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Promoting healthy lifestyles: Behavior modification and motivational interviewing in the treatment of childhood obesity

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Abstract. Childhood obesity has increased dramatically during the past two decades. The growing incidence of childhood obesity is alarming, given the significant short- and long-term health consequences associated with obesity and the strong tracking of obesity from childhood to adulthood. Lifestyle plays an important role in the development and maintenance of obesity. Behavior modification programs targeting eating, exercise, and diet behaviors continue to be the mainstay for treating obese children. Although family-based behavioral weight management programs have resulted in significant improvements in weight status, maintaining improvements in weight status continues to be a challenge, with many interventions resulting in considerable relapse. Motivational interviewing is one innovative approach, used alone or in conjunction with standard behavioral modification programs, which has been proposed to have the potential to enhance motivation for change and therefore improve long-term treatment outcomes for obese children. A broad literature search using two electronic databases, Medline and PsycINFO, to identify studies that used an intervention with a motivational interviewing component to modify diet and/or physical activity in the prevention or treatment of childhood obesity identified two studies that targeted weight as a primary outcome. The studies reviewed indicate that, although initial findings are encouraging, further research is needed to determine the effectiveness of motivational interviewing for prevention and treatment of childhood obesity. Concerted efforts are clearly needed to elucidate the mechanisms for maintenance of initial treatment gains, as well as the ultimate achievement of more ideal weight once formal treatment ceases.

The term *obesity* refers to a weight range that exceeds what is generally considered healthy for a specific height and has been shown to increase the chances of certain diseases and health problems.[1] Body mass index (BMI), a number that conveys the weight-for-height relationship as a ratio (weight in kilograms divided by the square of height in meters), is the standard measure for assessing obesity in children and adolescents.[2] According to the 2005 Institute of Medicine report,[3] children and adolescents ages 2 to 18 years with a BMI of >30 or ≥95th percentile for age and gender—whichever is smaller—are considered obese. A recent expert committee[2] also recommended that children and adolescents with a BMI ≥85th percentile but <95th percentile or a BMI of 30—whichever is smaller—be considered overweight. Although BMI is the standard measure

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for evaluating obesity in children and adolescents, it is not comprehensive, and other assessments, such as skinfold thickness, waist circumference, and evaluations of medical history, diet, physical activity, and family history, can be important for diagnosis.[1] Evaluation of associated risk factors, including hypertension, elevated blood pressure, dyslipidemia, acanthosis nigricans, and insulin resistance, is also recommended.[2] The reader is referred to Krebs and colleagues[2] for a detailed discussion of measures of overweight and obesity and assessments of associated risk factors.

Childhood obesity has increased dramatically during the past two decades.[4,5] The Centers for Disease Control and Prevention report that 16% of children (>9 million) in the United States, ages 6 to 19 years, are overweight or obese—a number that has tripled since 1980.[1] Figures 1 and 2 present data from the National Health and Nutrition Examination Surveys. Figure 1 illustrates the growing prevalence of overweight among US children and adolescents ages 2 to 19 years over time. Figure 2, which depicts data from the 2003–2004 National Health and Nutrition Examination Surveys on the prevalence of overweight by race/ethnicity for adolescent girls and boys ages 12 to 19 years, demonstrates the higher incidence of overweight among non-Hispanic black adolescent girls compared to non-Hispanic white and Mexican American adolescent girls. The growing prevalence of childhood obesity is alarming, given the significant short- and long-term health consequences associated with obesity. Obese children have an increased likelihood of displaying adverse levels of insulin, lipids, blood pressure, and acanthosis nigricans.[6–8] With the growing incidence of childhood obesity has come a dramatic rise in the prevalence of type 2 diabetes in children and adolescents.[9] Obesity during childhood also appears to be a precursor to various chronic health conditions in adulthood,

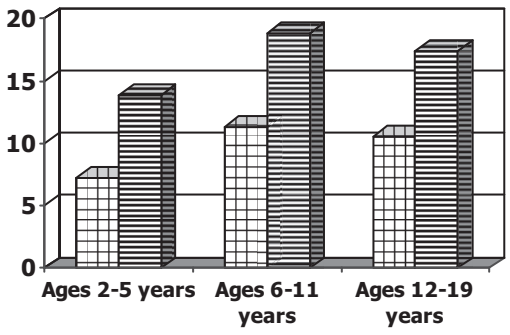

Figure 1 Percentage of overweight among US children and adolescents ages 2 to 19 years; National Health and Nutrition Examination Surveys (NHANES). Gender- and age-specific body mass index (BMI) ≥95th percentile based on Centers for Disease Control and Prevention growth charts. (From the Department of Health and Human Services Centers for Disease Control and Prevention. About BMI for children and teens. http://www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm.)

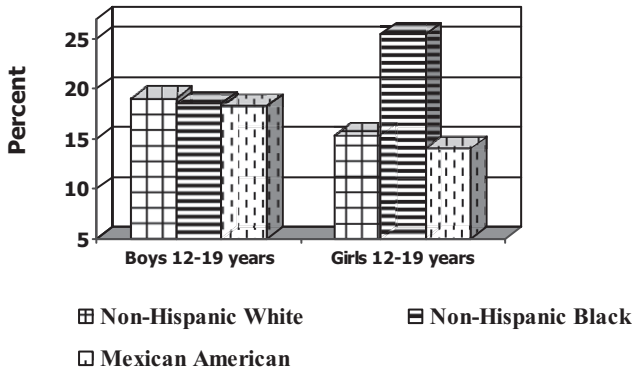

Figure 2 Percentage of overweight by race/ethnicity for adolescent boys and girls ages 12 to 19 years; National Health and Nutrition Examination Survey (NHANES) 2003–2004. Gender- and age-specific BMI ≥95th percentile based on the Centers for Disease Control and Prevention growth charts. (From Department of Health and Human Services Centers for Disease Control and Prevention. About BMI for children and teens. http://www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm.)

including cardiovascular disease, high cholesterol, hypertension, dyslipidemias, and non–insulin-dependent diabetes mellitus.[7,10] Childhood obesity is additionally associated with psychosocial problems, including low self-esteem, peer teasing, depression, and disordered eating.[11–14]

Health-related quality of life and childhood obesity

A number of authors have argued that improving quality of life is the ultimate goal of health care.[15,16] Health-related quality of life (HRQOL) has emerged as the most appropriate term for quality-of-life dimensions that represent a patient's perceptions of the impact of an illness and its treatment on their own functioning and well-being and which are thus within the scope of health care services and medical products.[17,18] HRQOL is a multidimensional construct, consisting at the minimum of the physical, psychological (including emotional and cognitive), and social health dimensions delineated by the World Health Organization.[17,19] HRQOL measurement has been increasingly acknowledged as an essential health outcomes measure in clinical trials and health services research and evaluation involving overweight and obese children and adolescents.[20–26] Well-validated HRQOL measures provide a common metric on which to compare interventions for different problems and different behaviors.[27] As such, HRQOL instruments provide an important outcomes measure for evaluation of pediatric obesity interventions.

In 2003, Schwimmer and colleagues[21] published one of the first studies examining the HRQOL of a clinical sample of severely obese children and adolescents. Using the PedsQL 4.0 Generic Core Scales, the authors found that compared to healthy children and adolescents, severely

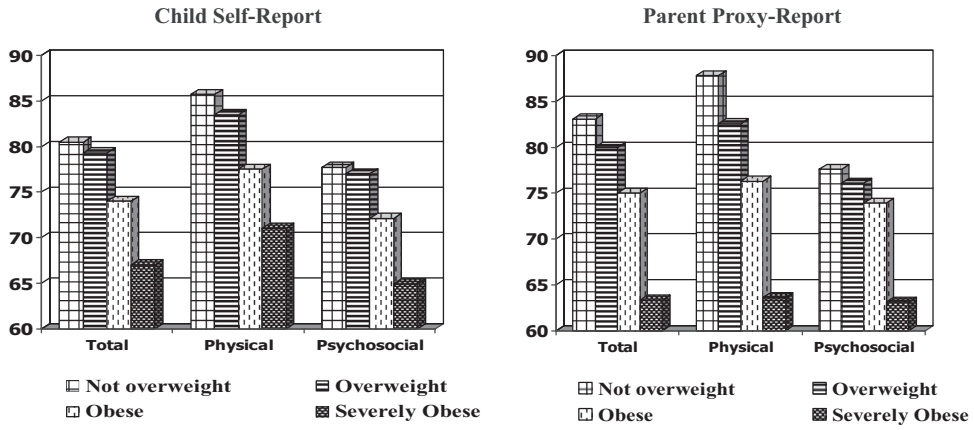

Figure 3 PedsQL 4.0 Generic Core Scale scores for child self-report and parent proxy-report. Higher values equal better health-related quality of life. Not overweight, overweight, and obese samples adapted from Williams and colleagues.[22] Severely obese sample adapted from Schwimmer and colleagues.[21]

obese children and adolescents reported significant impairment in all domains, including physical and psychosocial (emotional, social, and school) functioning. Severely obese children and adolescents reported similar HRQOL to those children and adolescents diagnosed with cancer receiving chemotherapy treatment. In 2005, Williams and colleagues[22] published a study investigating the HRQOL of obese, overweight, and non-overweight children and adolescents from a large Australian community-based sample. PedsQL scores for this sample, as well as the clinical sample of severely obese children and adolescents from Schwimmer and colleagues are presented in Figure 3. Figure 3 illustrates the obesity/HRQOL gradient for both child self-report and parent proxy-report. Children and adolescents demonstrated progressively more impaired HRQOL with increasing child and adolescent weight. The immediate and long-term physical and psychosocial consequences associated with childhood obesity, the clear gradient between increasing weight and impaired HRQOL, and the strong tracking of obesity from childhood to adulthood,[28,29] all underscore the critical need for efficacious and effective interventions for this population, which includes HRQOL outcomes in the process of identifying effective pediatric weight management programs.[20,26]

Treatment of childhood obesity

In treating childhood obesity, a major goal is to find an energy balance that best promotes changes in body composition without hindering the child's normal growth and development.[30] While selecting the most effective method for treating an obese child is complex, a comprehensive evaluation[2] can aid in treatment planning. Treatment can include modification of diet, increased physical activity, behavioral therapy, and, in extreme circumstances, weight loss medication and surgery.[31] The reader is refered to Spear and colleagues[32] for a thorough discussion of treatment options for childhood obesity. To date, behavior modification programs targeting eating, exercise, and diet behaviors have been the mainstay for treating obese children.[33–35]

Behavioral interventions and childhood obesity

Lifestyle plays an important role in development and maintenance of obesity. Participation in sedentary activities (eg, playing video games, watching television), lack of physical activity, high-caloric diets, and poor eating habits (eg, skipping meals) are associated with childhood obesity.[36,37] The increasing incidence of childhood obesity can be attributed in part to changes in the environment that have resulted in a reduction in energy expenditure and an increase in food consumption.[35] For example, the percentage of children with televisions in their bedrooms has increased.[38] Eating is associated with television watching, which often shifts time away from physical activity, decreasing energy expenditure.[35] In addition, with the growing number of single-parent families and families in which both parents work, families are increasingly eating out at restaurants. Meals at restaurants have larger portion sizes and use more added fats and oils, thus resulting in an increase in food consumption.[35]

Behavior modification programs that target eating, exercise, and diet behaviors have resulted in significant improvements in weight status, increased physical fitness, and psychosocial benefits for obese children, and have been found to reduce associated risk factors, including adverse levels of insulin, lipids, blood pressure, and acanthosis nigricans.[35,39–41] These programs use a combination of behavioral techniques, such as self-monitoring, goal-setting, stimulus control, cognitive restructuring, and relapse prevention to bring about lifestyle changes in obese children.[33,42–45] The main goal of behavior therapy techniques for pediatric obesity is to decrease undesirable (eg, eating high-fat foods, sedentary activities) and increase desired (eg, eating low-fat foods, sports activities) eating, exercise, and diet-related

behaviors by modifying the antecedents and consequences of these behaviors.[46] Antecedent stimuli act as cues for the performance of a particular behavior (eg, presence of high-fat foods in the home increases the probability of eating high-fat foods).[46] Consequences of a behavior are the events or contingencies that follow the performance of that behavior and affect the likelihood that a certain behavior will occur again (eg, receiving access to a computer game for 20 minutes only after exercising outside for 30 minutes).[46] Treatment of childhood obesity specifically targets health behaviors that contribute to attainment and maintenance of nonobese status, including adherence to a prudent diet plan, appropriate eating behavior, and regular exercise.[46]

Wilfley and colleagues[39] conducted a meta-analysis to evaluate the efficacy of lifestyle interventions (defined as an intervention involving any combination of diet, physical activity, and/or behavioral treatment recommendations) in the treatment of pediatric overweight by comparing lifestyle interventions with wait list/no-treatment control groups or information/education-only control groups. For the 14 randomized controlled trials identified, lifestyle interventions resulted in significant changes in weight status compared to no-treatment/wait-list and information/education-only control groups immediately following treatment and at follow-up (for trials with no-treatment controls, the mean effect size was 0.75 at the end of treatment and 0.60 at follow-up; for trials with information/education-only controls, the mean effect size was 0.48 at the end of treatment and 0.91 at follow-up).[39] There was a 2.1% increase in percentage in overweight subjects immediately following treatment and a 2.7% increase in percentage overweight at follow-up in children in the wait list/no-treatment and information/education-only control groups. Based on these findings, the authors concluded that overweight children receiving no treatment or information/education will continue to gain weight.

Family-based behavioral treatment programs for childhood obesity

Research indicates that obesity aggregates within families.[35,47] As a result, behavioral interventions for childhood obesity that target both the child and parent have demonstrated the greatest success in improving weight status and reducing cardiovascular risk factors in obese children.[35,48,49] Parental weight loss has been shown to consistently predict child weight loss.[39] Parents play a pivotal role in development of their children's food preferences, dietary intake, and activity patterns.[50] Through their feeding practices and the foods they offer their children, parents shape their children's eating behaviors.[51] Parents also shape their children's eating behaviors and activity patterns through direct modeling.[51] Taken as a whole, the evidence suggests that parental modeling of healthy behaviors and positive changes in the shared home environment enhance childhood obesity treatment outcomes.[35,39]

Although family-based behavioral weight-management programs are the cornerstone for treating childhood obesity, maintaining improvements in weight status continues to be a challenge with many interventions resulting in considerable relapse.[44,52,53] Childhood obesity must be treated as a chronic health condition because it is never cured, but requires long-term management like other chronic health conditions, such as diabetes.[46] Achieving and maintaining a healthy weight is a lifelong challenge that requires continuous monitoring to ensure healthy eating, exercise, and diet behaviors are sustained.

Weight-loss maintenance has been studied less in children compared to adult populations given the dearth of childhood obesity behavioral intervention studies following-up outcomes from time points of 12 months or more from baseline. The adult literature suggests that at 1-year follow-up, patients regain, on average, 30% of their initial weight loss.[47] By 3- to 5-year follow-up, most patients return to their baseline weight.[47] Increased physical activity and adherence to self-monitoring are the most reliable predictors of long-term maintenance of weight loss in adults.[47] Long-term maintenance of weight loss also appears to be improved by continued treatment contact.[54] Regular contact by phone and print has been shown to promote physical activity, as has delivery of personalized messages tailored to the individual's readiness to change their behavior.[55]

A recent study evaluated the effects of extending an intervention following a standard family-based behavioral weight loss treatment program on weight loss maintenance.[53] One-hundred fifty overweight 7- to 12-year-old children with at least one overweight parent underwent a 5-month weight loss treatment program and were then randomized to a no further treatment control group, a 4-month behavior skills maintenance group, or a 4-month social facilitation maintenance (SFM) group. Behavior skills maintenance builds on the behavioral approach in the initial weight-loss treatment program, but takes into account that the skills required to lose weight differ from those needed for weight maintenance. As such, behavior skills maintenance takes a cognitive-behavioral approach to weight maintenance adapted from adult weight maintenance programs and other evidence-based programs for children with anxiety and substance use disorders, emphasizing self-regulation behaviors and relapse-prevention strategies. SFM takes a social-ecological approach because parents are taught to promote child peer networks that espouse healthy eating and physical activity. In addition, SFM targets peer (eg, teasing) and self-perceptual (eg, body image) factors that are barriers to overweight children participating in physical activity. Body mass index z-scores were the outcome measure in this study. The authors found that both active maintenance groups resulted in improved short-term efficacy at the conclusion of the intervention compared with the control group. Greater maintenance of weight loss persisted through an additional 20 months of follow-up, particularly in children with few social problems who received SFM training. Although there was a statistically significant

effect of SFM training longer term, the effects of all interventions weakened over time and even at their peak were modest. These findings suggest that family-based behavioral weight-management programs for childhood obesity will require some form of ongoing long-term maintenance therapy to be most successful. The findings emphasize the need for additional research to better understand the psychosocial mechanisms that motivate children and their families to initiate changes in diet and physical activity and which sustain commitment to these behaviors for the long-term.

Motivational interviewing

Motivational interviewing is one innovative approach used alone or in conjunction with standard behavioral modification programs that has been proposed to have the potential to enhance motivation for change and therefore improve long-term treatment outcomes for obese children.[56] Motivational interviewing (MI) is a patient-centered therapeutic approach that facilitates behavior change by encouraging people to explore and work out their ambivalence toward change.[57] MI, which evolved from Miller's work in treating problem drinkers,[58] has been utilized extensively within the addictions field and has demonstrated success in increasing treatment initiation and completion rates and maintaining behavioral changes in patients with drug and alcohol addictions.[57,59,60] MI has proven to be particularly effective for patients who are less ready for change.[61] MI is based upon four general principles: (1) expressing empathy, (2) developing discrepancy, (3) rolling with resistance, and (4) supporting self-efficacy.[57]

Underlying the first principle of MI, expressing empathy, is the idea that acceptance facilitates change. Expression of empathy takes the form of reflective listening in MI. The practitioner uses reflective listening to understand the patient's feelings and perspectives without judging, and patient ambivalence or reluctance to change is viewed as a normal part of the human experience rather than as pathology. The second principle of MI, developing discrepancy, is based on the notion that change is more likely to occur when a behavior is seen as conflicting with important personal goals. Through selective reflections, the practitioner guides the patient toward recognizing the discrepancy between his/her problem behavior and his/her broader goals. Although MI is purposely directive, the practitioner is cautious not to explicitly advocate for change; the patient must be the one who provides the reasons for change.[57]

Rolling with resistance, the third principle of MI, requires the practitioner not actively oppose the patient's resistance to change, but instead accept it and flow with it through reflective listening. The practitioner does not impose new views or goals on the patient, but rather the patient is encouraged to express his/her own plans and solutions. Finally, the fourth principle of MI involves self-efficacy, a person's belief in his/her ability to successfully make a change. Self-efficacy is a key factor in one's motivation to change and a strong predictor of treatment outcomes. Thus, a major goal of MI is to increase a patient's confidence in his or her own ability to deal with challenges and succeed in change.[57]

MI and obesity

Children and families involved in behavioral weight management programs often experience ambivalence or resistance to making necessary behavior changes, such as improving eating habits, increasing physical activity, and limiting time spent in sedentary activities. MI can assist obese children and their families in more effectively addressing this ambivalence,[43] thus increasing the likelihood that a desired behavior change will take place and be sustained. Using the MI framework, children and their families are encouraged to (1) explore their reasons for and against recommended behavior changes and (2) think about how these reasons support or contradict their overall goal of reaching a healthier weight. Motivational interviewing provides children and their families with "the opportunity to customize and "buy into" a course of action for changing targeted health behaviors,"[43] and has been proposed to have the potential to improve treatment outcomes for obese children involved in behavioral weight management programs.

In a recent review article, Resnicow and colleagues[56] reviewed the adult literature to evaluate the effectiveness of MI in altering diet and exercise. Eight controlled outcome studies and one pilot study were identified (Table 1). Weight was not the primary outcome in any of these studies. According to Resnicow and colleagues, overall, the studies indicated that MI can be effective in altering diet and short-term physical activity in adults. In all but three studies,[62–64] a significant effect in favor of the MI group on at least one primary outcome was demonstrated. Effect sizes were, in general, in the small-to-moderate range (0.20–0.50) in these studies in which MI demonstrated significant outcomes. In each of the three studies where MI was used to modify fruit and vegetable consumption, significant effects were found. Harland and colleagues[65] found a short-term effect of MI on physical activity. However, significant long-term outcomes were not observed for this study[65] or for the one by Resnicow and colleagues.[66] Weight was at least a secondary outcome in four of the studies. Only one of these four studies found MI to have a significant effect on weight.[67] In the other three studies where MI did not demonstrate a significant effect on weight, MI demonstrated efficacy in reducing other risk factors targeted. For example, Smith and colleagues[68] found that older obese women with non–insulin-dependent diabetes mellitus assigned to the MI intervention group had significantly better glucose control post-treatment (9.8% vs 10.8%) compared to participants in the standard group.[68]

A recent study investigated whether adding MI to a behavioral weight program improved weight loss and glycemic control for overweight women with type 2 diabetes.[69] All participants took part in a 42-session group-based be-

Table 1 Studies utilizing motivational interviewing for adult diet, physical activity, and weight identified in Resnicow and colleagues[56]

First author, year	Outcomes	Intervention	Interventionist
Mhurchu, 1998	Dietary knowledge, stage of change, dietary intakes, lipid levels, and BMI (when appropriate)	MI at baseline, 6 weeks and, 3 months plus standard dietary education	Dietitians
Woollard, 1995	Blood pressure, alcohol consumption, dietary fat and salt intake, weight, physical activity	Low intervention group had one practice appointment and five telephone counseling appointments; high intervention group had six appointments in their general practice	Nurse counselors
Harland, 1999	Physical activity	Brief intervention groups given one motivational interview plus education; intensive intervention groups given six motivational interviews plus education	Health visitor
Resnicow, 2000	Fruit and vegetable intake, serum carotenoids, outcome expectations, barriers to fruit and vegetable intake, preference for meat meals, neophobia, social support to eat more fruit and vegetables, self-efficacy to eat more fruit and vegetables, nutrition knowledge	Culturally sensitive multicomponent intervention with one MI phone call; culturally sensitive multicomponent intervention with four MI phone calls	Dietitians or dietetic interns
Bowen, 2002	Percentage of energy from fat	Three individual MI contacts plus a dietary modification intervention	Dietitian
Resnicow, 2004	Fruit and vegetable intake, fat intake, vegetable preparation practices, intrinsic/extrinsic motivation, social support to eat more fruit and vegetables, self-efficacy to eat more fruit and vegetables	Two MI telephone calls plus a multicomponent intervention	Lay church members
Resnicow, 2005	Diet, physical activity	Four telephone counseling calls based on MI and culturally targeted self-help nutrition and physical activity intervention materials	Master's or Doctoral-level psychologists
Woollard, 2003	Blood pressure, antihypertensive drug prescriptions	Low group provided one face-to-face individual MI counseling session and monthly telephone contacts for 1 year; High group provided individual face-to-face MI counseling up to 1 hour monthly for 1 year	Nurses
Woollard, 2003	Diet, BMI, blood lipids	Low group provided one face-to-face individual MI counseling session and monthly telephone contacts for 1 year; High group provided individual face-to-face MI counseling up to 1 hour monthly for 1 year	Nurses
Smith, 1997	Blood glucose control, weight	Three individualized MI sessions plus a standard group behavioral weight-control program	Doctoral level psychologists

BMI, body mass index; MI, motivational interviewing.

havioral weight management program that focused on altering dietary and physical activity habits. As an addition to the behavioral weight control program, participants were randomized to receive either five individual sessions of MI or an attention placebo. Women in the MI group lost significantly more weight than women in the attention placebo group, and these effects were maintained at 18-month follow-up. The greater long-term weight loss that resulted from MI was modest, however; 1.6 to 1.8 kg more than the weight loss attained with the standard behavioral intervention. MI enhanced weight loss by increasing attendance at group sessions and improving quality of self-monitoring. Race influenced the long-term impact of MI on weight loss. Increased weight loss with the addition of MI was

Table 2 Studies utilizing motivational interviewing for childhood obesity

First author, year	Outcomes	Intervention	Interventionist
Resnicow, 2005	BMI, percentage body fat, waist and hip circumferences, blood pressure, serum measures of lipids, insulin, and glucose, and cardiovascular fitness	Four to six motivational interviewing calls by telephone plus a multicomponent behavioral intervention	Counselors with either a masters or doctoral degree in psychology or public health
Schwartz, 2007	BMI, physical activity, dining at restaurants, and watching television behaviors	Minimal intervention group received a brief 10 to 15 minute face-to-face MI counseling session; Intensive intervention group received two brief 10 to 15-minute MI counseling session plus two 45- to 50-minute MI sessions	Dieticians, pediatricians

BMI, body mass index; MI, motivational interviewing.

maintained at month 12, but dissipated by month 18 for African-American women; improved weight outcomes were still observed for white women in the MI group at month 18.

MI studies for childhood obesity

Data on the effectiveness of MI for treating childhood obesity are still very preliminary. A broad literature search conducted in October 2007 using two electronic databases, Medline and PsycINFO, to identify studies that used an intervention with a MI component to modify diet and/or physical activity in prevention or treatment of childhood obesity identified two studies that targeted weight as a primary outcome (Table 2). The first study was a multicomponent program for overweight African-American adolescent girls aged 12 to 16 years, which included MI as an essential component of the intervention.[70] The second of these studies was an obesity-prevention program for children ages 3 to 7 years using MI as the chief intervention strategy in primary care pediatric offices.[71]

In the study by Resnicow and colleagues,[70] African-American adolescent girls aged 12 to 16 years with a BMI >90th percentile participated in a 6-month church-based nutrition and physical activity program. Ten churches were randomized to either a high-intensity (24–26 sessions) or moderate-intensity (6 sessions) behavioral group program. Rather than using an attention control group, the moderate-intensity group served as the comparison group in this study. The high-intensity multicomponent intervention consisted of weekly group behavioral sessions that were attended by the girls. Parents were invited to every other session. Girls in the high-intensity intervention also received two-way pagers that delivered reminders about their eating and physical activity throughout the day and 4 to 6 motivational interviewing calls by telephone. MI telephone calls, which lasted approximately 20 to 30 minutes, were synchronized with the group sessions so that, for example, during the week when the group sessions addressed physical activity goals, the MI call that week focused on participants' plans and progress regarding their personal activity goals. The MI telephone calls were delivered by counselors who had either a masters or doctoral degree in psychology or public health and who received 16 hours of MI training plus ongoing supervision by doctoral level staff. Girls in the moderate-intensity intervention participated in a six-session behavioral program delivered once per month, selected from the larger pool of sessions delivered to the high-intensity group. The moderate-intensity group did not receive two-way pagers or the MI telephone calls.

One-hundred twenty-three girls completed baseline and 6-month follow-up assessments. At the 6-month follow-up, there were no statistically significant differences ($P = 0.20$) between the high- and moderate-intensity groups for BMI or any of the secondary outcomes. Furthermore, in the high-intensity group, change in BMI and the number of MI calls completed were not related. Results at 1-year after baseline mirrored those found at month 6.

Participants in the study by Schwartz and colleagues[71] included children aged 3 to 7 years presenting for well-child care visits and with a BMI ≥85th percentile but <95th percentile, or having a normal weight and a parent with a BMI ≥30. In the control condition, children received standard care and parents were provided with two safety-education tip sheets. In the minimal intervention group, parents received a brief 10 to 15 minute face-to-face MI counseling session from the pediatrician at the primary care pediatric office 1 month after the child's initial well-child care visit. In the intensive intervention group, parents received the brief 10- to 15-minute MI counseling session from the pediatrician 1 month after the child's initial well-child care visit, but this session was immediately followed by a 45- to 50-minute MI session with a registered dietitian (RD). Three months after the child's initial well-child visit, parents in the intensive intervention group returned to the primary care pediatric office to receive one additional MI

session with the pediatrician and one additional MI session with the RD.

Pediatricians and RD reviewed a two-page checklist completed by the parent about the child's eating and television-viewing behaviors to identify topics for the MI sessions. The intervention phase lasted 6 months. Pediatricians and RDs delivering the MI sessions completed a 2-day MI training workshop and were supervised by a psychologist in MI techniques.

Ninety-one children from the three study arms were weighed and measured 6 months after their initial well-child visit. Mean decreases in BMI of 0.6, 1.9, and 2.6 percentiles, respectively, were reported at 6-month follow-up for the control group, minimal intervention group, and intensive intervention group. After adjusting for days from follow-up, the differences between the groups were not statistically significant ($P = 0.85$).

The studies reviewed here indicate that further research is needed to determine the effectiveness of MI for prevention and treatment of childhood obesity.

Discussion

Family-based behavior-modification programs targeting eating, exercise, and diet behaviors have resulted in significant short-term improvements in weight status for obese children. The major challenge in the treatment of childhood obesity is ensuring long-term maintenance of behavior change, including adherence to a prudent diet plan, appropriate eating behavior, and regular exercise. Concerted efforts are clearly needed to elucidate the mechanisms for maintenance of initial treatment gains, as well the ultimate achievement of more ideal weight once formal treatment has ceased.

One aspect of maintenance that should be further investigated is the nature and duration of intervention contact.[47] It has still not been established whether there are critical time periods in childhood in which prevention or treatment interventions for obesity are most important.[43] Studies investigating the relationship between birth weight, infant-feeding practices, and rate of weight gain in infancy/early childhood with weight status later in life point to the importance of intervening early in a child's life.[43] Research is needed to investigate how parental involvement interacts with other factors, such as child age or gender, and how factors such as age, extreme weight, co-morbid conditions, and race/ethnicity affect the magnitude and variability of treatment response.[39] Although researchers have begun to study the extent to which treatment duration is related to child weight outcomes, the optimal level of treatment contact and duration for child populations has not yet been determined.[39] Given that longer treatments are associated with better outcomes in both child and adult populations,[53,72] one method for ensuring long-term maintenance of behavior change may be to extend the length of behavioral weight management programs. However, longer treatments present challenges in maintaining participants in treatment.[73]

Additionally, given findings from a multidisciplinary weight management program for obese children that demonstrated the efficacy of a progressive exercise program used in conjunction with behavior-modification sessions,[74] the inclusion of exercise regimens as a treatment component should be considered in future research. Future research should also move beyond traditional clinic-based models and examine other intervention methods that can increase the percentage of children who are able to lose and maintain weight losses. Church-based behavioral interventions[70] and interventions delivered via the Internet[75] have the potential to reach a greater number of people. Internet interventions can enhance treatment outcomes by offering an avenue to disseminate educational information, assist with recommended behavioral therapy activities, such as self-monitoring and problem-solving, and increase communication between families and program providers.[43] Interventions delivered over the Internet can also provide a convenient and affordable alternative to face-to-face programs[27] and can help families remain engaged in a behavioral weight-loss program and provide them with the support to maintain behavioral strategies needed to be successful.[43] However, given the paucity of studies that have investigated the effects of Internet interventions for childhood obesity, and results from a pilot study that found 8-year-old African-American girls participating in a 12-week intervention (4-week summer day camp followed by an 8-week home Internet intervention) did not achieve significant differences in BMI compared to the control group, the efficacy of Internet interventions for child weight control still needs to be established.[75]

Although MI has been proposed to have the potential to enhance motivation for behavior change and thus improve long-term treatment outcomes for obese children, the studies reviewed here suggest that considerably more research is needed in the form of randomized controlled trials to determine the value of MI for child weight control. These studies, however, provide evidence that MI can be feasible with obese children and adolescents and their families. Adolescent girls in the Resnicow study[70] appeared pleased with the MI telephone calls, as 21% reported being somewhat satisfied and 66% reported being very satisfied. Furthermore, >80% of the girls reported that their MI counselors provided the right amount of time, listened to them, and were supportive. Parents in the Schwartz study[71] reported high satisfaction with the MI intervention as >88% of parents indicated that the pediatrician and RD discussed values important to them and were supportive and encouraging. Overall, the Schwartz study demonstrated that pediatricians and RDs can learn to use MI techniques, and this approach was well-received by parents. Findings from this study also add to evidence that the pediatric primary care office is an important setting for the prevention and treatment of obesity in children and adolescents.[76]

Conclusion

Lifestyle behaviors are strongly associated with childhood obesity. Although behavior-modification programs targeting eating, exercise, and diet behaviors have resulted in significant improvements in weight status, increased physical fitness, and psychosocial benefits for obese children, ensuring long-term maintenance of these behavior changes continues to be a challenge. Greater research attention should be directed at understanding what motivates children and their families to initiate changes in diet and physical activity and what sustains commitment to these behaviors for the long-term.

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