments.

Note: White served as the reference group for all analyses