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Results of a Multi-Media Multiple Behavior Obesity Prevention Program for Adolescents

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Abstract

Background—This study reports on effectiveness trial outcomes of *Health in Motion*, a computer tailored multiple behavior intervention for adolescents.

Methods—Using school as level of assignment, students (n=1800) from eight high schools in four states (RI, TN, MA, and NY) were stratified and randomly assigned to no treatment or a multi-media intervention for physical activity, fruit and vegetable consumption, and limited TV viewing between 2006 and 2007.

Results—Intervention effects on continuous outcomes, on movement to action and maintenance stages, and on stability within action and maintenance stages were evaluated using random effects modeling. Effects were most pronounced for fruit and vegetable consumption and for total risks across all time points and for each behavior immediately post intervention. Co-variation of behavior change occurred within the treatment group, where individuals progressing to action or maintenance for one behavior were 1.4–4.2 times more likely to make similar progress on another behavior.

Conclusion—*Health in Motion* is an innovative, multiple behavior obesity prevention intervention relevant for all adolescents that relies solely on interactive technology to deliver tailored feedback. The outcomes of the effectiveness trial demonstrate both an ability to initiate behavior change across multiple energy balance behaviors simultaneously and feasibility for ease of dissemination.

Keywords

Obesity; primary prevention; exercise; nutrition; adolescent

Introduction

Consensus exists that curbing the obesity epidemic requires impacting multiple energy balance behaviors including physical activity, nutrition, and sedentary behavior (Kumanyika et al., 2008). To date, there have been few trials testing the efficacy of multiple behavior

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Conflict of interest statement

The authors declare that there are no conflicts of interest.

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interventions for general populations of adolescents, particularly high school students (Mauriello et al., 2007). Adolescents are an important population for obesity prevention. Behaviors related to obesity prevention decline with age (Driskell et al., 2008; Pate et al., 2002). In addition, the probability that childhood obesity will persist into adulthood increases in adolescence (Kvaavik et al., 2003).

Interactive technologies have been cited as a promising means to impact energy balance behaviors related to obesity prevention (Baranowski, et al., 2002; Casazza & Ciccazzo, 2007; Geiger et al., 2002; Long et al., 2006). Recent reviews, however, concluded that there is a need for more rigorous testing of such interventions for youth (Mauriello et al., 2007; Norman et al., 2007). The use of interactive technology is often limited and combined with some form of direct contact (i.e., curriculum based, physical education class or nutrition lab, or counseling). As a result, the focus has been on small studies with programs targeting select samples instead of whole populations.

In this paper, the effectiveness of *Health in Motion*, a computer tailored obesity prevention intervention is reported. This program enhances the existing evidence by relying solely on interactive technology to provide individually tailored messages to high school students. *Health in Motion* addresses recommended guidelines for three target energy balance behaviors related to obesity risk: physical activity (PA; at least 60 minutes on at least 5 days per week), fruit and vegetable consumption (FV; at least 5 servings of fruits and vegetables each day), and limited TV viewing (TV; 2 hours or less of TV each day; USDHHS, 2001). Individualized tailoring is based on the theoretical constructs (stage of change, decisional balance, self-efficacy, and processes of change) of the Transtheoretical Model of Behavior Change (TTM) (Prochaska & DiClemente, 1983). *Health in Motion* is relevant for the entire population of adolescents, regardless of current weight or health behaviors. Additionally, the use of the TTM as a theoretical framework allows messages to be individualized based on readiness to engage in the target behaviors. More information about the intervention and the application of the TTM to the intervention design can be found in earlier publications (Mauriello et al., 2006; 2007).

The primary objective of this project was to evaluate *Health in Motion*'s impact on continuous measures for each target energy balance behavior. Secondary outcomes included movement to the action or maintenance stage of change for each behavior (indicating meeting the recommended criterion for that behavior), stability in action and maintenance among those in A/M at baseline, overall reduction in number of behavioral risks, evaluation of co-variation of behavior change (the likelihood of students making progress to action or maintenance on more than one behavior), and assessment of movement to overweight body mass index (BMI) classification.

Methods

Participants

Students were recruited from eight high schools in Rhode Island, Massachusetts, New York, and Tennessee to participate in a 14-month effectiveness trial. Eligibility requirements necessitated that students were English-speaking and in the 9th, 10th, or 11th grade. Schools were stratified based on race/ethnicity, geographic location, and percentage of students receiving reduced priced lunches and then randomly assigned to the treatment (n=1128) or control group (n=672). Schools were the unit of assignment. Following protocols of other school-based trials, the generalized estimating equation method of analysis controlled for intra-class correlations within each school (Gortmaker, Cheung et al., 1999; Gortmaker, Peterson, et al., 1999). Based upon a priori calculations this study was adequately powered (b=.80) to find small to medium effects which translates to increasing exercise by 30

minutes ($d=.30$), increasing fruit and vegetable intake by a half serving ($d=.39$), and reducing sedentary behavior by at least an hour a day ($d=.36$) for all primary outcomes for a one-tailed alpha of .01.

School administrators invited students from various classes to participate. Some schools over-recruited students due to the ease of incorporating the research into their schedules, making it easier to retain students in the research in subsequent semesters. This unique process for each school, reflecting a real world effectiveness trial, contributed to the larger sample size for the treatment group.

Parents received a letter describing the research and opt-out forms two weeks prior to the baseline session. Few parents ($n=48$) withheld permission (2.6%) and 8 students refused to participate (0.4%). Once enrolled, only 10 students refused to complete a follow-up session. Table 1 shows retention rates across four follow-up sessions. This research was approved by Pro-Change's Institutional Review Board.

Intervention Description

Students self-directed through the 30-minute program in which they completed a series of TTM-based assessments and received stage-matched and tailored feedback messages based on their responses. For example, someone in preparation who reported evaluating the Pros of getting more physical activity highly (in comparison to a normative database collected in a separate measurement study), but underutilizing helping relationships to get enough physical activity, received positive feedback on their evaluation of the Pros, and suggestions on how to increase their use of support with getting exercise. Unlike many TTM-based interventions, *Health in Motion* incorporated assessments and feedback on the full range of TTM constructs.

To avoid overwhelming participants with assessments and feedback and to fit the intervention in one class period, a combination of full and optimal tailoring was offered. A full TTM intervention was delivered for PA, in which each of the appropriate constructs of the TTM for a particular stage of change was addressed (someone might get feedback on up to eight TTM constructs for PA). Which constructs individuals in various stages of change received feedback on was based on empirically-derived decision rules calculated on a large normative dataset collected as part of a preliminary survey development study (Mauriello et al., 2006). Physical activity was designated as the largest component of the intervention because of its importance for long-term weight management (Steinbeck, 2001) and the dramatic declines in activity during high school (Pate et al., 2002), which have been shown to predict risk of being overweight as an adult (Kvaavik et al., 2003). Optimally tailored interventions were delivered for FV and TV. These interventions offered feedback on the most important TTM constructs based on stage of change. In *Health in Motion* the optimally tailored sections for FV and TV included tailored feedback on the Pros of changing and stage-matched summary feedback summarizing some of the most important strategies for changing that particular behavior. Multimedia components included audio, video, and animations.

Intervention Delivery

A school-based effectiveness trial was conducted between 2006 and 2007. The treatment group received three intervention sessions (baseline, 1 month, and 2 months), in addition to 6 and 12 month follow-up assessments. The control group completed assessments at baseline, 2, 6, and 12 months. All sessions were administered via computers in school computer laboratories. Research assistants who were not blind to the group assignment were present to assist with any login or technical difficulties. Most treatment participants (90.2%)

received at least three intervention sessions. Due to a programming error discovered in the first week of the trial, some treatment group participants (21.5%) received an extra dose of the intervention. Overall, the average number of intervention sessions was 3.09.

Measures

Continuous Assessments

Physical activity: Students were asked, “In a typical week, how many days do you do 60 minutes or more of physical activity?”

Fruit and vegetable consumption: Students were asked, “How many servings of fruits and vegetables do you usually eat each day?”

Limited TV viewing: Students were asked, “How many hours of TV do you usually watch per day? (Include time watching TV, videotapes and DVDs)”

Categorical Stage of Change Assessments: The following measures were validated by other existing behavioral measures in a previous study that was focused on developing assessments and norms for the current program (Mauriello et al., 2006; Driskell et al., 2008).

Physical activity: Stage of change assessed readiness to do at least 60 minutes of physical activity on at least 5 days of the week. This measure has been validated by three questions from the Youth Risk Behavior Surveillance Survey (YRBSS), all of which varied significantly by stage of change.

Fruit and vegetable consumption: Stage of change assessed readiness to eat at least five servings of fruits and vegetables each day. This measure has been validated by questions from the YRBSS. A sum of six questions on consumption of 100% fruit juice, fruit, green salad, carrots, potatoes, and other vegetables, showed increased servings per day across stages of change.

Limited TV viewing: Stage of change assessed readiness to watch two hours or less of TV each day. The Robinson and Killen (1995) TV time measure has been used to validate stage of change for TV. Reported TV time declined for school and weekend days across the stages of change.

Body Mass Index Classification: Height and weight were self-reported and used with information on gender and age to calculate body mass index (BMI). BMI was compared to the CDC growth charts to determine classification in the underweight, normal weight, at-risk, or overweight group (Kuczmarski et al., 2002).

Statistical Analyses

A 2×4 factorial repeated measures design compared treatment and control groups at 0, 2, 6, and 12 months. Efficacy was assessed separately for each target behavior. Primary outcomes were evaluated by group differences on continuous measures for each behavior. Secondary outcomes were assessed by group differences on movement to action or maintenance (meeting the behavioral criteria), in co-variation of behavior change, in overall risk reduction, in percentage moving to overweight status, and in stability in the action or maintenance stages (among those who were in A/M at baseline). Random effect modeling controlling for school as the unit of assignment on all available data was conducted for each behavior separately.

Multiple imputation (MI) (Harel & Zhou, 2007; Rubin, 1987) estimated missing data for the 2, 6, and 12 month assessments for primary and secondary outcomes. MI uses a simulation technique to replace each missing value with a set of plausible values, resulting in multiple complete datasets that differ only in the imputed values (Schafer & Graham, 2002). For the current study, 10 datasets were imputed using multivariate imputation by chained equations (Van Buuren & Oudshoorn, 2004), which is implemented by R package ‘mice’ version 1.16. The imputation model included baseline variables related to outcomes being imputed and to missingness including demographics, stage of change, BMI, and continuous measures.

Complete datasets were analyzed using complete data methodology—in this case, generalized estimating equations (GEE) examining repeated measures effects and random effects of school as unit of assignment—and the results pooled by using SAS v9.1 PROC MIXED and PROC MI for the continuous outcomes and PROC GLIMMIX and PROC MI for the categorical outcomes. Statistical significance of the pooled results was evaluated using a t-test and degrees of freedom that take into account the uncertainty in the data and the uncertainty due to missing values. Progression to action or maintenance (A/M) status for the treatment vs. control groups was also analyzed with odds ratios (OR) and 95% CI. All GEEs were run with an unstructured variance matrix and used the control group as reference. Analyses included individuals in a pre-action stage of change (meaning precontemplation, contemplation, or preparation) at baseline for each behavior. All time points were included in the GEE analyses.

Results

Table 2 presents demographics and baseline stage distributions. At baseline the majority of students were at-risk (defined as in a pre-action stage or not meeting the recommendation for that behavior) for PA (60%), FV (82.2%), and TV (51.4%).

Primary Outcomes

These analyses assessed group differences in changes in continuous assessments for each behavior among those in a pre-action stage at baseline. Please refer to Table 3 for the group means and significant results for both complete case and MI results.

Physical Activity—The treatment group reported greater numbers of days doing at least 60 minutes of physical activity at 2 months (3.38 versus 2.72) than the control group.

Fruit and Vegetable Consumption—The treatment group reported eating significantly more servings than the control group at 2 months (3.86 versus 3.0), 6 months (3.55 versus 2.73), and 12 months (3.67 versus 2.97).

Limited TV Viewing—The difference between groups on reported average hours of TV was not significant at any timepoint.

Secondary Outcomes

These analyses assessed group differences in movement to action or maintenance stages (A/M) among those in a pre-action stage at baseline for each behavior. Please see Table 4 for the group percentages for movement to A/M and for the significant results for both complete case and MI results.

Physical Activity—More treatment group participants progressed to A/M at 2 months than control group participants (28.5% versus 14.4%, OR=2.10).

Fruit and Vegetable Consumption—Significant differences in stage distribution for FV between groups at baseline led to baseline stage being used as a covariate. More treatment group participants progressed to A/M at 2 months than control group participants (35.5% versus 12.7%, OR=2.53) and at 6 months (29.6% versus 10.4%, OR=2.44).

Limited TV Viewing—Significant differences in the stage distribution for TV viewing between groups at baseline led to baseline stage being used as a covariate. More treatment group participants progressed to A/M than control group participants at 2 months (43% versus 24.7%). The overall group effect was not significant, but follow-up tests indicated a significant difference between treatment and control groups at 2 months, OR=1.94.

Risk Reduction—Participants were considered “at-risk” for each behavior by membership in a pre-action stage. The mean number of total behavioral risks at baseline was 1.87 and 1.84 for treatment and control groups, respectively (with a possible range of 0–3). Those in the treatment group reported significantly ($p < .001$) fewer risks compared to the control group at 2 months, $F(1, 861)=95.61$, $\eta^2=.10$ (1.34 vs. 1.87), 6 months $F(1, 861)=30.41$, $\eta^2=.03$ (1.46 vs. 1.76), and 12 months $F(1, 861)=51.731$, $\eta^2=.06$ (1.46 vs. 1.83).

Co-variation of behavior change—Logistic regression analyses determined if movement to A/M at follow-up for any one behavior increased the likelihood of moving to A/M for another behavior. Analyses were conducted for each behavior pair at each time point for the treatment and control group separately. For each behavior pair, participants in a pre-action stage for both behaviors were included.

Progress on one behavior led to progress on another behavior among treatment but not control group participants. The treatment group exhibited significant co-variation among each behavior pair at 2 and 6 months, and between PA and FV at 12 months, while the control group did not exhibit co-variation for any behavior pair at any time point. Among the treatment group, those progressing to A/M were 1.4 to 4.2 times more likely to progress on another behavior (Table 5).

Stability in Action and Maintenance Stages—Analyses were conducted with data from students who were in the action or maintenance stage at baseline ($N=725$) to assess the effectiveness of *Health in Motion* in keeping students in these stages across time points, versus them regressing to a pre-action stage. Random effect modeling controlling for school as the unit of assignment on all available data was conducted for each behavior separately.

The intervention was successful at keeping significantly more students in the treatment condition in action or maintenance at 2 months for PA ($t(1631)=3.83$, $p<.001$, OR=2.39), FV ($t(705)=4.14$, $p<.001$, OR=4.07), and TV ($t(1928)=3.20$, $p<.01$, OR=2.32). Significant differences remained for FV at 6 months ($t(705)=3.01$, $p<.01$, OR=2.47) and 12 months ($t(705)=3.11$, $p<.01$, OR=2.68). The percentages remaining in A/M by group for all behaviors at all time points are presented in Table 6.

Weight Status—As a secondary aim, the percentage of students of the treatment and control groups that moved to overweight was investigated. Preliminary cross-sectional analyses demonstrated significantly fewer treatment group participants moving to overweight status (0.9%) at the 2 month session than control group participants (2.5%). The significant difference between groups disappeared when school was controlled for with longitudinal analyses.

Discussion

Health in Motion initiated behavior change across energy balance behaviors and also helped students who were already doing the behaviors to maintain their healthy behavior. The effects of the intervention were most pronounced for FV (both for movement to A/M and stability in A/M), for total behavior risks across all time points, and for each behavior immediately post intervention. A noteworthy success is the significant co-variation of behavior change in the treatment group, whereas movement to action on one behavior led to movement to action on another behavior. This underscores the importance and efficacy of treating multiple behaviors simultaneously.

The optimally tailored intervention for FV produced the most sustained treatment effects. This behavior had the largest percentage of students in a pre-action stage at baseline, suggesting it might be the behavior most in need of treatment. The increase in FV servings and the movement to A/M among the treatment group closely mirror the results of Di Noia and colleagues' (2008) fully tailored intervention for urban African American adolescents. Despite full TTM tailoring, the PA intervention showed the greatest variability in treatment effects over time, particularly noted by improvements in the control group at 6 months. Levels of physical activity are known to fluctuate depending on weather and season (Tucker & Gilliland, 2007), perhaps making it more difficult to show consistent treatment effects. Van Sluijs et al's (2007) review of youth physical activity found only five of 24 studies included a follow-up of six months or more. Future trials of physical activity interventions should include longer follow-up assessments to understand the longevity of treatment effects.

Noteworthy for *Health in Motion* is the ability to produce co-variation of behavior change and to reduce overall behavioral risk. The treatment group exemplified significant covariation effects among behavior pairs at each timepoint, meaning that movement to A/M for one behavior increased the likelihood of moving to A/M for another behavior. Using a different methodology and only looking at 12-month data, Rosenberg et al. (2007) did not find covariation among similar target behaviors. Our data suggest that synergy among multiple behaviors can allow for a more efficient approach to healthy weight management. There is the concern that treating multiple behaviors simultaneously could over-burden participants and potentially be ineffective. With *Health in Motion*, the co-variation effect was seen while only one behavior was treated with a full TTM tailored intervention, with the other two behaviors being treated with optimal tailoring. This design decreased both participant assessment burden and the length of the intervention.

Study Limitations and Strengths

Questions may be raised regarding the relative "success" of the control group. It is important to note that control group participants completed assessments at all four timepoints to allow for direct comparison to the treatment group on all TTM measures. However, this may have served as a mini-intervention for the control group. By asking participants to rate their pros and cons, for example, the assessment indirectly provided focus on powerful behavior change strategies (Prochaska et al., 2005).

The effects of *Health in Motion* were greatest post-intervention, with the effect for PA and TV dropping off somewhat at the 6 and 12 month timepoints. Intervention adjuncts such as a workbook or booster sessions may have helped sustain the treatment effects. Effective TTM-based behavior change interventions for adults have included printed or on-line e-workbooks that participants could use for added assistance with implementing behavior change strategies (Evers et al., 2006; Johnson et al., 2008).

For feasibility of this effectiveness trial and testing translation to dissemination, self-report data, rather than objective measures, were used as indicators of outcomes for this study. The use of objective measures would have provided validation of the self-report data used in this study. Other characteristics common to effectiveness, rather than efficacy, trials could have contributed unknown error and bias to the results, such as differences in recruitment and implementation across schools. However, this also can be viewed as a strength. Despite the study occurring in close to “real world” circumstance, significant outcomes were demonstrated.

The ultimate goal with encouraging energy balance behaviors is to help curb the high numbers of youth who become or remain overweight or obese in adulthood. The multiple behavioral changes demonstrate the ability of *Health in Motion* to help promote critical energy balance behaviors. This program was designed to be population-based, and was not intended as treatment for adolescents who are overweight. Similar to most other school-based lifestyle interventions targeting obesity prevention among youth, a significant impact on BMI was not found. Recent reviews have concluded that there is insufficient and inconsistent evidence on the effectiveness of diet and physical activity interventions to impact weight (Brown & Summerbell, 2008; Harris et al., 2009). Within a relatively short timeframe, while fighting the secular trend, and with a minimal intervention for weight management, non-significant differences between groups with regard to weight are to be expected with lifestyle interventions.

The feasibility of the platform of *Health in Motion* can lead to successful dissemination. The interactive technology can be self-directed by students, requiring little to no staff training or time. The combination of full and optimal tailoring allows for multiple behaviors to be impacted within a brief 30 minute session, while still providing feedback on a range of theoretical constructs. The program can be distributed widely without the need for screening or determining eligibility based on weight or behavioral risk. With demonstrated effectiveness and a cost-effective and easily deliverable approach, *Health in Motion* has the potential to impact populations of adolescents. A demonstration can be viewed at www.prochange.com/obesitydemo.

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Table 1

Retention rates of students recruited from eight high schools in four states (RI, TN, MA, and NY) between 2006 and 2007.

Time point	Control n(%)	Treatment n(%)	Total n(%)
Baseline	672	1128	1800
1 month	-	1024 (90.8)	1024 (90.8)
2 months *	463 (68.9)	837 (74.2)	1300 (72.2)
6 months	524 (78.0)	906 (80.3)	1430 (79.4)
12 months	457 (68.0)	725 (64.3)	1182 (65.7)

* Significant at $p < 0.05$

Table 2

Baseline demographic information of students recruited from eight high schools in four states (RI, TN, MA, and NY) between 2006 and 2007.

	Control n(%)	Treatment n(%)	Total n(%)
Gender			
Male	342(50.9)	543(48.1)	885(49.2)
Female	330(49.1)	585(51.9)	915(50.8)
Ethnicity***			
American Indian or Alaskan Native	4(0.6)	5(0.4)	9(0.5)
Asian/Other Pacific Islander	5(0.7)	123(10.9)	128(7.1)
Black, not Hispanic	139(20.7)	50(4.4)	189(10.5)
Hispanic	24(3.6)	75(6.6)	99(5.5)
White, not Hispanic	471(70.1)	816(72.3)	1287(71.5)
Combination	19(2.8)	43(3.8)	62(3.4)
Other	10(1.5)	16(1.4)	26(1.4)
Grade***			
9 th	207(30.8)	180(16.0)	387(21.5)
10 th	220(32.7)	224(19.9)	444(24.7)
11 th	237(35.3)	695(61.6)	932(51.8)
12 th	8(1.2)	29(2.6)	37(2.1)
BMI categories*			
Underweight	16(2.4)	22(2.0)	38(2.2)
Normal	469(71.2)	832(76.9)	1301(74.7)
At Risk	50(7.6)	82(7.6)	132(7.6)
Overweight	124(18.8)	146(13.5)	270(15.5)
Physical Activity***			
Precontemplation	94(14.0)	196(17.4)	290(16.1)
Contemplation	110(16.4)	236(20.9)	346(19.2)
Preparation	150(22.3)	289(25.6)	439(24.4)
Action	68(10.1)	76(6.7)	144(8.0)
Maintenance	250(37.2)	331(29.3)	581(32.3)
Nutrition (F&V)			
Precontemplation	190(28.3)	264(23.4)	454(25.2)
Contemplation	160(23.8)	249(22.1)	409(22.7)
Preparation	206(30.7)	412(36.5)	618(34.3)
Action	10(1.5)	21(1.9)	31(1.7)
Maintenance	106(15.8)	182(16.1)	288(16.0)
TV Time***			
Precontemplation	280(41.7)	352(31.2)	632(35.1)
Contemplation	53(7.9)	104(9.2)	157(8.7)
Preparation	40(6.0)	97(8.6)	137(7.6)

	Control n(%)	Treatment n(%)	Total n(%)
Action	118(17.6)	168(14.9)	286(15.9)
Maintenance	181(26.9)	407(36.1)	588(32.7)
Age***	15.78	16.08	15.97

* Significant at $p < 0.05$;

*** Significant at $p < 0.001$.

Table 3

Mean scores on continuous outcomes across time points by group with associated statistical results from high school-based intervention study conducted in four states (RI, TN, MA, and NY) between 2006 and 2007.

	Baseline	2 months	6 months	12 months
Physical Activity (minutes)				
Treatment	2.24	3.38	3.32	3.28
Control	2.4	2.72	3.27	2.87
<i>All Available Data</i>		t(3330)=3.82, p<0.001	ns ^I	t(3330)=2.31, p<0.05
<i>Multiple Imputation</i>		t(385)=3.09, p<0.01	ns ^I	ns ^I
Fruit & Vegetable (servings)				
Treatment	2.25	3.86	3.55	3.67
Control	2.43	3.0	2.73	2.97
<i>All Available Data</i>		t(4662)=5.71, p<0.001	t(4662)=5.76, p<0.001	t(4662)=4.65, p<0.001
<i>Multiple Imputation</i>		t(2627)=5.30, p<0.001	t(1160)=5.15, p<0.001	t(562)=3.42, p<0.001
Television Viewing (hours)				
Treatment	4.6	3.42	3.48	3.28
Control	4.78	4.14	3.73	3.77
<i>All Available Data</i>		ns ^I	ns ^I	ns ^I
<i>Multiple Imputation</i>		ns ^I	ns ^I	ns ^I

^I ns stands for not statistically significant (p>0.05)

Table 4

Percentages of progression to action or maintenance (A/M) for physical activity, fruit and vegetable consumption, and limited television viewing with associated statistical results from high school-based intervention study conducted in four states (RI, TN, MA, and NY) between 2006 and 2007.

	Baseline	2 months	6 months	12 months
Physical Activity				
Treatment	0	28.5	27.0	25.0
Control	0	14.4	28.0	20.4
<i>All Available Data</i>		t(2257)=3.95, p<0.001 OR=2.42	ns ^I	ns ^I
<i>Multiple Imputation</i>		t(400)=3.52, p<0.001 OR=2.10	ns ^I	ns ^I
Fruit & Vegetable				
Treatment	0	35.5	29.6	29.4
Control	0	12.7	10.4	13.4
<i>All Available Data</i>		t(3181)=4.11, p<0.001 OR=3.05	t(3181)=4.19, p<0.001 OR=3.13	t(3181)=2.77, p<0.01 OR=2.11
<i>Multiple Imputation</i>		t(3263)=3.17, p<0.01 OR=2.53	t(6275)=3.03, p<0.01 OR=2.44	ns ^I
Television Viewing				
Treatment	0	43.0	43.7	46.0
Control	0	24.7	32.1	31.0
<i>All Available Data</i>		t(1956)=2.42, p<0.05 OR=2.01	ns ^I	ns ^I
<i>Multiple Imputation</i>		t(6769)=2.39, p<0.05 OR=1.94	ns ^I	ns ^I

^I ns stands for not statistically significant (p>0.05)

Table 5

Predictors of progression to action or maintenance (A/M) for physical activity, fruit and vegetable consumption, and limited television viewing results from high school-based intervention study conducted in four states (RI, TN, MA, and NY) between 2006 and 2007.

Behaviors	Treatment OR	95% CI	Control OR	95% CI
Physical Activity				
<i>Fruit and Vegetable Consumption</i>				
2 months	4.20***	(2.66,6.65)	1.02	(0.28,3.70)
6 months	3.36***	(2.14,5.28)	1.04	(0.42,2.62)
12 months	2.66**	(1.53,4.63)	0.80	(0.22,2.93)
<i>Limited Television Viewing</i>				
2 months	2.60***	(1.53,4.43)	0.51	(0.14,1.87)
6 months	2.08**	(1.23,3.52)	0.50	(0.23,1.11)
12 months	1.40	(0.76,2.57)	0.77	(0.32,1.84)
Fruit and Vegetable Consumption				
<i>Limited Television Viewing</i>				
2 months	2.13**	(1.34,3.37)	0.97	(0.39,2.42)
6 months	1.99**	(1.26,3.15)	0.91	(0.36,2.30)
12 months	1.35	(0.78,2.33)	0.88	(0.30,2.62)

** Significant at $p < 0.01$;

*** Significant at $p < 0.001$

Table 6

Percentages of students remaining stable in action/maintenance stages across time points by group in a high school-based intervention study conducted in four states (RI, TN, MA, and NY) between 2006 and 2007.

		Treatment	Control
Physical Activity	2 months (n=534)*	84.0	68.3
	6 months (n =589)	74.1	66.4
	12 months (n=520)	74.0	69.7
Nutrition	2 months (n =245)***	85.5	57.0
	6 months (n =258)**	73.5	51.1
	12 months (n=214)**	73.0	49.4
TV Time	2 months (n =648)**	89.6	79.2
	6 months (n =704)	85.6	85.4
	12 months (n=589)	82.6	79.1