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RESEARCH ARTICLE

Improved Body Mass Index Measures Following a Middle School-Based Obesity Intervention—The MATCH Program

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ABSTRACT

BACKGROUND: Motivating Adolescents with Technology to CHOOSE Health™ (MATCH) is an educational and behavioral intervention in seventh grade.

METHODS: Teachers in 2 schools delivered the MATCH curriculum, with 1 control school. Using a quasi-experimental design, outcome measures included lessons completed, body mass index (BMI), BMI *z*-score (zBMI), BMI percentile, weight category, and self-reported lifestyle behaviors. We used multiple regression models to compare group results.

RESULTS: For the MATCH group (N = 189), teachers provided lessons over 14 weeks; the control group (N = 173) received usual curriculum. Postintervention, the MATCH group had significant decreases in BMI measures compared with the control. In combined overweight and obese participants, the mean (95% confidence interval) zBMI change was −0.05 (−0.07, −0.03) in MATCH and −0.01 (−0.04, 0.02) in control, p = .034 between groups. After 1 year, improvements are sustained: for the overweight subgroup, the mean zBMI decreased from 1.34 to 1.26 post-MATCH, then to 1.26 after 1 year; for the obese subgroup, mean zBMI = 2.16, to 2.13 post-MATCH to 2.08 after 1 year. Self-reported lifestyle behaviors showed no differences.

CONCLUSIONS: MATCH integrates theory-based strategies into standard curriculum delivered by teachers. No prior middle-school intervention has shown sustained change in BMI measures. MATCH warrants further study as a strategy to address obesity.

Keywords: child and adolescent health; nutrition and diet; growth and development; health education; instructional program.

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Continued efforts to reduce obesity remain of paramount importance for the health of current and future generations. Although recently there have been some encouraging trends that prevalence may be decreasing or stabilizing in some subgroups, an astounding number of children, over 12.5 million in the United States, are already affected by obesity and face high rates of obesity-related comorbidities in the future.[1,2] Institute of Medicine and Cochrane reviews suggest schools are important sites for intervention and policy change for obesity reduction;[3,4] yet, the Agency for Healthcare Research and Quality has called for more evidence from school-based interventions to address obesity, particularly in early adolescence.[5]

Despite the importance of schools as settings for obesity intervention, prior middle school-based efforts have not shown consistent effects on body mass index (BMI),[6-8] and any health-related effects often wane

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over time.[9,10] To enhance acceptability and feasibility, school-based efforts should be designed to work within existing school infrastructure[11,12] and with flexibility in timing of the intervention and personnel involved.[13]

Motivating Adolescents with Technology to CHOOSE Health™ (MATCH) is a school-based, combined educational and behavioral intervention for seventh grade that has been reported previously.[14,15] In the pilot at 1 school from 2006 to 2008, the creator of the program delivered MATCH as an intensive curriculum that included 31 lessons; 8 lessons included additional technology components for 55 hours total contact time.[14] Although promising, with the results after 4 years showing sustained decrease in percent overweight from 20% to 12%,[14] the model and results had not been replicated in controlled study and with other teachers implementing a less-intensive curriculum.

In 2009, after review of select school-based childhood obesity interventions by a North Carolina (NC) think tank, the State Board of Education funded an expansion effort of MATCH as a model program in NC schools. This study describes the process used to expand MATCH to additional teachers and schools and reports the results from 2 MATCH schools compared with 1 control school, and the 1-year results from the MATCH schools. Outcomes included number of lessons/activities taught, changes in BMI measures, and self-reported lifestyle behaviors postintervention.

METHODS

Participants

School recruitment. The State Board of Education decided to fund MATCH expansion in November 2008 with project completion by June 2009. The MATCH director contacted principals at a convenience sample of 5 schools, with the first 4 schools agreeing to participate serving as intervention sites; the fifth school agreed to serve as a control in spring 2009, with plans to implement MATCH later. Each school received approximately $20,000 for MATCH-related expenses (the coordinator stipend, computer, printer, stadiometer, scale, travel and substitute teacher for training attendance, student incentive items, materials for lessons, and a rewards day) with any remaining funds to purchase items for health or physical education (PE) classes. For this formal evaluation study, we report results from 2 intervention schools and 1 control school, at which anthropometry was conducted by a trained research team following a standard protocol.

Participant recruitment. All seventh graders served in regular classes at the intervention and control schools completed the study measures during the school day; those at the 2 intervention schools received the MATCH curriculum. Prior to the start of intervention, school staff sent letters home about the plan for height and weight measures and the MATCH program. Letters included parent consent and student assent forms to provide permission for results of measures done at school to be included in the research study; students returning both signed forms were enrolled. For control participants, the return rate of signed forms in 2009 was <35%. To increase participation in a follow-up study, in 2013 the research team conducted a second phase of recruitment. The team identified those students at 2 high schools who were at the control school in spring 2009 and who had not originally enrolled. The students were sent recruitment letters, assent forms, and ''opt-out'' parent consent forms. For this study, control participants included all students who in 2009 returned both signed consent and assent forms, plus any additional assenting students from 2013 whose parent did not return an ''opt-out'' form. A power analysis to establish sample size was not conducted because the sample size was predetermined by school class size.

Instrumentation

Outcome measures. Sex, race (provided by parent upon school registration), and birth date were recorded from school files. Age was calculated from date of birth and date of measurement. Height to nearest 1/4 inch and weight measures, with shoes off and wearing a school uniform, were completed privately following routine procedures using a stadiometer (Schorr productions, Olney, MD) and calibrated scale. BMI was calculated from height and weight and sex-specific BMI *z*-score (zBMI), BMI percentile, and weight category (underweight <5th percentile; healthy weight <85th percentile; overweight 85th < 95th percentile; obese ≥95th percentile) were determined using Centers for Disease Control and Prevention (CDC) parameters.[16] The study team completed anthropometry at School 1 in September 2008 to assess effect of daily physical activity (PA) in the fall without MATCH, and at all schools at baseline, in January 2009, and postintervention in May 2009; for the MATCH group measures were repeated at the end of eighth grade, 1 year post-MATCH; but in the control school measures were not done at this follow-up point because of scheduling barriers.

All students at baseline, and students at MATCH schools postintervention, also completed fitness testing in physical education classes following Fitnessgram® procedures[17] and a 37-item lifestyle habits questionnaire designed for MATCH using questions, where possible, taken from existing validated surveys, such as the Youth Risk Behavior Survey and the National Health and Nutrition Examination Survey. Through

completion of this ''SEAT survey,'' participants self-assessed their habits in sleep, eating, physical activity, and technology use.

Procedure

The MATCH intervention. MATCH is comprised primarily of educational and behavioral curriculum grounded in social cognitive[18] and self-determination[19] theories. Lessons are delivered by classroom teachers and embedded within standard educational curricula in seventh grade. Providing the intervention in the school setting takes advantage of the active learning environment and the natural accountability occurring in school with homework, quizzes, and peer expectations to reinforce lessons. Details of the intervention have been described previously.[14,15] In this transition from the program-creator delivering MATCH to other teachers learning and teaching the program, 1 teacher received a $1200 stipend to serve as a coordinator at each school to direct MATCH implementation. Teachers provided the majority of lessons in science classes, with some interdisciplinary lessons in other classes, in a sequenced, planned manner, so key concepts were repeated and applied to enhance skill development in making healthy eating and physical activity choices. Each student maintained a notebook tracking lessons and progress. At given intervals associated with lessons and achieving goals, teachers provided pedometers and small incentives such as pens, lanyards, drawstring bags, calculators, and water bottles.

At School 1, the daily schedule included a 25-minute supervised PA period spent either outside or in the wellness center. To assess for effect of the PA alone prior to the MATCH intervention, students had height and weight measured at the start of the school year and again pre-MATCH. School 2 did not provide daily PA.

MATCH training. Author and MATCH program director conducted all trainings. Two weeks prior to implementation, school coordinators attended a 2-day orientation with training on lessons and project management responsibilities. The following week, subject-matter teachers attended separate 1-day trainings. Teachers learned about MATCH and their role in the interdisciplinary approach, with detail about lessons and activities in their discipline that met standard educational objectives using wellness themes (Table 1). Teachers received paper copies of lesson plans, a compact disk of the entire curriculum, and a suggested timeline. Following MATCH, teachers completed a checklist of lessons taught and portion completed, rated as: none, 25, 50, 75%, and all.

Table 1. **Educational and Behavioral Components of MATCH: Teacher Reported Lessons Taught and Activities Completed (Provided in Science Class Unless Otherwise Indicated With Superscript)**

Educational Intervention Components		
Lessons/Activities	**Intervention School 1 (% Completed)**	**Intervention School 2 (% Completed)**
What is obesity	100	100
Weight management	100	100
What is my BMI	100	100*
Calculating BMI‡	100	100
Nutrients	100	100
Hypertension	100	100
Risk factors for heart disease	100	100
What are calories	100	100
Smoking	100	100
My pyramid reports	100	100
Calorie balance	100	100
Dietary recall activity	100	100
Reading food labels	100	75*
Calculating target heart rate	100*	75*
Labels and percent daily value	75	100
Carbohydrates	100	50
Fats	100	50
Proteins	100	50
My favorite foods query	75	50*
What is blood pressure	100	50
Exercise prescription	100	50
Zero calorie beverage lab	100	0
Portion distortion web activity	100	0
Essay on "how to take care of your heart"	100	0
Reading-rethink your drink white paper	100	0
Box/whisker plot of Fitnessgram results	0	100
MATCH poster contest	100	0
Behavioral intervention components		
Action plan with goal setting	100	50†
Self-assessment of nutrition and physical activity behaviors with journaling, at 2 points	100	100
Exercise log—at 4 time points	100	100
Pedometer challenge—a step counting activity with group goals	100	100
Small rewards given for reaching goals, at 3 time points	100	100

BMI, body mass index; MATCH, Motivating Adolescents with Technology to CHOOSE Health™.
*Taught in math class, at least in part.
†Taught in language arts class, at least in part.

Data Analysis

All analyses were conducted in SAS 9.3 (SAS Institute, Cary, NC). Baseline characteristics were compared between groups and between those retained and lost to follow-up using chi-square test or Fisher's exact test as appropriate, for categorical variables: sex, race, and weight category distribution; and 2-sample t-test for continuous variables: age, BMI, zBMI, and BMI percentile. We used multiple regression models to compare the changes in BMI measures between the

2 groups controlling for effects of sex, race, school, and baseline BMI measures. Both race and school effects were found not to be statistically significant for all BMI measures, and hence, were eventually excluded from all regression models. A significance level of .05 was adopted for all statistical tests.

RESULTS

Lessons Taught

Results from the checklists of educational and behavioral components completed, and in which course subject, are shown in Table 1. In all, 23 and 26 educational lessons were taught at intervention Schools 1 and 2, respectively, with several additional behavioral intervention activities provided at both.

Participant Characteristics

MATCH participants included 189 of 206 eligible seventh graders (92%). Control participants include 59 who enrolled originally and 114 who enrolled when recruited for the follow-up study in 2013, for a total 173, representing 75% of 229 enrolled in 2009 and 90% of 191 with height and weight measures. There were statistically significant differences ($p < .001$) in the proportions of race categories, with the MATCH schools having somewhat lower percent black (64% vs 73%) and higher percent white (31% vs 15%) students; in addition, the percent of students participating in the National School Lunch Program was lower in the MATCH schools compared with control (71% in MATCH vs 96% in control). At baseline, the weight status of the MATCH group was less healthy with a lower percentage Healthy Weight (40% MATCH vs 53% control; $p = .02$) and higher percentage combined obese + overweight (60% MATCH vs 48% control; $p = .02$) than control (Table 2).

Although few participants were lost to follow-up (9 MATCH, 19 control), when testing for differences in sex, race, weight category, and BMI measures between those students retained versus lost, there were differences for race. Postintervention, more students were lost in the ''other'' race category (3/11 lost in MATCH, $p < .005$; 14/21 lost in control, $p < .001$) than in the white or black groups in which <4 were lost. For BMI measures, there were no statistically significant differences in BMI or zBMI.

BMI Measures

Results of the BMI measures for all participants and for the combined group of overweight and obese participants (OW/OB) are shown in Table 3. In the MATCH group, there were significant decreases in zBMI postintervention and no change in BMI, and the changes were significantly different from control for both measures. In the control group, there were slight increases in zBMI and BMI. To assess for any effect on BMI of the students having daily PA at School 1, when comparing the zBMI in September 2008 ($N = 111$) to January 2009 ($N = 108$), there was negligible mean change (0.0003, $p = .98$). There was also no difference in mean change in zBMI post-MATCH between School 1 (−0.05) and School 2 (−0.07), $p = .604$ (no daily PA).

To compare trends in relative weight status over time, Figure 1 shows bar graphs depicting the mean zBMI by baseline weight category for both groups. In MATCH, for the overweight subgroup, the mean zBMI decreases post-MATCH and then is maintained after 1-year (from 1.34 to 1.26 post-MATCH to 1.26 after 1 year); and for the obese subgroup a downward trend continues through the end of eighth grade (from 2.16 to 2.13 post-MATCH to 2.08 after 1 year). In comparison, in the control group, the mean zBMI did not change over time for all subgroups. For example, the overweight mean zBMI stayed at 1.37, while in the obese the mean zBMI increased slightly from 2.08 to 2.09).

Using the mean changes in zBMI to represent the overall results comparing groups, Table 4 shows results stratified by weight category, sex, and race. Overall, the MATCH group had a mean decrease in zBMI compared with the control group (mean change −0.06 MATCH vs 0.02 control; $p < .001$). This is also true for the healthy and combined OW/OB subcategories. In the OW/OB subgroup, the mean change in MATCH

Table 2. **Baseline Participant Characteristics, MATCH and Control Groups**

	MATCH N = 189 Mean (SD)	Control N = 173 Mean (SD)	Test for Difference p (t-Test)
Age in years	13.3 (0.79)	13.1 (0.53)	.006
BMI	24.8 (6.43)	23.4 (5.66)	.04
BMI percentile	77.8 (25.84)	74.3 (25.84)	.08
BMI *z*-score	1.10 (1.07)	0.92 (1.03)	.08
	N (%)	**N (%)**	**p (Chi-Square Test)**
Sex			.67
Female	88 (47)	85 (49)	
Male	101 (53)	88 (51)	
Race			<.001
Black	120 (64)	127 (73)	
White	58 (31)	25 (15)	
Other	11 (6)	21 (12)	
Weight category			.07
Healthy weight	76 (40)	92 (53)	
Overweight	43 (23)	29 (18)	
Obese	69 (37)	51 (30)	
School students receiving free/ reduced-price lunch 2008-2009 (%)	71%	96%	<.001

MATCH, Motivating Adolescents with Technology to CHOOSE Health™; BMI, body mass index.

Table 3. **Mean Changes After Intervention, MATCH Compared With Control Group**

	MATCH, N = 189	Control, N = 173	p, Chi-Square Test
Percentage of students remeasured	95%	89%	.03
Among all subjects (all weight categories†)			
N	180	154	p‡
Mean change (95% confidence interval)			
BMI	−0.02 (−0.14, 0.10)	0.31** (0.18, 0.43)	.001
BMI *z*-score	−0.06** (−0.08, −0.03)	0.02 (−0.001, 0.05)	<.001
Among overweight† and obese† combined			
N	108	69	
BMI	−0.07 (−0.24, 0.10)	0.27* (0.05, 0.49)	.02
BMI *z*-score	−0.05** (−0.07, −0.03)	−0.01 (−0.04, 0.02)	.03

*p ≤ .05, p value for pre-to-post change, calculated based on matched pairs t-test.
**p ≤ .0001, p value for pre-to-post change, calculated based on matched pairs t-test.
MATCH, Motivating Adolescents with Technology to CHOOSE Health™; BMI, body mass index.
†Weight category based on Centers for Disease Control and Prevention sex-specific BMI percentiles for age.[16]
‡p values are from multiple regression models controlling for baseline BMI measure and sex.

was −0.05 (p < .001), and in the control group there was no change of −0.01, p = .6 (between groups p = .03). Compared with control, the MATCH group had significantly greater mean decreases in the obese, sex, and race specific subgroups, except for borderline significance in the female subgroup.

Lifestyle Behaviors

Analysis of results of the lifestyle behavior questionnaire for select behaviors targeted in MATCH showed no differences at baseline between the MATCH and control groups. Also, we detected no differences in changes in these behaviors postintervention in the MATCH group overall or for those participants with and without a decrease in zBMI. The following specific behaviors were investigated for differences: reported frequency of servings of junk/snack foods, water, sweet drinks/soda, days/week with >60 minutes PA or total hours per week of technology use including TV, video games, computer, and/or cell phone and in assessment of the perceived importance of PA; yet, no significant differences were found.

DISCUSSION

In this study of young adolescents from a rural region of NC with high obesity prevalence, we demonstrate that the MATCH intervention, embedded in standard school curriculum, resulted in decreased BMI measures with improvements sustained at 1-year. The intensity of the MATCH intervention in this study was less than in the original program created by 1 teacher, yet, results were still significant and improved in comparison with a control school.

The most likely explanation for the observed changes in BMI measures in MATCH compared with the control group is that changes did occur among participants in key lifestyle behaviors resulting in favorable energy balance between intake and expenditure. Although we did not detect significant differences in select lifestyle behaviors, we believe that is most likely because of lack of sensitivity of the survey questions. Examples of more sensitive measures would be dietary measures for drinks quantified in ounces, rather than ''servings per day,'' and physical activity and/or screen time measured in minutes, rather than

Figure 1. **Comparison of Mean BMI *z*-Score by Weight Category, MATCH Versus Control Groups, at Baseline, Postintervention, and After 1 Year**

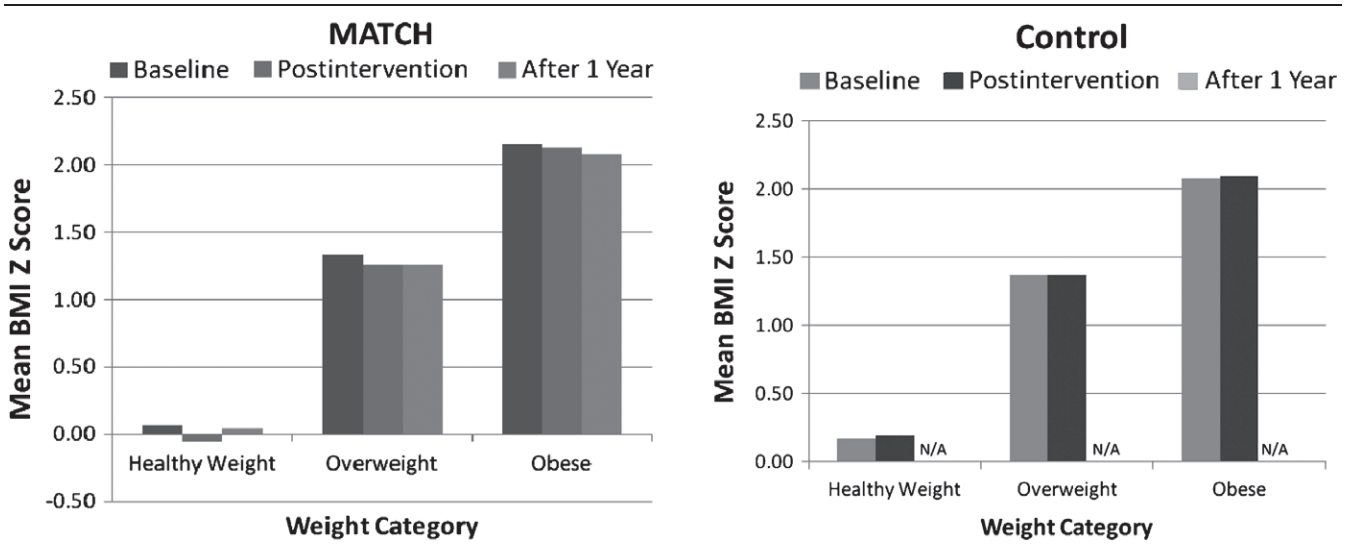

Table 4. **MATCH Versus Control: Postintervention Mean Change in BMI *z*-Score, Stratified by Weight Category, Sex, and Race**

	MATCH		Control		
	Mean (95% CI)	N	Mean (95% CI)	N	p[†]
All participants	−0.06 (−0.08, −0.03)**	180	0.02 (−0.004, 0.05)	154	<.001
By weight category[‡]					
Healthy weight	−0.08* (−0.13, −0.03)	71	0.05* (0.01, 0.09)	84	.006
Overweight	−0.08* (−0.12, −0.03)	41	−0.01 (−0.04, 0.02)	27	.23
Obese	−0.03* (−0.05, −0.01)	67	−0.01 (−1.75, 1.45)	42	.07
OW/OB	−0.05** (−0.07, −0.03)	108	−0.01 (−0.04, 0.02)	69	.02
By sex					
Males	−0.08** (−0.11, −0.05)	95	0.03** (−0.01, 0.07)	78	<.001
Females	−0.04 (−0.08, 0.003)	85	0.02** (−0.02, 0.05)	76	.05
By race					
White	−0.08* (−0.13, −0.04)	56	0.01 (−0.07, 0.09)	22	.04
Black	−0.05** (−0.08, −0.01)	116	0.02* (−0.01, 0.05)	125	.003
Other	−0.08 (−0.2, 0.03)	8	0.1* (0.01, 0.18)	7	.01

*$p \leq .05$, p value for pre-to-post change, calculated based on matched pairs t-test.
**$p \leq .0001$, p value for pre-to-post change, calculated based on matched pairs t-test.
MATCH, Motivating Adolescents with Technology to CHOOSE Health™; BMI, body mass index; OW/OB, overweight/obese.
[†]Weight category based on Centers for Disease Control and Prevention sex-specific BMI percentiles for age.
[‡]p values are from multiple regression models controlling for baseline BMI *z*-score and sex, except that the p values for comparisons by sex only have baseline BMI *z*-score controlled.

days per week of >60 minutes or total hours per day. Future larger studies should use objective measures of targeted behaviors or validated instruments designed with sensitivity adequate to detect individual behavior changes over time.

Our results are particularly encouraging that all weight categories achieved decreases in BMI measures, and decreases persisted after 1 year. Other subgroup results from this study are interesting in that effect size was the greatest in boys and stronger in white than black participants. Possible contributing factors for the effect in boys is that School 1 offered daily PA time and School 2 had a PE teacher who emphasized vigorous PA; it is possible boys were more engaged in these PA-promoting aspects of MATCH and achieved a greater result. In continued, yet unpublished work in 6-12 schools, we have not found a differential effect by either sex or race. Future larger studies are needed to delve further into subgroup analyses.

Although the intention in this MATCH expansion was for the curriculum to be taught across classes in an interdisciplinary manner, the reality was the majority of lessons were taught by the science teacher. This seemed to work well, but future acceptability may be enhanced if lessons could be more interdisciplinary and spread across classes.[20] Previous efforts in middle schools have tried various approaches. Planet Health® offered an average of 14 lessons across the curriculum and resulted in a small effect on BMI in the subgroup of black girls.[21] In the intensive approach of the HEALTHY study, many changes were made across the school environment to promote healthier behaviors without emphasizing classroom teacher involvement.[22] The main publicized results of the HEALTHY study[7] and other studies showing no or modest effect on BMI may be interpreted to suggest that school-based interventions have not been effective in improving BMI. Important secondary outcomes in the HEALTHY study, however, showed improvement in several indicators, including decreased zBMI and insulin levels, particularly in the obese subgroup and additional analyses showed success in changing nutritional offerings at intervention schools;[7,23] these findings and our results highlight the importance of further development of middle school-based strategies.

The study has several notable strengths including high participation rates in a high-risk population and design *by a teacher* to work within existing school structure and core curricular standards. Delivery by classroom teachers may increase educational effectiveness and minimizes need for additional resources. The 1-year follow-up measures support sustained effect rarely demonstrated in obesity interventions; the 4-year results will be reported separately.

Interestingly, despite different teachers implementing MATCH and fewer lessons taught, the effect size in mean change in BMI measures are of similar magnitude to the original pilot where mean change in zBMI in OW/OB group was −0.08 and −0.04 in cohorts 1 and 2, respectively.[14] Given these were teachers delivering this content for the first time and with less contact time, the results are promising. Future, larger, randomized studies are needed in more diverse populations, with more sensitive and objective measures of lifestyle behaviors; in addition, measures important for educators, such as resources needed and academic outcomes, should also be included.

Limitations

This is a relatively small study with several limitations to consider. The setting represents a nonrandom convenience sample of few schools with mainly white and black students and baseline demographic and weight differences between groups. Results may not be generalizable to urban, high resource, or more diverse populations. The schools received generous support that could have enhanced effectiveness in ways not attributable to MATCH. Of note, in the preceding summer, School 1 received a grant and installed a wellness center that included treadmills, elliptical trainers, and active dance video games. This daily PA at School 1 may have contributed to the effect, although the BMI measures completed prior to the start of MATCH showed zBMI was stable with daily PA time alone, and there were no differences in effect size when compared with School 2 that did not provide daily PA. Another limitation is that study measures were limited in ways that make it difficult to substantiate and/or define reasons for the demonstrated effect. There were no objective measures of lifestyle behaviors, no follow-up behavior measures in the control group, and limited assessment of program fidelity.

Another source of potential bias results from the 2-phase process used for recruitment of control participants resulting in 75% participation rate. The later recruitment eliminated as potential participants students who dropped out of school by 11th grade and theoretically could have been more overweight. This may have contributed to why MATCH participants had healthier weight status at baseline and could have skewed results favoring the MATCH group. Baseline BMI was controlled for in analyses, however, and based on school data, the main source of students attrition was relocation, although this cannot be quantified.

Conclusions

Although many national efforts to combat obesity are appropriately focused on prevention from birth to early childhood and on environmental and policy changes, this focus fails to address the reality that a large number of children age 10 years and older are already overweight or obese.[1] Within a decade many of them may become parents and models for the next generation. Current strategies also need to address behavior change in these young adolescents in a targeted way as they are unlikely to improve substantially from indirect and gradual effects of environmental change.

MATCH uses theory-based approaches in an educational setting at a developmentally sensitive time of young adolescence to intentionally promote changes in behaviors that are under students' control, specifically snack/beverage choice, portion size, and PA time. The results from this study suggest that a feasible, school-based, educational and behavioral intervention is worthy of serious study for potential large-scale impact for obesity prevention.

IMPLICATIONS FOR SCHOOL HEALTH

While solving the obesity problem is not the primary responsibility of schools, if there is a way through embedded lessons in standard curriculum and a few additional resources to influence student health behaviors to prevent or reduce obesity, the resulting obesity reduction would provide tremendous long-term benefits to individuals and society. This study describes the successful expansion of the MATCH intervention with delivery by standard classroom teachers and early results suggesting positive effect on weight status. Schools have limited resources and time available to devote to the many healthy issues that can be addressed in schools, such as substance abuse, teen pregnancy, and so on. Priority in resource allocation should go to efforts with demonstrated effectiveness while being practical for implementation. Given the lack of existing evidence for effective efforts to combat obesity in middle schools,[5] public health and school leaders have the opportunity to consider the MATCH approach in young adolescents. The emphasis in MATCH on influencing key, targeted health behaviors in the control of the adolescent is an approach that should be considered for testing on a larger scale.

Human Subjects Approval Statement

This study was approved by the University Medical Center Institutional Review Board (#07-0741) at East Carolina University.

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