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Improving Health Behaviors and Weight Parameters With Motivational Interviewing and the TEEEN Program in an Ethnically and Socioeconomically Diverse Pediatric Population

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ABSTRACT

Objective: Obesity affects 14.7 million children and adolescents in the United States. Children's health behaviors are affected by parental health practices. Therefore, pediatric obesity interventions should include parents. The objective of this study was to assess the changes in self-reported health behaviors in a diverse population attending the TEEEN program, with motivational interviewing of child-parent dyads as a key component, for 1 year.

Methods: Here we assessed the changes in Family and Nutrition and Physical Activity (FNPA) screening tool scores, a tool that assesses obesogenic behaviors, in the context of MI of child-parent dyads in a racially, ethnically, and socioeconomically diverse population who attended the TEEEN (Teens, Empowerment, Education, Exercise, Nutrition) program, a nonclinic and family-based behavior program in Massachusetts, for 1 year.

Results: Participation in the TEEEN program, which includes MI of child-parent dyads, was associated with a significant increase in the overall FNPA score (median change= 4 points, $P = .007$). We observed that 76.5% of children experienced a decrease in BMI% and BMI z-score. The change in BMI% (median= −0.9, $P = .006$) and change in BMI z-score (median= −0.2, $P = .008$) were statistically significant.

Conclusion: Participation in the TEEEN program seemed to be beneficial based on aspects of the FNPA screening tool and changes in weight parameters. The FNPA screening tool enhanced-motivational interviewing of child-parent dyads shows promise as an approach to address obesogenic behaviors. This study provides a detailed framework for medical providers to address pediatric obesity in a nonclinic setting with less time constraints.

1. Introduction

The prevalence of obesity and its associated comorbidities, such as nonalcoholic fatty liver disease (NAFLD) and type 2 diabetes, is increasing in both children and adults globally. Currently, 18.5% of youths and 42.4% of adults in the United States are affected by obesity.[1,2] Children and adolescents affected by obesity are approximately five times more likely to be affected by obesity as adults than their peers who are not affected by obesity in childhood and adolescence.[3,4] Having parents who are affected by obesity and who practice poor nutritional behaviors are risk factors for childhood obesity.[5] Indeed, studies showing that children's health behaviors are affected by parental health practices have been reported.[6] The authors found that the following parental behaviors were practices that were associated with healthier behaviors in children: offering healthy options, modeling behavior, and using authoritative parenting style.[6] Therefore, in addition to addressing comorbidity and risk factors, it is imperative that interventional strategies for children and adolescents with obesity include parents.[7]

Biopsychological determinants of obesity interacting with person-specific characteristics contribute to the development of obesity.[5] The current standard practices for children affected by obesity include

Abbreviations: BMI, body mass index; FNPA, Family and Nutrition and Physical Activity; MI, motivational interviewing; NAFLD, nonalcoholic fatty liver disease; SD, standard deviation; TEEEN, Teens, Empowerment, Education, Exercise, Nutrition.

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lifestyle modification, pharmacotherapy, and metabolic/bariatric surgery.[8] Overall, the primary goal is to increase energy expenditure and decrease energy consumption. However, effectively engaging children in the clinic is challenging and time-consuming. Despite public health initiatives and current clinical practices, the prevalence of obesity continues to rise.[1]

Motivational interviewing (MI) is a client-centered communication style that uses reflective listening, acceptance of resistance, autonomy support, and shared-decision making to empower patients to transition from building motivation to planning a course of action.[9,10] It aims to enhance readiness for change and tries to elicit the client's motivation for change.[9]

Several studies suggest that MI can significantly improve outcomes in health-related disorders compared to standard treatment alone.[11–13] For example, improved adherence to medications among the elderly population and promotion of healthy heart habits in an adult population affected by obesity suffering from heart failure have been shown.[11,12] Indeed, integrating MI into standard treatment has increased weight loss and improved metabolic parameters in adult populations.[13]

MI enables patients to reflect and provide more detailed responses to health behavior questions and provides the interviewer the chance to clarify and reinforce statements made. However, using this health behavior intervention in adolescents has been inconclusive.[14] Indeed, studies that have evaluated MI in the context of children with obesity in a diverse population (minorities) are scarce and most are short term (<6 months). Hampl et al., in the recently published guidelines for the evaluation and treatment of pediatric patients with obesity, state that more work is needed to examine the optimal characteristics of MI as an intervention.[15] It is essential to involve parents as their health practices affect their children's health behaviors.[16] Some studies report improvements in child eating behaviors, in child as well as parent activity levels, and in parental baseline attendance at pediatric obesity intervention after parent participation in an MI intervention.[17–19] More studies should focus on interventional programs that incorporate MI of both parent and child and demonstrate both a significant reduction in anthropometric outcomes and a significant behavior change.[20]

The Family and Nutrition and Physical Activity (FNPA) screening tool[21,22] assesses obesogenic environmental risks (eg, screen time, family meals). There is an inverse association between FNPA screening tool score and level of adiposity as well as CVD risk profile.[23] A previous study demonstrated significant correlations between body mass index (BMI) and FNPA screening tool total score as well as 7 of the 10 constructs in the FNPA screening tool.[21] Researchers have evaluated the FNPA screening tool as an MI tool and have found it helpful in addressing obesogenic behaviors.[24]

The objective of this study was to assess the changes in self-reported health behaviors in a diverse population attending the Teens, Empowerment, Education, Exercise, Nutrition (TEEEN) program,[25] a nonclinic, non-school-based program, with MI of child-parent dyads as a key component, for 1 year. Health behavior changes were measured at the start and at the end of the study using the FNPA screening tool, a tool used in the context of MI of child-parent dyads. In addition, as secondary analyses, we assessed changes in weight parameters. We hypothesize that participation in the TEEEN program, which includes MI of child-parent dyads as a key component, will yield improvements in the FNPA screening tool scores. Additionally, indicators of behavior changes, not just weight parameters, give a more comprehensive view of the various determinants of health that can be used to personalize obesity health practices.

2. Materials and Methods

2.1. Study Design

This was a nonrandomized, observational study aimed at quantifying the changes in FNPA screening tool scores, a tool used in the context of MI, in child-parent dyads attending the TEEEN program. Children, ages 8-20 years, with a BMI% ≥ 85 who were patients in a group practice and their parents were invited to participate in the monthly TEEEN program for 1 year. Participants were allowed to invite their friends and those who met the inclusion criteria were invited to participate in the study. Changes in child's weight parameters were examined as a secondary analysis. Motivational interviews were offered at each monthly TEEEN program session (Supplemental Tables 1-2, available online). Over the years, we have found that, due to various commitments, child-parent dyads may not be able to attend the program every month for 1 year. Our experience has been that a minimum dose of four sessions is associated with benefits. Therefore, to participate in the study, each child-parent dyad must have participated in at least four motivational interviews conducted during the TEEEN program sessions. The duration of the intervention was 1 year. The TEEEN program was founded in 2003. Incorporating MI of child-parent dyads using the FNPA screening tool was a new component of the TEEEN program introduced in 2015. This study included participants who participated in the program from 2015 to 2020. The exclusion criteria for enrollment were patients <8 and >20 years of age, no parental participation, and current use of medications with the possible side effects of weight gain/loss. Weight and height measurements were taken prior to the first session and at the end of their participation in the study. Data on parental education and occupation and the child's family history of obesity, type 2 diabetes mellitus, dyslipidemia, hypertension, and heart disease was obtained.

The study was approved by the ethics committee at St. Elizabeth's Medical Center (IRB #00725) as a quality initiative study. We obtained verbal consent and verbal assent from the parent and the child, respectively, prior to participation in the program. The principal investigator explained the study to the parent and the child and gave information on the program and an information letter on the study. All materials were administered by a TEEEN program coach and the FNPA screening tool was available in English and Spanish.

2.2. Parental Didactic Sessions

Parents were invited to participate in a 1-hour interactive curriculum presented in both English and Spanish. Parental didactic sessions are held during the third hour of the TEEEN program, do not include the children, and run in parallel with the children's information sessions (Supplemental Tables 1-2, available online).

2.3. TEEEN Program Overview

The TEEEN program is an innovative, award-winning, nonclinical, family-based behavioral program established in 2003 to address the epidemic of pediatric obesity that uses social cognitive and modeling theories and play-based learning and is conducted as group sessions.[25] The social cognitive theory allows for knowledge acquisition by observing others, such as medical and graduate students, within the context of social interactions in the program and the modeling theory allows for changes in behavior to occur as a result of observing someone else's behavior. The program meets monthly on a Saturday afternoon, is delivered outside of the clinic setting, and is directed by a pediatrician/Obesity Medicine Specialist–led team of fitness experts, medical and graduate students, and nutritionists. The sessions are structured into four 1-hour segments that include: (1) registration and tracking of nutritional choices and physical activity behavior; (2) fun, interactive, noncompetitive physical activities that promote physical activity self-efficacy; (3) interactive presentations; and (4) cooking demonstrations that promote nutritional skill building (Supplemental Table 1, available online). Peer-to-peer education is encouraged. A sample agenda is shown in Supplemental Table 2 (available online).

2.4. Motivational Interviewing

The motivational interview process consisted of the following: (1) the parent completed the FNPA screening tool (http://www.myfnpa.org/uploads/9/7/9/8/9798478/fnpa_tool_4_point_scale.pdf); (2) the interviewer guided a short discussion with the parent and child about areas they were doing well on and areas they could improve upon; and (3) together, the parent and child chose a goal that the child could work on the following month. The goal categories were the FNPA constructs: family meals, family eating practices, food choices, beverage choices, restriction/reward, screen time, healthy environment, family activity, child activity, and family schedule/sleep routine.

2.5. FNPA Screening Tool

Health behaviors and the family environment were assessed at the start and end of the study using the validated FNPA screening tool. The development and validation of the FNPA screening tool has been previously described.[21,22] It includes 20 questions to quantify obesity-related family behaviors and environment. The questionnaire covers 10 constructs: family meals, family eating practices, food choices, beverage choices, restriction/reward, screen time, healthy environment, family activity, child activity, and family schedule/sleep routine. Each of these constructs was captured by two survey questions, each answered by the parent using a Likert-type scale (1-4) scale, with the following range: "almost never, sometimes, usually, and almost always", represented by a score of 1, 2, 3, and 4, respectively. Directionality was inverted for six questions so that a higher score was consistently related to healthier family behaviors. The lower the total score, the more prevalent obesogenic behaviors are in the lifestyle (http://www.myfnpa.org/uploads/9/7/9/8/9798478/fnpa_tool_4_point_scale.pdf). Individual questions were summed to create a continuous score for each construct, and then all construct scores were summed to create one composite total FNPA screening tool score, ranging from 20 to 80. The total score was used to interpret the results of health behaviors and family environment. Additionally, the difference in the FNPA screening tool scores from the study endpoint to the baseline was used to determine changes in overall health behaviors.

Ihmels et al. have indicated that the alpha reliability of the single-factor FNPA scale (0.72) indicates that there is reasonable internal consistency in the FNPA screening tool.[21]

2.6. Statistical Analysis

Descriptive statistics were generated to view the distribution of the data and identify potential outliers. Due to the small sample size and nonnormal distributions, nonparametric statistical tests were used. Changes in FNPA screening tool scores and weight parameters were analyzed using the signed rank test. Pearson correlation was used to test for an association between change in weight parameters and the number of MI sessions attended. The threshold for statistical significance was set to $P < .05$. All statistical analysis was performed in SAS 9.4 (SAS, Cary, N.C.).

2.7. Sample Size Calculations

A prior study that used a MI-based counseling tool during well-child visits reported an FNPA screening tool score change of 4.2 (standard deviation [SD] = 5.7) over 6 months in patients 4-16 years of age.[24] Using this mean and SD, and assuming a paired *t*-test, 80% power, alpha = 0.05, and a two-sided test, 17 patients are needed to detect an effect this size or larger. We planned to continue enrollment until 17 participants completed the study. As the treatment duration for the current study was longer, and therefore a larger effect was expected, using a mean FNPA screening tool score of 4.2 is conservative.

Table 1
Child and Parent Characteristics.

Characteristic	*n* (%)* Total Cohort = 17
Child age (mean ± SD)	10 ± 1.2
Sex (female)	10 (58.8)
Ethnicity	
Hispanic	9 (53.0)
Race**	
Black	1 (0.07)
White	9 (57.1)
Multiple races	5 (35.7)
Maternal education	
<High school degree	4 (23.5)
High school degree	6 (35.3)
At least some college	7 (41.2)
Paternal education***	
<High school degree	5 (31.3)
High school degree	6 (37.5)
At least some college	5 (31.3)
Most frequent occupation	
Maternal: cleaning	8 (50.0)
Paternal: painter/construction worker***	6 (37.5)
Family medical history	
Obesity	9 (52.9)
Type II diabetes mellitus	9 (52.9)
Dyslipidemia	7 (41.2)
Hypertension	11 (64.7)
Heart disease	6 (35.3)

* All values reported are *n* (%) unless otherwise noted.
** *n* = 14 (self-reported: missing information on 3).
*** *n* = 16 (missing information on 1).

3. RESULTS

3.1. TEEEN Program Demographics

Participants (*n* = 17 dyads, mean age 10 ± 1.2 years) who attended the TEEEN program between 2015 and 2020 (median = 7 sessions with MI) completed the intervention. In total, 51 dyads were invited to participate and completed the informed consent, but 23 dyads were lost to follow-up, 2 dyads did not attend ≥4 sessions with MI (exclusion criteria), 2 dyads did not come in for the endpoint assessment, and 7 dyads were recruited but endpoint data was not needed as study had achieved the goal of 17 completers (Supplemental Figure 1, available online). Additionally, 53% of the participants were Hispanics, and 58.8% of the participants were female. The majority of the parents had a high school education or less (mothers: 58.8% and fathers: 68.8%). The most common maternal occupation was cleaning (50%). Other maternal occupations included: real estate agent, banker, engineer, and nursing assistant. The most common paternal occupation was painter/construction worker (37.5%). Other paternal occupations included: chef, engineer, restaurant manager, and driver. The majority of parents self-reported family history of someone affected with obesity and obesity-associated comorbidities: 52.9% reported obesity, 52.9% type 2 diabetes, and 64.7% hypertension (Table 1). Baseline characteristics of program completers and those lost to follow-up were comparable at baseline (Supplemental Table 3, available online). The mean duration of time from first session to last session was 13.5 months. All dyads had their experience last more than 6 months.

3.2. FNPA Screening Tool

Child-parent dyads who attended the TEEEN program experienced a significant increase in the overall FNPA screening tool score (median change = 4 points, $P = .007$) after participation in the study compared to baseline (Figure 1A). We observed the most improvement in the FNPA screening tool scores in the "Screen time behavior and monitoring" (median improvement=1 point, $P = .02$) and "Child activity involvement"

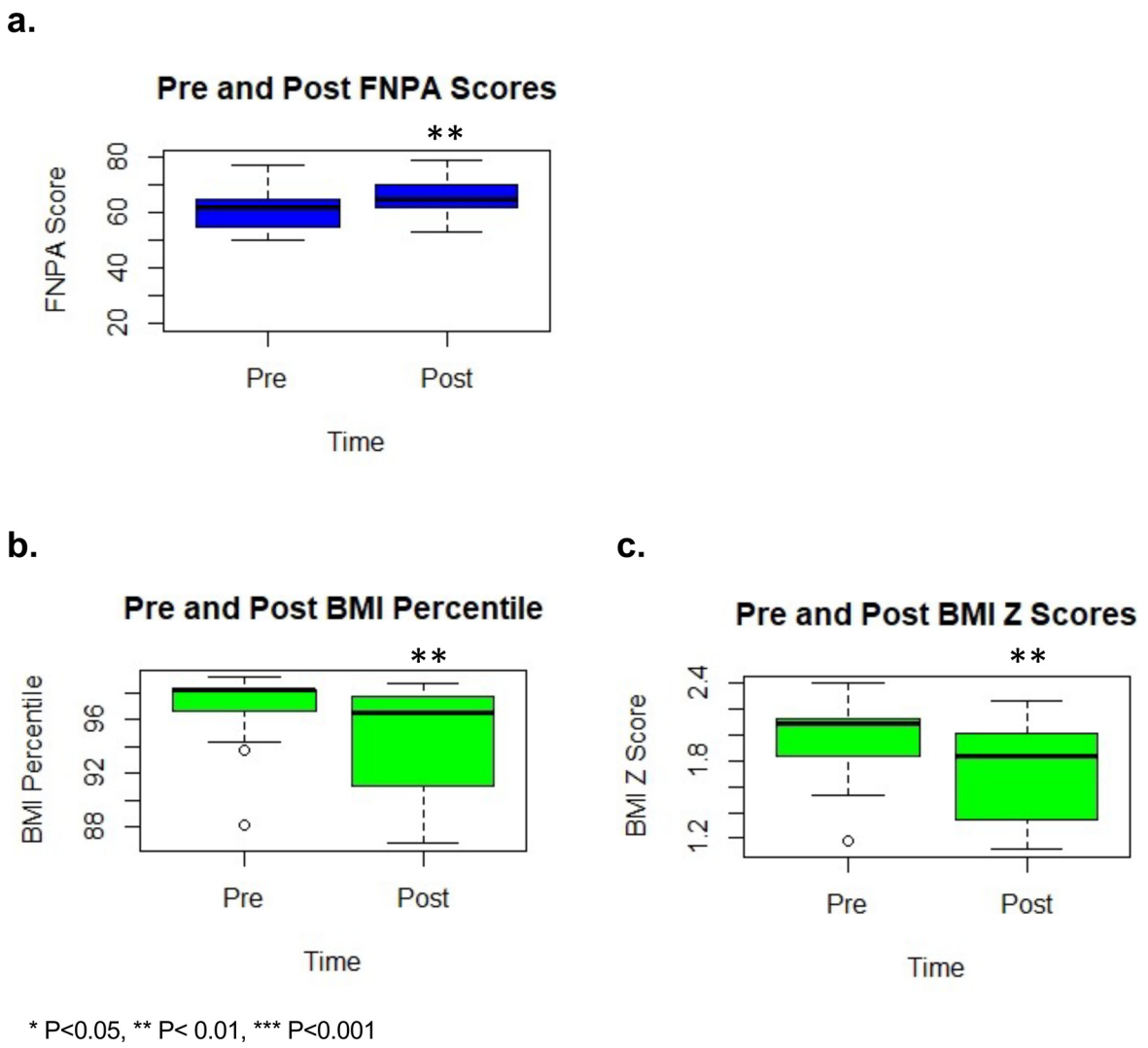

Figure 1. Motivational Interviewing significantly improved pediatric and parent dyad health and nutritional behaviors. (**A**) The Family and Nutrition and Physical Activity (FNPA) screening tool included 20 survey questions, covering 10 categories. Participants answered the questionnaire at the start of the TEEEN program sessions, over the period of 1 year. The total score prior to enrollment into the study was compared to 1-year study endpoint. (**B** and **C**) Height and weight measurements were taken prior to the study start date and at study endpoint. BMI percentile (**B**) and BMI z-score (**C**) were calculated. Signed rank test was used to evaluate changes in parameters prior to study start and at study endpoint.

Table 2
Changes in the Family Nutrition and Physical Activity (FNPA) Construct Scores After 1 Year of Participation in the TEEEN Program.

Health Behavior	Median [25th, 75th Percentile]	*P*-Value
Family meal patterns	1.0 [0.0, 1.0]	.12
Family eating habits	0.0 [0.0, 1.0]	.07
Food choices	0.0 [−1.0, 1.0]	.75
Beverage choices	0.0 [−1.0, 2.0]	.40
Restriction/reward	0.0 [−1.0, 1.0]	.94
Screen time behavior and monitoring	1.0 [0.0, 2.0]	**.02**
Healthy environment	0.0 [−1.0, 1.0]	.80
Family activity involvement	0.0 [0.0, 2.0]	.16
Child activity involvement	1.0 [0.0, 1.0]	**.03**
Family routine	0.0 [0.0, 1.0]	.45

(median improvement = 1 point, $P = .03$) categories (Table 2). More specifically, improvement on one question from the "Screen time behavior and monitoring" category (#11: my child spends less than 2 h on TV/games/computer per day) approached significance, $P = .05$, and improvement on one question from the "Child activity involvement" category (#17: my child does physical activity during his/her free time) was statistically significant ($P = .03$).

We did not find a significant association between the change in total FNPA screening tool score and the number of sessions (correlation=−0.06, $P = .82$).

3.3. Changes in Weight Parameters

We evaluated changes in weight parameters as a secondary endpoint. Following 1 year of participation in the TEEEN program and MI, we observed that 76.5% of children experienced a decrease in BMI% and BMI z-score. The change in the BMI% (median = −0.9, $P = .006$) (Figure 1B) and change in BMI z-score (median = −0.2, $P = .008$) (Figure 1C) were statistically significant.

4. Discussion

This study aimed to assess the changes in self-reported health behaviors in a diverse population attending the TEEEN program for 1 year. Health behavior changes were measured using the FNPA screening tool,[21,22] a tool used in the context of MI of child-parent dyads

that assesses obesogenic environmental risks (eg, screen time, family meals). As a secondary analysis, we assessed changes in weight parameters in a pediatric population affected with overweight or obesity following 1 year of participation in this study. We observed a statistically significant increase in the FNPA screening tool total score. The changes in reported perceptions in the categories of screen time behavior and monitoring and child activity involvement in the FNPA screening tool were statistically significant. Improvements in child BMI metrics, both BMI% and BMI z-scores, were also statistically significant. Studies have shown that a BMI z-score reduction of 0.15 to 0.25 is associated with improvements in cardiovascular and metabolic risk factors.[26] A BMI z-score reduction of 0.09 or greater was associated with increased HDL cholesterol levels and decreased fasting glucose and triglycerides levels.[27] The potential ramifications of the changes in weight metrics seen in this study include better cardiovascular health and decreased risk of obesity in adulthood. Additionally, from a clinical standpoint, if a patient's BMI% stays the same or decreases, we consider that a good response as most patients with obesity tend to experience worsening of BMI% throughout their pediatric years, especially without any intervention.

Our study contributes to the current literature on pediatric obesity interventions as it assesses outcomes of attending the TEEEN program, a program that includes MI of child-parent dyads using the FNPA screening tool. Unlike the majority of pediatric obesity management programs, the TEEEN program is founded by a pediatrician/obesity medicine specialist and takes place in a nonclinic venue. There are benefits to providing an intervention outside of the clinic or school setting. Based on reported guidelines, the benefits of interventions correlate with increased direct-contact hours. Having our study at a nonclinic venue helps to destigmatize and provides more time for delivery of intervention. The latter allows for better implementation of the social cognitive theory, which allows for knowledge acquisition by observing others, such as medical and graduate students, within the context of social interactions in the program and for better implementation of the modeling theory, which allows for changes in behavior to occur as a result of observing someone else's behavior. Here, we focus on the health behaviors of an ethnically, racially, and socioeconomically diverse pediatric population attending the TEEEN program over 1 year, a longer follow-up period than previously reported in most studies. In addition, not many studies in this field have been able to demonstrate improvements in both health behaviors as well as weight parameters. Our study demonstrated statistically significant changes in both self-reported health behaviors as measured by the FNPA screening tool and weight parameters. This may indicate that the TEEEN program had potentially positive outcomes based on some of the aspects of the FNPA screening tool.

In the pediatric population, the efficacy of managing weight and health behaviors with MI is unresolved due to lack of power, risk of bias, short intervention periods, and loss to follow-up.[20] The *Healthy Lifestyles Pilot Study* was a 6-month feasibility study that looked at MI in a primary care setting in the 3-7 age group in children affected with overweight, not obesity, and in children of normal weight who had a parent with a BMI of 30 or greater.[28] They saw a nonstatistically significant decrease in BMI% in the groups they studied. Furthermore, Walpole et al. investigated the effect of MI as an intervention. They also did not find a statistically significant change in BMI z-scores.[29] This study's limitations include that the group was not ethnically diverse, the study lasted only 6 months, and the study did not include a parent-child dyad. Ethnic diversity is important as minority children and families are at higher risk of being affected by obesity.

However, in a study based in general practices and secondary care clinics in New Zealand, Dawson et al. showed that just one session of MI improved parental self-determined motivation to make changes to improve their child's lifestyle.[30] A subsequent phase 2 of the study showed that low-dose customized health advice was more effective at reducing BMI and BMI z-score and improving health behaviors compared to the standard of care.[19] The age group for both studies was 4-8 years of age. In a pilot study in the primary care setting, Christison et al. showed that pairing MI with a nutrition and physical activity assessment and counseling tool during the well-child visit was feasible and could influence patient health behaviors.[24] However, providers gave lower satisfaction scores to the time spent to use the assessment and coaching tool, to the impact on workflow, and to the overall duration of the patient appointments compared to the tool's accuracy, and to the tool's ability to facilitate discussion, increase the efficacy of counseling, emphasize pertinent behavior change, and help families set realistic goals. The duration of this study was only 6 months, and only 7% of the population studied was Hispanic. Thus, our study, lasting longer than 6 months, incorporating older children, demonstrating statistically significant changes in BMI% and in BMI z-score, including an ethnically diverse population, and including participants with overweight and obesity, adds to the current literature on management of pediatric obesity. These findings will broaden the interventional strategies for long-term obesity treatment in pediatric populations.

Our study had several strengths. Our study incorporated MI of both children and parents who attended the TEEEN program. It is important to include the parents in this type of intervention. Parents are the primary educators of their children, and their behaviors affect their child's lifestyle behaviors, especially as a large percentage of the parents are affected by obesity. Children's lifestyle habits are a product of their surrounding environment, which is determined by the behavior of their parents.[5,6] Savage et al. found that parental behaviors such as offering healthy options, modeling behavior, and using an authoritative parenting style were associated with healthier behaviors in children.[6] In addition, our study included an ethnically, racially, and socioeconomically diverse population with a larger percentage of Hispanics (53%). Compared to previous studies, our study included older children (mean age= 10 ± 1.2 years), lasted longer than other studies, and included feedback during the MI sessions. In addition, measuring changes in scores of a survey that identifies reported perceptions of obesogenic behaviors and weight parameters provided a comprehensive view of determinants of health and of individual change.

Limitations of our study include a small sample size, limited generalizability, a relatively high drop-out rate, and a lack of a comparison group. The minimal clinically important difference in the FNPA score has not been assessed. A validation study showed higher odds for overweight/obesity (odds ratio = 2.49, confidence interval = 1.17-5.31) in first-graders with FNPA scores in the lowest tertile compared to the highest tertile.[31] Future work should examine the change in score and association with clinical impact. Literature demonstrates high rates of attrition from pediatric weight management programs, ranging from 27% to 73%.[32] Our drop-out rate was average compared to previous studies. Many times, this is due to lack of transportation, conflict with the parent's job schedule, other demands, and child's schedule. In addition, it is not clear what influenced outcomes and more research is needed.

5. Conclusion

In conclusion, with the rising rate of comorbidities associated with being affected by obesity and associated healthcare costs, there is an urgency to use new methods in approaching pediatric obesity as the prevalence continues to increase. We found that in a small study, there was evidence that participation in the TEEEN program seemed to be beneficial and had positive outcomes based on aspects of the FNPA screening tool. The FNPA screening tool enhanced-MI of child-parent dyads shows promise as an approach to identify and address obesogenic behaviors. Unlike traditional primary care approaches to pediatric obesity, the TEEEN program is an innovative, award-winning, family-based behavioral program that uses social cognitive and modeling theories and play-based learning. Our results will guide curriculum development to maximize health outcomes.

Ethical Approval

The study protocol was reviewed and approved by St. Elizabeth's Medical Center Research Ethics Board Minimal Risk Committee: IRB #00725.

Informed Consent

Informed verbal consent and verbal assent were obtained from all individual parents and children, respectively.

Author Contributions

J.C.L. and S.G. conceived the study. J.C.L, M.L., H.S.Z., and S.G. contributed to the acquisition and interpretation. L.L.P. performed the data analysis. J.C.L., M.L., H.S.Z., L.L.P., and S.G. drafted the manuscript and critically revised the manuscript. All authors critically revised and gave final approval of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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