Efficacy of Family-Based Weight Control Program for Preschool Children in Primary Care

WHAT'S KNOWN ON THIS SUBJECT: Overweight children are at risk for becoming obese adults, especially if they have an obese parent. Family-based behavioral interventions, largely implemented in specialized settings, have shown efficacy in weight control in youth aged ≥ 8 years.

WHAT THIS STUDY ADDS: This study demonstrates the efficacy of a family-based behavioral weight control program translated to be implemented in the primary care setting. The work underscores the importance of pediatricians intervening early and shifting their focus from the child to the family.

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KEY WORDS

obesity, primary care, percent over BMI, preschool children

ABBREVIATIONS

IC—information control

%OBMI—percent over BMI

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abstract

OBJECTIVE: To test the efficacy of an innovative family-based intervention for overweight preschool-aged children and overweight parents conducted in the primary care setting.

METHODS: Children with BMI ≥ 85 th percentile and an overweight parent were randomized to intervention or information control (IC). Trained staff delivered dietary and physical/sedentary activities education to parents over 6 months (10 group meetings and 8 calls). Parents in the intervention received also behavioral modification. An intention-to-treat analysis was performed by using mixed analysis of variance models to test changes in child percent over BMI (%OBMI) and z-BMI and to explore potential moderators of group differences in treatment response.

RESULTS: Ninety-six of 105 randomized families started the program: 46 children (31 girls/15 boys) in the intervention and 50 (33 girls/17 boys) in the IC, with 33 and 39 mothers and 13 and 11 fathers in intervention and IC, respectively. Baseline characteristics did not differ between groups. Children in the intervention group had greater %OBMI and z-BMI decreases at 3 and 6 months compared with those assigned to IC ($P < .0021$). A greater BMI reduction over time was also observed in parents in the intervention compared with parents assigned to IC ($P < .0001$). Child %OBMI and parent BMI changes were correlated ($r = .31$; $P = .003$). Children with greater baseline %OBMI were more likely to have a greater %OBMI decrease over time ($P = .02$).

CONCLUSIONS: Concurrently targeting preschool-aged overweight youth and their overweight parents for behavioral weight control in a primary care setting reduced child %OBMI and parent BMI, with parent and child weight changes correlating. *Pediatrics* 2012;130:660–666

Among preschool children aged 2 to 5 years, the prevalence of obesity doubled from 5.0% to 10.4% over the past 3 decades,¹ and the prevalence of overweight is currently at 34.7% of children of this age.² Obesity tracks throughout development and 52% of obese children 3–5 years remain obese as adults.³ The risk of a child being obese as an adult is a joint function of being overweight as a child and parental obesity. The contributions of parental eating and activity habits and obesity status to their child's overweight are well known.^{4,5} Parental change toward healthier habits, modifying the shared family eating and activity environment, supporting healthier behaviors, and modeling new behaviors are important factors leading to both child and parental weight change.^{6–10} There is considerable evidence base on obesity treatment in specialized obesity clinics for youth ≥ 8 years of age but less research on early intervention, especially in the primary care setting.^{11,12} Therefore innovative programs are necessary to treat overweight youth at a young age to reduce the risk of overweight prevailing into adulthood and preventing the onset of early obesity-related comorbidities.^{13–16}

The goal of this study was to test the efficacy of an innovative family-based intervention program designed for treating overweight/obese children aged 2 to 5 years and an overweight parent in the primary care setting. We hypothesized that children and parents randomized to a family-based behavioral intervention would have greater reductions in percent over BMI (%OBMI) and BMI, respectively, compared with children and parents randomized to information control (IC) and that child and parent adiposity changes would be positively correlated.

METHODS

Participating children were recruited by their health care provider (pediatrician

or nurse practitioner) at the time of a well-or-sick-child visit in 4 large urban/suburban practices. Health care providers identified overweight children, approached the parents providing a brief standardized description of the program, and introduced the family to office embedded study recruiters who further described the study, consented parent/guardian, and conducted eligibility questionnaires. The recruiters flagged the electronic records of children with a BMI percentile qualifying for the study at their previous visit. Inclusion criteria were as follows: girls and boys aged 2 to 5 years with BMI ≥ 85 th percentile for age and gender, with normal developmental milestones and having 1 participating parent with a BMI ≥ 27 . Participating parents had to be willing to attend all treatment sessions, speak English or Spanish at a fifth-grade level, and continue care for their child at the same pediatric practice throughout the study. Exclusion criteria included child's height below 2 SD from the mean for age and gender or pathologic growth velocity, history of small for gestational age, medications known to affect weight, and child or parent with psychiatric/eating disorder or a pathology preventing performance of physical activity. To prevent contamination of treatments, families were also excluded if the participating mother was pregnant or planning a pregnancy, if parents were acquainted with the family of a child enrolled in the program, or the child's family resided within .5 miles from another participating child.

The study was approved by the Institutional Review Boards of the Women and Children's Hospital of Buffalo and the University at Buffalo and was conducted in accordance with the Declaration of Helsinki. After providing written informed consent for their child and undergoing screening, blocks of 12 child-parent dyads were randomized by

using a random number generator to intervention or IC stratifying for gender. Within each block the intervention and IC groups were run in parallel.

Treatment Components Common to Both Groups

Both treatment arms included ten 60-minute sessions over 6 months (4 weekly, 2 bimonthly, and 4 monthly) in which a consistent group leader delivered dietary/physical and sedentary activities education, and trained staff engaged the children in active games. Parents received 8 phone calls between meetings by an assigned "coach." During didactic group meetings, the group leader instructed parents on appropriate serving sizes and number of daily servings from each food group for their child to consume recommended daily energy intake of 1000 to 1400 calories per day (depending on the child's age).^{17,18} Parents were given a child weight loss goal of 0.5 to 1 pound weekly to gradually decrease % OBMI. The child's physical activity goal was 60 minutes per day in blocks of 10 minutes or longer, and sedentary activity goal was to limit TV and screen time to < 2 hours/day. Pediatricians, blind to group assignment, reviewed the child's progress providing follow-up with a standardized letter at 3 months and during a well-child visit at 6 months.

Components Pertinent Only to the Intervention

During group meetings, the group leader emphasized parenting and behavioral strategies to promote child and parent behavior change, including parenting-related techniques (selective ignoring, time out, praising, rewarding, contracting) and strategies aimed at changing parental behavior that would facilitate parent and child change (pre-planning, stimulus control, shaping, modeling, self-monitoring, changing

the home environment, social support, and changing black and white thinking). Before or after the group sessions parents attended a 1:1 meeting with an assigned coach who assisted the parents in shaping behavioral goals after having reviewed food/activity diaries. Group leaders and coaches were closely supervised by investigators TQ and JNR. Parents were instructed to record their child's and their own food intake, as well as physical and sedentary behaviors, by using a simplified icon-based diary that allowed for shaping of goals by changing the number of icons on the page. Parents were asked to weigh themselves and their child twice per week. They were given a weight loss goal of 1 to 2 pounds per week and received instruction regarding the appropriate number of servings from each food group leading to daily energy goals of 1500 and 1800 for mothers and fathers, respectively. Physical and sedentary activity goals for parents were the same as those adopted for the children, but parents were advised to model physical activity by engaging in active play with the child at least 10 minutes per day.

Anthropometric Parameters

Children's weight was measured by a trained research assistant every session in both groups by using a Tanita electronic scale, model BWB-800A. Height was measured at baseline, 3 months, and 6 months by using a Seca 216 Accu-Hite stadiometer. Parents' weight was measured every session in the intervention group and at baseline and 6 months in the IC group. The scale and stadiometers were calibrated before each assessment, and research assistants followed a standardized protocol. Height and weight were used to calculate BMI, z-BMI, and %OBMI. Child weight changes are expressed as %OBMI defined as [(child's

actual BMI minus BMI at the 50th percentile) / BMI at the 50th percentile] * 100.¹⁹

Sample Size Considerations

On the basis of a decrease in %OBMI of 6.5% (SD of 21%) in a 12-week pilot study,²⁰ we calculated that in a mixed-effect model a sample of 108 subjects was required to have at least 85% power to detect the treatment difference if a difference of $\geq 8.7\%$ was maintained between the intervention and IC groups throughout the study. The first cohort started the study in October 2008, and all cohorts completed 6 months by December 2011. Recruitment was closed at 105 families because preliminary analyses indicated efficacy of the primary outcome.

Statistical Analysis

Data are mean $\pm$ SD except in Fig 2 for which the data are mean $\pm$ SEM. Intention-to-treat analysis was performed, and all tests were 2-sided by using a significance level of .05. Several measures have been proposed to track children's responses to weight control therapy. We chose %OBMI because z-BMI measure can attenuate change for heavier children.^{19,21} However, z-BMI changes are also reported. Potential moderators of group differences over time in children were explored with additional mixed models, by using baseline child %OBMI and parent BMI as candidates of moderation. Baseline and demographic comparisons between groups were performed by using analysis of variance and/or the Pearson's χ^2 test, as appropriate. The repeated-measure outcomes including the primary outcome (%OBMI) were analyzed by using a mixed effect analysis of variance for both child %OBMI and parent weight and BMI in which the explanatory variables included the treatment group, time, and their in-

teraction as class variables with baseline values of the respective outcome variable as covariates. We also examined whether there were group-specific missing patterns based on the Pearson's χ^2 test. Child %OBMI change scores and parents' BMI change scores were calculated by subtracting baseline from 6 months. The correlation between child %OBMI change and parent BMI change was analyzed by using the Pearson's correlation coefficient and the multiple regression, with the latter allowed to investigate the roles of confounding factors such as gender of children or parents.

RESULTS

Figure 1 shows the study subject flow throughout the study. Of the 105 randomized families, 6 did not receive the allocated intervention, and 3 did not receive the allocated IC because they did not start the program. Reasons included father preventing mother from attending ($n = 1$), work schedule change ($n = 3$), and did not come to session 1 and could not be contacted ($n = 5$). Parents were not privy to group assignment. The families received 100% of the planned intervention as long as they remained enrolled in the study. An intention-to-treat analysis was performed for the 96 child-parent dyads that started the program and had data at baseline (46 assigned to intervention and 50 to IC). The baseline physical characteristics of children and participating parents and demographics did not differ between the 2 study arms (Tables 1 and 2). Overall the sample included 26 minority children. Yearly family income was \$65 729 $\pm$ 30 061 with 8.3% of the households reporting a yearly income $< \$20\,000$.

Model-adjusted mean estimates of child %OBMI in the intervention were 30.6 $\pm$ 9.7, 26.0 $\pm$ 9.9, and 24.2 $\pm$ 10.1 at baseline, 3 months, and 6 months,

FIGURE 1
Flow diagram of study participants.

TABLE 1 Children's Characteristics at Baseline

	Intervention	IC	P
N	46	50	.683
Age, y	4.6 ± 1.1	4.4 ± 1.1	.389
Gender, female/ male	31/15	33/17	.885
%OBMI	32.4 ± 22.4	29.8 ± 17.1	.513
z-BMI	2.2 ± 0.8	2.1 ± 0.7	.706
Race/ethnicity			
Non-Hispanic white	33	37	.633
Non-Hispanic black	7	4	.366
Hispanic	5	4	.739
Asian	1	0	.000
Other	0	5	.000

respectively, compared with 30.5 ± 9.3 , 28.7 ± 9.4 , and 28.3 ± 9.5 in the IC (Fig 2). Children in the intervention group had greater %OBMI decreases at 3 and 6 months compared with those assigned to UC with greater %OBMI decrease over time ($P < .0021$). In the intervention group, children

weight estimates were 52.8 ± 4.3 , 52.2 ± 4.4 , and 52.9 ± 4.5 pounds at baseline, 3 months, and 6 months, respectively, compared with 52.8 ± 4.1 , 53.4 ± 4.1 , and 54.7 ± 4.2 in the IC group at the same interval. In the intervention group, height estimates were 42.6 ± 0.6 , 43.2 ± 0.6 , and 43.8 ± 0.6 inches at baseline, 3 months, and 6 months compared with 42.6 ± 0.6 , 43.2 ± 0.6 , and 43.9 ± 0.6 in the IC at the same interval. Greater BMI reduction over time was also observed in parents in the intervention compared with parents assigned to IC ($P < .0001$). Model adjusted means of parents' BMI in the intervention were 36.7 ± 1.3 and 34.6 ± 1.4 at baseline and 6 months, respectively, and adjusted mean estimates of parent's BMI in the IC at baseline and 6 months were 36.7 ± 1.3 and 36.1 ± 1.3 , respectively. Adjusted means for parental weights were 226.7 ± 8.4 and 213.1 ± 9.0 pounds at baseline and 6 months, respectively, in the intervention compared with 226.5 ± 8.1

TABLE 2 Parent's Characteristics at Baseline

	Intervention	IC	P
N	46	50	.683
Age, y	37.2 ± 5.0	36.4 ± 5.0	.477
Gender, female/ male	33/13	39/11	.479
BMI	37.2 ± 8.3	36.2 ± 6.9	.536
Race/ethnicity			
Non-Hispanic white	38	42	.655
Non-Hispanic black	5	5	1.0
Hispanic	1	3	.317
Asian	0	0	—
Other	0	2	.00

and 222.9 ± 8.3 pounds in the IC group. BMI changes were not significantly different in participating fathers (-1.8 ± 1.5) compared with mothers (-1.1 ± 1.6 ; $P = .49$).

Baseline values of child age, %OBMI or z-BMI, and gender were not significant moderators of weight changes in the 2 groups, but children with high baseline %OBMI were more likely to have greater weight decrease over time (child baseline %OBMI * months, $P = .02$). Baseline parent BMI moderated group × time effects ($P = .02$), with increasing treatment differences when parent BMI was greater. Child %OBMI and parent's BMI changes were correlated at 6 months ($r = .311$, $P = .003$, Fig 3). Participating parent's gender or combinations of parent's and child's genders were not significant moderators of child weight changes in the 2 groups ($P = .86$ and 0.34 , respectively).

DISCUSSION

Our data indicate that treating overweight preschool-aged children and parents in the primary care setting with a family-based behavioral approach was effective in reducing %OBMI and z-BMI in children and BMI in parents. After a 6-month treatment period, children randomized to the intervention exhibited a greater decrease in %OBMI compared with children assigned to the IC. Across

FIGURE 2 A, Child %OBMI changes. * $P < .01$, ** $P < .001$. B, Child z-BMI changes. * $P < .02$, ** $P < .001$.

both groups children with high baseline %OBMI were more likely to have greater weight decrease over time. The added benefit of the family-based approach is

the weight loss observed in parents treated concurrently with their children, in keeping with previous studies implemented by our group in older youth.^{22–25} Also, behaviors leading to obesity may be more easily reshaped while both child and parent experience reduction in adiposity.²⁶ Indeed promoting healthy eating and physical activity in parents and encouraging parental modeling of healthy behaviors will make children more likely to exhibit the behaviors themselves.^{27,28} For the intervention group, we tried to induce parental responsive feeding, encouraging meal preplanning, set meal routine, and parental modeling of healthy mealtime behaviors.^{29,30} Golan has demonstrated that training parents to implement behavioral and home en-

vironment changes for their children resulted in greater child's weight loss, even if the children were not targeted by the program.³¹ Our data confirm an association between child and parent weight changes, with baseline parent BMI being a moderator of child weight changes with increasing treatment differences when parent BMI was greater. This may be due in part to the fact that heavier parents may have made more behavior changes to achieve their weight loss, which led to more modeling of healthier behaviors and greater changes in the shared family environment. Although balanced across groups, the number of participating mothers exceeded that of fathers. This is not surprising given that mothers are responsible for taking their child to the doctor in 84% of households.³² Nevertheless, our data indicate that the gender of the participating parent did not predict the child's weight outcome. Moreover, BMI changes did not differ between participating fathers and mothers.

A goal of the Buffalo Healthy Tots program is to translate intensive, yet effective, components of existing weight control programs to a less intense and less demanding intervention that can be delivered outside of a specialized academic obesity clinic, such as in the primary care setting. This was done, in part, by decreasing the number of sessions from 15 or 16 to 10 sessions over a 24-week period. Phone contact between sessions by an assigned coach replaced the need for parents to make time to come to the pediatricians' office and attend the additional meetings. However, innovative and technologically savvy strategies are needed to support parents in sustaining healthy changes, while further limiting the investment of time, which is often cited as a main barrier to attending or completing a weight control program.³³ In this regard, limiting the numbers of treatment sessions and

FIGURE 3 Correlation between child %OBMI and parent BMI changes.

conducting them in the pediatrician's office are likely important elements of the success of Buffalo Healthy Tots. Still, behavioral modification and readiness to change, necessary for successful weight control, can be a challenge for some parents. Even among those parents who agreed to participate and did not have any difficulties in completing baseline assessments, some never began the program, and some dropped from the study.

We strongly encouraged intake and activity monitoring for the child and parental self-monitoring. Although these are demanding tasks requiring much behavioral effort, they have previously been shown to be predictors of weight outcome and were likely helpful in our study as well.^{34–36} Monitoring was greatly simplified by using icons that parents, and even children when they grew older, could easily cross to track child's and parents' food group servings and active and sedentary behaviors.

The program is also innovative in that pediatricians identified, referred, and followed the progress of these young, overweight children in the study, whereas parents perceived the program as being an extension of the pediatrician's care. Health care providers also played a key role by providing parents with positive reinforcement throughout the program. The study required health care providers to shift their focus from the child to the overall family, while

implementing the Expert Committee Recommendations for Prevention and Treatment of Overweight and Obesity. Health care providers were trained to explain the significance of BMI above the 85th percentile and its predictive value. Nevertheless, parents are often not easily convinced of the need for weight control therapy as their child in many instances "does not yet look" overweight. Moreover, even simple recommendations to increase physical activity or reduce television time are often also met with resistance, because parents feel it is unfair to implement these changes for their children when indeed they are not willing to try it for themselves.³⁵ More effective educational and motivational messages need to be developed so that parents understand the value of making changes for their child at an early age. Despite the limitations cited here, parents regard the primary health care provider's opinion about their child's weight and healthy lifestyle habits as a motivating factor for considering implementing behavior changes.³⁷ In our experience the introduction of the program by health care providers at the time of the visit was effective. A close partnership between pediatricians and individuals trained to deliver dietary and behavioral teaching may be the model that best promotes parents initiating and maintaining changes in their own and their child's weight control behaviors.

Buffalo Healthy Tots is a step toward translating empirically validated treatments to usual clinical practice and providing the pediatrician with effective tools that can be used in clinical practice to treat obesity.

CONCLUSIONS

Concurrently targeting toddlers and parents with behavioral weight control in the pediatric clinic setting leads to greater reductions in children's %BMI and z-BMI and parents' BMI with association between parent and child weight changes. To implement the recommendations for prevention and treatment of overweight in the young child, parental behavioral changes and modeling of healthy behaviors are essential. Therefore, pediatricians should approach weight control by using a family-based approach to succeed in halting the progression of the young overweight child toward obesity. We suggest a model in which pediatricians shift their focus from the child to the family and adult practitioners move their focus from the adult to the family.

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