

# Pediatric Weight Management Program Outcomes in a Largely Minority, Low Socioeconomic Status Population



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**ABSTRACT:** This article describes the outcomes of a pediatric weight management program for a population primarily composed of minority ethnic groups and those from a lower socioeconomic status group. As these groups are disproportionately affected by pediatric obesity and overweight complicated by higher rates of attrition and poorer response to intervention, it is important that adequate and effective treatment exists for patients in these groups. Further research is needed to analyze the outcomes and attrition in these high-risk populations.

**KEYWORDS:** pediatric, obesity, weight management, attrition

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## Introduction

Obesity affects approximately one in five children in the United States, with higher prevalence in minority groups including African-Americans and Hispanics,<sup>1</sup> as well as those from lower socioeconomic groups.<sup>2</sup> Obesity in children and teens has increased dramatically over the past several decades. Between 1980 and 2006, rates of obesity more than doubled from 6.5% to 17.0% among school-aged children and more than tripled from 5% to 17.6% among adolescents.<sup>3</sup> It is imperative that successful treatment options exist to address this growing epidemic. Obesity in children can have both medical and psychosocial effects and, if untreated, will continue into adulthood.<sup>4</sup> Medical effects of obesity in childhood include cardiometabolic effects such as derangements in blood lipid levels, elevated low-density lipoprotein (LDL) cholesterol and triglycerides, lowered high-density lipoprotein cholesterol levels, and cardiovascular disease.<sup>5</sup> High body mass index (BMI) in childhood has also been associated with type 2 diabetes mellitus and premature death.<sup>6,7</sup>

Guidelines for successful treatment for childhood obesity were set forth by the Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity in 2007. Children should first be provided with stage 1 and 2 interventions, which are primary care-based treatments consisting of education, goal setting, and monitoring, usually delivered in the primary care office. Those who are unable to achieve adequate weight loss through

stage 1 and 2 interventions should be referred to stage 3 and 4 interventions.<sup>8</sup> Stage 3 interventions are multidisciplinary weight management programs provided at pediatric tertiary care centers, which should provide a minimum of 8–12 weekly visits with subsequent monthly visits thereafter.<sup>9</sup> Stage 3 programs provide a structured program that includes behavior modification, food monitoring, short-term diet and physical activity goal setting, and contingency management.<sup>10</sup> Staffing for stage 3 programs should include a behavior counselor, registered dietitian, exercise specialist, and primary care provider (PCP) to maximize efficacy.<sup>8</sup> Children who are severely obese and/or who have been unable to lose weight with stage 3 treatment may require stage 4 interventions, which use the therapies listed in stage 3 programs but may also include use of medications, very low calorie diet, and/or weight control surgery.<sup>8</sup>

Unfortunately, despite detailed guidance on best practices for treatment of pediatric obesity and overweight set forth by the Expert Committee, programs aimed at reducing childhood obesity have met with variable success and faced high rates of attrition in many cases.<sup>11,12</sup> Factors identified with treatment failure and/or program attrition in previous studies have included higher parent and adolescent BMI at baseline,<sup>13</sup> ethnic minority status,<sup>13–15</sup> Medicaid recipients,<sup>16,17</sup> self-reported greater depressive symptomatology, and lower self-concept.<sup>16</sup> One study that examined program efficacy in a population with these characteristics showed their multidisciplinary weight management program to be successful for a population



that they described as high risk, with multiple comorbidities, low socioeconomic status, and from racial/ethnic minorities.<sup>17</sup> However, the sample size was small (66 patients); other literature generally has shown less successful outcomes in children with a similar demographic profile. As children in minority groups and in lower socioeconomic status groups are disproportionately affected by obesity and its sequelae,<sup>17,18</sup> it is critical that effective, scalable programs are developed to successfully provide pediatric weight management services to this vulnerable population.

The objective of this study was to examine the outcomes of a stage 3, interdisciplinary pediatric weight management program in an ethnically diverse population who are mostly Medicaid recipients. Anthropometrics and fasting laboratory values were compared pre-treatment to those variables at 12 months after treatment initiation to examine changes in the study population. The study population was largely African-American and insured by medical assistance, factors that place these patients at higher risk as these factors have been associated with treatment failure and/or attrition in many previous studies.<sup>15,16</sup> This study examined change in BMI z-score as the primary outcome to assess changes in weight status in this group, with a secondary focus on changes in laboratory values to assess changes in cardiometabolic risk factors after completing the program. Additionally, return rates for the visits at 12 months were compared to the initial visit sample size to compare attrition across groups with different demographic characteristics.

## Methods and Procedures

**Methods.** The program provides stage 3<sup>18</sup> interdisciplinary weight management to overweight/obese children aged between 2 and 18 years. The program operates at a pediatric specialty hospital in a large metropolitan area in the Mid-Atlantic Region. Participants are mostly referred from their PCPs, with a smaller number who are referred from subspecialists or self-referred. Participants or their guardians complete an intake packet prior to evaluation that details social, medical, birth, and feeding histories, as well as food and exercise logs. Participants are required to complete fasting lab-work, which is drawn prior to the initial clinic visit by the referring PCP. Completion of fasting lab-work prior to the clinic visit was an eligibility criterion for inclusion into the study.

Participants in the weight management program are evaluated by a medical provider and psychology staff member. Based upon the clinical interview and the intake questionnaire that was completed prior to the clinic appointment, basic recommendations are provided to the child/family at the conclusion of the initial intake designed to increase physical activity and improve diet. They are then enrolled in either a 10-week family-based group program of educational sessions and exercise or a self-paced program of behavioral modification sessions with lifestyle recommendations interspersed.

Inclusion criteria to the group or self-paced programs include a BMI  $\geq$  85th percentile for age and sex, age 7–18 years, and participation by a parent or guardian in sessions. The determination of which treatment intervention the child or teen and guardian are enrolled into is ascertained during the initial interview based on psychological and medical assessment of physical and mental health status, readiness to change, difficulties in family schedules, and financial feasibility. Specifically, exclusion criteria for the group program may include significant medical issues precluding exercise (eg, Blount's disease), psychosis, externalizing behavior problems, reported binge eating, suicidal and/or homicidal ideation, and/or disinterest in participation. Participants in either treatment track return to clinic approximately every three months after initiating treatment to assess ongoing progress and provide support for lifestyle change.

**Procedures.** Staff conducted a Western Institutional Review Board (WIRB®) approved retrospective chart review of youth. Written informed consent was obtained from parents or guardians and assent was obtained from adolescents by program staff at the initial clinic visit. Fasting lab-work including lipids, glucose, insulin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and glycosylated hemoglobin were obtained through their PCPs prior to the initial clinic visit and prior to the 12-month follow-up visit. Additional medical information obtained in clinic included anthropometric measurements and body fat measurements by bioimpedance. A homeostasis model assessment of insulin resistance (HOMA-IR) level was also calculated at baseline from fasting glucose and insulin laboratory values.

## Measures

**Demographics information.** Basic demographic information was obtained from the intake questionnaire completed by the family prior to clinic visit. Any information missing from the questionnaire was obtained by interview during the clinic appointment. Demographic information obtained included age, gender, race/ethnicity, insurance coverage, parent/guardian ages, and parent/guardian reported height and weight, from which BMI was calculated.

**Anthropometrics.** Weight and height were obtained for the youth at the initial clinic visit and at a follow-up visit 12 months after the initial program visit. Weight was obtained in street clothes without shoes via either a calibrated Health-O-Meter Professional Plus wheelchair scale or the Tanita® SC-331S bioimpedance machine. Weight was corrected for amount of clothing worn using standardized methods. Height was obtained using a calibrated, wall-mounted stadiometer (Holtain Limited). BMI z-scores were calculated for the initial clinic visit and at the follow-up visits using a web-based program from Baylor College of Medicine (<https://www.bcm.edu/cnrc-apps/bodycomp/bmiz2.html>). Body fat measurements were obtained by bioimpedance using the Tanita® SC-331S bioimpedance machine. If patients did not return for



their 12-month follow-up visit, records were requested from their PCPs to obtain anthropometric values from their offices if the patient had a visit to their PCPs that was within three months of the date of their missed appointment.

**Statistical analysis.** Data analysis was performed using Statistical Package for the Social Sciences, version 20.0 (SPSS 20). Descriptive statistics were used to determine demographic information including race, gender, and age. Paired *t*-tests were run to assess changes in anthropometric and laboratory values. Chi-square analyses were run to control for variables known to affect outcomes (ie, race, sex, insurance payer, ethnicity, and parental BMI). Regression analyses were run to assess differences in outcomes by treatment track. Fisher's exact test results were also run to examine attrition. Fisher's exact tests were run using GraphPad Prism 6 statistics software.

## Results

**Participant characteristics.** A total of 1051 youth were evaluated in the Weigh Smart® clinic for participation between 2005 and 2013. Of those evaluated in clinic, only 203 (19%) had anthropometric data available at 12 months after the initial visit to be included in the analysis of program outcomes. Patients who did not have 12-month data did not have a return visit to either the program or their PCPs and were therefore excluded from the final analytic sample. There was significant attrition in the population, especially within Medicaid recipient patients. Those patients made up 60% of the population at the initial clinic visit, but comprised only 46% of the study population that had 12-month visits. A higher number of patients with commercial insurance returned for a 12-month visit, with 46% of the commercially insured patients having 12-month visits, despite making up only 40% of the total baseline population.

The mean age of participants in the analytic sample was  $12.06 \pm 2.51$  years and ranged from 7.76 to 16.91 years.

Participants in the final analytic sample with 12-month visits were largely female (60%), African-American (63%), and equally split between having Medical Assistance as their insurance coverage (46%) and commercially insured (46%). The number of patients in the initial sample with Medicaid coverage was much higher, at 60%, with significant attrition at 12 months for Medicaid recipients as previously discussed.

Children met criteria for being significantly obese with the mean BMI z-score equal to  $2.50 \pm 0.27$ , which is greater than the 99th percentile BMI for age and gender. Parents were also obese; the mother's mean BMI was  $34.98 \pm 9.03$  kg/m<sup>2</sup> and the father's mean BMI was  $32.45 \pm 7.74$  kg/m<sup>2</sup>. Participant characteristics, laboratory and anthropometric measurements at the initial clinic visit, and the 12-month visit are presented in Tables 1 and 2.

Of those who had 12-month data available, 159 (77.9%) had their data collected at our center and the other 45 (22.1%) had their data collected at the PCP offices. The data points available from the PCP offices were included in the analysis for 12-month data if those patients did not have a 12-month visit at our program site. As presented in Table 1, there were no significant differences found between those who did and who did not return for a 12-month visit on sex, but there were significant differences on ethnicity and type of insurance. Attrition was higher for African-American patients when compared to Caucasians ( $P = 0.0183$ ), and a trend toward greater attrition in comparison to Hispanic children ( $P = 0.0546$ ). Differences in return rates for Hispanics versus Caucasians were not statistically significant. There was a trend for greater return rates among children with commercial insurance than those with Medical Assistance; 17.2% of patients with Medical Assistance had 12-month data versus 22.6% of patients with commercial insurance ( $P = 0.0647$ ).

Analyses were done to ensure that there was no confounding between the children or adolescents who received treatment in the group track versus the self-paced track. Common

**Table 1.** Baseline and 12-month representative characteristics.

		BASELINE DEMOGRAPHICS (n = 1051)	12-MONTH DEMOGRAPHICS (n = 203)
Sex, no. (%)	Female	637 (60.6)	122 (60.1)
	Male	414 (39.4)	81 (39.9)
Race/ethnicity, no. (%)	African-American	707 (67.3)	128 (63.1)
	Caucasian	208 (19.8)	50 (24.6)
	Hispanic	55 (5.2)	12 (5.9)
	Asian	4 (0.4)	2 (1.0)
	Biracial	15 (1.4)	2 (1.0)
	Other	35 (3.3)	8 (3.9)
	Missing	27 (2.6)	1 (0.5)
	Insurance type (SES indicator), no. (%)	Self-pay	8 (0.8)
Medical assistance		627 (59.7)	108 (46.3)
Commercial		416 (39.6)	94 (46.3)

**Table 2.** Baseline and 12-month laboratory and anthropometric values.

SERUM TEST	VALID n = 172 (LISTWISE)	INITIAL SCREENING (n = 203)	VALID n = 74 (LISTWISE)	TWELVE-MONTH SCREENING (n = 203)	P VALUES
BMI z-score, mean (s.d.)	203	2.50 (0.27)	190	2.38 (0.37)	<0.001
BIA, mean (s.d.)	199	45.64 (6.85)	123	44.56 (8.81)	0.036
Glucose, mean (s.d.), mg/dl	200	87.21 (21.43)	130	85.67 (7.44)	0.506
Insulin, mean (s.d.), U/l	183	22.60 (17.147)	112	19.27 (11.09)	0.007
HOMA-IR, mean (s.d.)	183	5.11 (4.70)	106	4.02 (2.3)	0.005
Total cholesterol, mean (s.d.), mg/dl	202	164.42 (31.66)	125	156.3 (33.31)	0.003
Triglycerides, mean (s.d.), mg/dl	202	106.48 (65.63)	125	91.46 (55.65)	0.005
ALT, mean (s.d.), IU/l	200	23.51 (21.16)	130	19.37 (14.1)	0.003
AST, mean (s.d.), IU/l	201	22.80 (11.26)	127	20.78 (7.17)	0.007
HbA1C, mean (s.d.), %	194	5.74 (0.86)	120	5.66 (0.67)	0.066

variables known to affect outcomes are higher parental BMI, age, gender, ethnicity, and insurance payer. It was found that there were no significant differences between the groups. Chi-square analyses were run to control for all these variables. A chi-square test was conducted between the mother's BMI and the patient's program track for mother's BMI above or below 30 kg/m<sup>2</sup>. There was no statistically significant association between the mother's BMI and treatment track assigned to the child,  $\chi^2(1) = 0.005$ ,  $P = 0.945$ . A chi-square test was conducted between patient's sex and the program track the patient was assigned. There was no statistically significant association between the patient's sex and treatment track assigned to the child,  $\chi^2(1) = 1.217$ ,  $P = 0.270$ . A chi-square test was conducted between patient's race and the program track the patient was assigned. There was no statistically significant association between the patient's ethnicity and treatment track assigned to the child,  $\chi^2(5) = 0.2.883$ ,  $P = 0.718$ . A chi-square test was conducted between patient's insurance provider and the program track the patient was assigned. There was no statistically significant association between the patient's insurance provider and treatment track assigned to the child,  $\chi^2(2) = 0.694$ ,  $P = 0.707$ . Finally, a chi-square test was conducted between patient's age and the program track the patient was assigned. There was no statistically significant association between the patient's age and the assigned treatment track,  $\chi^2(10) = 9.770$ ,  $P = 0.461$ .

In addition, regression analyses were performed to evaluate changes in anthropometric and laboratory values across

the two treatment interventions to determine if there were significant differences in outcomes. Patients in both treatment tracks had similar results; there were no statistically significant differences in outcomes between the two treatment tracks (data not shown).

**Anthropometric and laboratory changes from baseline.** Baseline and 12-month BMI z-scores, body fat measured by bioimpedance analysis (BIA), and laboratory values were compared using paired sample *t*-tests to determine if participants who complete the program have improved anthropometric and laboratory parameters after program completion. When comparing the baseline data to 12-month data, there were statistically significant improvements in the BMI z-score ( $P < 0.001$ ), insulin level ( $P = 0.036$ ), HOMA-IR ( $P = 0.005$ ), cholesterol ( $P = 0.003$ ), triglycerides ( $P = 0.005$ ), AST ( $P = 0.007$ ), ALT ( $P = 0.003$ ), and HbA1C ( $P = 0.066$ ) levels. Changes in glucose and body fat (BIA) were not statistically significant. Pre and post program data points are summarized in Table 2.

## Discussion

Based on a comparison of initial and 12-month data, results suggest that a population that has demographic characteristics considered to be high risk, minority ethnicity status, Medicaid recipients, and with parents who have elevated BMI values, can show improvements in laboratory and anthropometrics after participation in a stage 3, interdisciplinary weight management program. Statistically significant changes were seen in laboratory values and anthropometric measurements one year after initiation of the program for those patients who returned for a 12-month visit. Since outcomes data were measured at one year after the initial visit, this suggests that participants were able to sustain long-term weight changes. These outcomes are encouraging, as based on previously published studies, participants who have characteristics matching those of the study population (ie, Medicaid recipients, minority ethnic status, and parents or guardians with elevated

**Table 3.** Study age characteristics for children and adolescents within this study.

STUDY CHARACTERISTICS (n = 203)	
Age, mean (s.d.), yr	12.06 (2.51)
Age, percentiles, yr	2.5    7.76
	97.5   16.91



BMI levels) typically have high attrition and/or low treatment success. It is also important to note that this study showed marked improvement in insulin sensitivity after completion of the program with improved HbA1C and HOMA-IR levels. This result is clinically relevant given the high proportion of African-American children in this study and the disproportionately high number of African-Americans affected by type 2 diabetes mellitus.<sup>19,20</sup> Some of the other laboratory changes, although statistically significant, were not as clinically significant when viewed as aggregate results; however individually, many patients had changes that were quite clinically significant.

Although patients who returned for their 12-month visits showed improvements in anthropometric and laboratory values, one significant limitation to this study is that there was significant attrition, especially in Medicaid recipients. Overall, our attrition over 12 months was 81%. This is in line with reported rates from 33% to 83% cited previously in literature on pediatric weight management programs.<sup>15,22–24</sup> It should also be noted that our study, similar to the studies by Tershakovec and Kuppler,<sup>15</sup> Jelalian et al.<sup>13</sup>, and Cote et al.<sup>16</sup>, found that there were higher attrition rates in African-American patients versus Caucasian patients and also in Medicaid recipients versus commercially insured patients. This higher attrition rate for African-American children and those from lower socioeconomic groups is of concern, as those are groups with higher rates of obesity and comorbidities<sup>25</sup> and therefore, in greatest need of services. Parental BMI is also significant as it has been found to be associated with attrition.<sup>13</sup> This study did not examine outcomes by parental BMI but should be part of future studies. This study also did not elucidate reasons for attrition; however, further work needs to be done to assess program barriers and factors that may contribute to attrition in populations that are at highest risk of obesity and associated sequela.

Another factor to consider for this study is that it is possible that the patients who returned to clinic at 12 months are patients with better outcomes than those who did not return to clinic, which would skew the data to make outcomes appear more favorable for the program overall. As patients lost to follow-up did not return, it was not possible to assess their anthropometric or biochemical changes at 12 months. Program staff did attempt to obtain anthropometric data from the PCP offices; however, those patients had not returned to their PCP offices either.

The results of this study contribute to the existing literature that has shown that minority ethnic groups and Medicaid recipients had higher attrition. Increased accessibility to pediatric weight management and enhanced retention for diverse populations should be an area for existing weight management programs to consider when examining their own outcomes and practices. Additional involvement with referring PCPs may be of utility in keeping patients at higher risk of dropout engaged. In addition, further research is needed to enhance

retention and/or assess and address program barriers for an ethnically diverse, low socioeconomic status population, who are most vulnerable for obesity and its sequelae.

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## Author Contributions

Conceived and designed the experiments: MD-H, AOS, MWW, EAG. Analyzed the data: MWW, MD-H. Wrote the first draft of the manuscript: MD-H. Contributed to the writing of the manuscript: MD-H, EAG, BAS, MWW. Agreed with manuscript results and conclusions: VSR, AOS, MWW. Jointly developed the structure and arguments for the paper: MD-H, EAG, BAS, AOS, MWW. Made critical revisions and approved the final version: MD-H, EAG, BAS, AOS, MWW. All the authors reviewed and approved the final manuscript.

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