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Evaluating a Targeted, Universal Middle School Program for Childhood Overweight and Obesity: StayingFit

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by

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ABSTRACT OF THE DISSERTATION

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Professor Denise E. Wilfley, Chairperson

Childhood obesity is a pressing public health concern associated with significant medical and psychosocial comorbidities. Intervention is crucial, and schools are often suggested as an important venue through which to intervene, although the results of such interventions are inconsistent and mixed. The present study sought to expand on the literature by evaluating the effect of a targeted and universal school-based obesity intervention, *StayingFit,* in three middle schools in a low-socioeconomic status, rural community. The intervention was tested in both a cluster-randomized (Study 1) and pre-post (Study 2) design. *StayingFit* was largely ineffective in creating changes in relative weight, behavior, or psychosocial outcomes. Possible reasons for the ineffectiveness of the intervention include the nature of the population and community, insufficient use of behavioral strategies and technology, limited program duration, low completion rates, and lack of parental engagement. Further research is needed to design multi-level and multi-sector interventions that can create meaningful change in high-risk communities.

Introduction

Background

The childhood obesity epidemic is a public-health crisis. Rates of childhood obesity in the United States increased threefold between 1971 and 2002 (Freedman, Khan, Serdula, Ogden, & Dietz, 2006), and current levels remain high. Childhood overweight is defined as a Body Mass Index (BMI) between the 85th and 95th percentiles for age and sex, whereas obesity is defined as BMI at or greater than the 95th percentile for age and sex (Kuczmarski et al., 2000). According to this definition, approximately one third of youth are either overweight or obese, with 17.7% of children (ages 6-11), and 20.5% of adolescents (ages 12-19) falling into the obese category (Ogden, Carroll, Kit, & Flegal, 2014). Rates of overweight and obesity are also disproportionately high in some populations, including in African Americans, Native Americans, and Hispanics, and those of lower socioeconomic status (Barlow & Committee, 2007; Freedman et al., 2006; Ogden et al., 2014). Overweight and obesity[1] are associated with a variety of poor medical and psychosocial consequences, including an increased risk of developing diabetes, cardiovascular diseases, and other chronic health conditions, increased rates of depression and anxiety, increased risk for the development of eating disorders, reduced quality of life, poorer social relations, and increased bullying and teasing (August et al., 2008; BeLue, Francis, & Colaco, 2009; Dietz, 1998; Erickson, Robinson, Haydel, & Killen, 2000; Francis & Susman, 2009; Han, Lawlor, & Kimm, 2010; Latner & Schwartz, 2005; Schwimmer, Burwinkle, & Varni, 2003). In addition to the considerable damage to

[1] Please note that the term obesity will henceforth be used to refer to both overweight and obesity, unless referring to children with overweight/obesity, where people first language is used.

an individual's health and wellbeing, childhood obesity poses significant economic costs to society, with an estimated 14.1 billion additional dollars spent on medical care associated with the effects of excess weight in childhood (Trasande & Samprit, 2009). Without effective treatment, children with overweight/obesity are likely to age into adults with overweight/obesity, and thus these personal and societal costs are likely to increase over time (Katzmarzyk et al., 2014; Trasande, 2010). Childhood obesity clearly poses a significant public health burden and intervention is crucial.

Etiology

Excess weight gain is the result of energy intake (diet) exceeding energy expenditure (physical activity/inactivity) over time (energy balance; Hall et al., 2012); however, the development of obesity appears to result from not only excess energy intake and insufficient energy expenditure, but also the interaction of these behaviors with genetic and environmental factors (Barlow & Committee, 2007). Importantly, whereas biological factors can contribute to risk for an individual to develop obesity, the rapid increase in rates of obesity at a population level over a short time span cannot be explained by genetics alone (Barlow & Committee, 2007; Freedman et al., 2006). Thus, environmental changes have likely contributed to an increase in energy intake and decrease in energy expenditure over time (Barlow & Committee, 2007; Han et al., 2010). Individual behaviors also do not exist in isolation and are developed and maintained within a socio-environmental context, with influences from family, peers, and the community (Glass & McAtee, 2006). In order to meaningfully impact childhood obesity, interventions will need to occur across these levels (Huang, Drewnosksi, Kumanyika, & Glass, 2009).

Interventions for Childhood Obesity

Goals of obesity interventions. Two primary goals exist in the field of childhood obesity intervention: prevention and treatment (Barlow & Committee, 2007). The primary aim of prevention efforts is to prevent non-obese children from gaining excess weight, whereas the main aim of treatment efforts is to promote weight loss in children who already have overweight/obesity (Wang et al., 2013). Significant strides have been made in demonstrating the efficacy of treatments for children with obesity; however, weight loss remains both difficult to achieve and to maintain without extended treatment contact (Wilfley et al., 2007a). In-person treatment is also expensive to deliver, which limits the possibility of reaching the large number of people who need intervention (Caprio, 2006). Therefore, population-level interventions that do not require intensive in-person resources are necessary to impact childhood obesity, and prevention is a major component of managing the public health crisis to avert increases in obesity prevalence and degree of overweight (Barlow & Committee, 2007). Unfortunately, current prevention models have been limited in their ability to create meaningful change for children across the weight range, possibly due to insufficient intensity or limited use of behavioral strategies (Baranowski, Klesges, Cullen, & Himes, 2004; Brown & Summerbell, 2009; Han et al., 2010; Katz, O'Connell, Njike, Yeh, & Nawaz, 2008; Wang et al., 2013).

Components of childhood obesity interventions: Weight and behavioral change. Poor diet, limited physical activity, and high levels of sedentary activity are risk factors for excess weight gain and are associated with many health consequences (Patrick et al., 2004). Thus, the majority of prevention and treatment interventions for childhood

obesity target the same behavioral changes—dietary modifications (improve diet quality and/or regulate quantity) and energy expenditure modifications (increase physical activity and/or decrease sedentary activity; Barlow & Committee; Katz et al., 2008) with the goal of improving health and reducing or stabilizing weight. Behavioral strategies (e.g., self-monitoring, stimulus control) can also be used to provide individuals with the skills necessary to improve and maintain energy balance behaviors. Indeed, interventions that use a behavioral component are considered the most effective treatments for childhood obesity (Whitlock, O'Connor, Williams, Beil, & Lutz, 2010), and behavioral interventions have been shown to have greater efficacy than education-alone interventions, both in-person (Wilfley et al., 2007b) and online (An, Hayman, Park, Dusaj, & Ayres, 2009). Whereas the use of behavioral strategies is considered critical to treatment interventions, prevention interventions largely employ education-only programs that are not grounded in behavioral change theory (Han et al., 2010), which may help explain their reduced effectiveness. Including behavior change strategies in prevention interventions may be important to ensure maximal outcomes in prevention efforts. A final potential component of obesity interventions is including parents/caregivers to help facilitate behavior change, a component that has led to improved outcomes in multiple treatment studies (Altman & Wilfley, 2014). Parental involvement may result in improved outcomes through parents modifying the home environment and modeling healthy eating and activity behaviors for their children (Best et al., 2016).

Psychosocial targets of interventions. In addition to improving diet, physical activity, and weight status, obesity interventions often additionally focus on improving

psychosocial correlates of childhood obesity, including sleep, poor body image, emotional eating, mood, Health-Related Quality of Life (HRQoL), and self-efficacy. Research has demonstrated that decreased sleep duration is associated with increased risk of obesity in children and adolescents (Chen, Beydoun, & Wang, 2008), and sleep disturbance has been associated with decreased physical activity in adolescents (Gupta, Mueller, Chan, & Meininger, 2002), making improved sleep quantity and quality an important obesity intervention target.

Obesity is also associated with poor body image and eating disordered behaviors in children (Tanofsky-Kraff et al., 2004), and obesity in childhood is a strong predictor of eating disorder development (e.g., Gardner, Stark, Friedman, & Jackson, 2000). Improving body image should thus be an important goal of obesity interventions (Jones et al., 2008). There is concern within the field that obesity interventions may increase eating disorder risk, therefore addressing both positive body image and healthy weight regulation simultaneously is considered important (Neumark-Sztainer, 2005). Eating in response to negative emotions, a factor in the development of eating disorders, could also lead to the development of obesity (Striegel-Moore et al., 1999), and should thus be addressed in obesity interventions. Mood has also been prospectively related to the development of obesity over time (Goodman & Whitaker, 2002) and children with depression are at risk of developing overweight (Wilson & Goldfield, 2014), making mood another important target in interventions for the prevention of overweight/obesity.

Children with overweight and obesity have also been shown to have worse HRQoL outcomes than their healthy weight peers (Friedlander, Larkin, Rosen, Palermo, & Redline, 2003; Ottova, Erhart, Rajmil, Dettenborn-Betz, & Ravens-Sieberer, 2012), an

important area for intervention. Finally, self-efficacy and willingness have long been considered critical in health behavior change (e.g., Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986); therefore improving children's self-efficacy to engage in healthy behaviors is an important component of any intervention.

Early intervention. Research has shown that excess weight gain in children as young as two years predicts obesity in childhood (Taveras et al., 2011), and obesity in childhood and adolescence predicts obesity in adulthood, which is associated with increased morbidity and mortality (Reilly et al., 2003). Early intervention is therefore critical to disrupt this trajectory, and expert committee recommendations suggest that obesity prevention should target "all children, starting at birth" (Barlow & Committee, 2007, p. 171). Intervening at younger ages may also be indicated because the behavioral targets of prevention and treatment interventions for childhood obesity - diet and physical activity - are less well established in children (Birch, Savage, & Ventura, 2007), potentially making them more amenable to change. Thus, interventions introduced at a young age may better help establish healthy eating and activity patterns that will protect against the future development of obesity than interventions started at a later age (Barlow & Committee, 2007; Braet, Tanghe, Decaluwe, Moens, & Rosseel, 2004; Dietz, 1998; Goldschmidt, Wilfley, Paluch, Roemmich, & Epstein, 2012; Vanucci, White, & Wilfley, 2010). Schools are a common avenue to reach young children and represent an opportunity to provide intervention across socio-environmental levels.

School-based interventions. With 98% of seven- to thirteen-year-olds enrolled in public and private institutions in 2015 (National Center for Education Statistics, 2015), schools are an important avenue for reaching children and are considered a natural setting

for influencing children's diet and physical activity behaviors (Dehghan, Akhtar-Danesh, & Merchant, 2005; Koplan, Liverman, & Kraak, 2005). Schools provide an optimal venue to teach children about energy balance and healthy dietary and activity behaviors (Koplan et al., 2005) in part because they offer continual contact with children during the years when behavioral habits are formed (Katz et al., 2008). In addition, children attend school for over half of their waking hours and have multiple opportunities to make decisions about food and physical activity, affording them opportunities to put knowledge into practice (Koplan et al., 2005). Schools can also play multiple roles in the prevention and treatment of childhood obesity, through policy, environmental, and behavior change interventions (Katz et al., 2008).

Numerous behavior change interventions have been conducted in schools; however, results have been inconsistent and limited success has been achieved, particularly in influencing weight outcomes (Baranowski et al., 2004; Brown & Summerbell, 2009; Han et al., 2010; Katz et al., 2008; Wang et al., 2013). For example, a recent comprehensive review of childhood obesity prevention efforts found there was limited evidence that school-based interventions prevented obesity or overweight in children (Wang et al., 2013), and some researchers have questioned whether utilizing resources on interventions based in schools is advisable (Katz et al., 2008). Several criticisms of existing childhood obesity prevention efforts may help explain poor outcomes, including lack of grounding in behavior change theories, insufficient intensity, and insufficient parent involvement (Baranowski et al., 2004; Barlow & Committee, 2007; Brown & Summerbell, 2009; Han et al., 2010; Katz et al., 2008; Story, 1999). In understanding the limited success of school-based interventions, it may also be helpful to

consider that whereas many school-based interventions are employed as prevention interventions, approximately one-third of children already have overweight/obesity and may have different needs from peers who are at a healthy weight (e.g., weight loss vs. maintenance of weight or prevention of weight gain; Katz et al., 2008; Wang et al., 2013). Therefore, interventions may need to be targeted based on weight status in order to achieve favorable outcomes for all students (Wang et al., 2013); however, different goals for children based on weight status are rarely specified in school-based interventions.

Targeted and universal interventions. Targeted interventions are given directly to a person who is either at high risk for developing a condition or who already has a condition, whereas universal interventions are given to an entire group of people (e.g., school or community) without directing efforts toward individuals within that group based on their risk (Offord, Kraemer, Kazdin, Jensen, & Harrington, 1998). Targeted approaches may be beneficial because they conserve resources for individuals with the highest needs; however, targeted approaches can be costly to deliver, involve resource-intense screening for high-risk individuals, and can increase stigmatization (Offord et al., 1998). In contrast, universal interventions minimize stigmatization, focus on contextual factors within the community, and address a whole population; however they may result in fewer benefits to individuals and a small overall effect (particularly for those at highest risk), potentially resulting in lower cost-effectiveness (Offord et al., 1998).

Two priorities exist within the field of childhood obesity that can be addressed by universal and targeted approaches. First, a universal approach suggests that children at a healthy weight need interventions focusing on healthy eating and activity to ensure that they are able to develop and maintain healthy behaviors that could help prevent the

development of overweight and associated comorbidities later in life. Second, children who already have overweight/obesity need interventions of sufficient intensity to produce meaningful changes in energy balance behaviors that result in weight loss and prevent the child from continuing to have overweight/obesity as an adult, suggesting that targeting needs to occur based on weight status. Current universal school-based interventions are of insufficient intensity to meet these goals (Wang et al., 2013), and, given limited resources, it is not feasible to deliver an in-person intervention to all students with overweight/obesity in schools (Caprio, 2006). Using an intervention that is targeted *and* universal, such as a coordinated suite of online programs, may be a superior approach to delivering universal prevention while simultaneously providing a targeted intervention of sufficient intensity for students who already have overweight or obesity. To maximize effectiveness, these interventions should also draw on research from the treatment field and include behavioral strategies such as self-monitoring to facilitate change. Embedding a targeted intervention within a universal intervention and using technology-based programs can address some of the disadvantages of implementing these programs alone (e.g., cost, stigmatization, appropriate screening and targeting).

Use of technology. There are many benefits to using Internet- and technology-based interventions, including lower costs, ability to reach people in remote areas, potentially greater reach to low-income populations, greater anonymity (which may lead to greater utilization of services for stigmatized problems), and standardized delivery (Ybarra & Eaton, 2005). Outcomes produced by Internet-based interventions are also promising. A recent meta-analysis suggests that Internet-based therapist-guided interventions for depression and anxiety are as effective as treatment delivered in-person

(Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014). Specific to weight loss, a meta-analysis found that interactive computer-based weight management interventions in adults produced greater results than no intervention or usual care (Wieland et al., 2012). In this meta-analysis, smaller weight losses were found for online than in-person treatments, although the clinical significance of these differences is small, suggesting that online programs can be effective (Wieland et al., 2012). Using technology may be particularly advantageous in youth given the high rates of utilization in this population, with a study showing, for example, that 91% of children in 7th and 10th grade reported occasional or regular home Internet use (Gross, 2004). Importantly, greater program usage has been shown to be associated with improved outcomes in both physical and psychological online interventions (Donkin et al., 2011), thus maximizing program acceptability and engagement in an Internet-based program is crucial.

Online interventions for childhood obesity: *StayingFit.* School-based interventions should ideally have the dual goals of 1) providing universally accessible and cost-effective programs and 2) providing a level of intervention that is appropriate to the degree of presenting risk. *StayingFit* aims to meet both of these challenges by using a targeted and universal online program. *StayingFit* is a cognitive-behaviorally based intervention that focuses on healthy eating and activity, and uses behavioral strategies (e.g., self-monitoring) to facilitate these changes. Within the intervention, multiple programs exist so that each student is assigned to a program based on their presenting weight status (healthy weight vs. overweight/obese). Importantly, students are blinded to their program assignment and programs appear similar in order to minimize the chance that students will be able to tell that the programs are different, reducing the chance that

children with overweight/obesity will face stigma as a result of their program assignment. Students who are at a healthy weight receive the *Healthy Habits* program that delivers core messages around eating, activity, behavior change, and body image. Students who have overweight/obesity receive the *Weight Management* program that focuses on the same core components and introduces weight management strategies. In a trial of *StayingFit* in a high school in the San Francisco Bay Area, there was a mean increase in fruit and vegetable consumption among all participants and a decrease in self-reported BMI of children with overweight/obesity (Taylor et al., 2012). This pilot trial suggests that the targeted and universal approach employed by *StayingFit* is a promising intervention for childhood obesity in schools.

Current Studies

The aim of the current studies was to evaluate the efficacy of implementing the *StayingFit* program using a cluster randomized design in 24 classes in two middle schools in the Tri-Lakes community in Missouri (Study 1). Given several implementation challenges encountered in Study 1, a second study examined the effectiveness of the intervention in a pre-post design in a third school (Study 2). The goals of the interventions were to achieve weight loss or weight stabilization (as appropriate based on presenting weight status), and to increase physical activity and decrease sedentary activity, improve dietary intake, and optimize psychosocial outcomes in middle school students. The current studies expanded upon previous research conducted on *StayingFit* by 1) evaluating its effectiveness in a younger population, and 2) testing the intervention in a low income rural community, a setting that is not reached by most interventions (Summerbell et al., 2005).

Early intervention. Whereas *StayingFit* has demonstrated initial effectiveness in high school (Taylor et al., 2012), early intervention is critical (Altman & Wilfley, 2014), with significantly less weight loss needed for younger children with obesity (e.g., age 8) to reach a healthy weight compared to older children (e.g., age 12; Goldschmidt et al., 2012). Evaluating *StayingFit* in middle school provides a test of the effectiveness of the intervention in younger students during an important developmental time. Middle school represents a time when students are beginning to become independent from parents (Wentzel, 1998) and make more of their own eating and activity decisions. Further, the transition from elementary to middle and high school is often associated with decreases in the healthfulness of food intake (Lytle, Seifert, Greenstein, & McGovern, 2000), making middle school an optimal time for intervention.

Intervention with high-risk populations. In the current studies, *StayingFit* was implemented in a low income, rural community. Risk for childhood obesity is higher in populations with lower SES and in rural areas (Ogden et al., 2014), and interventions are often not tested in these populations (Summerbell et al., 2005). Thus, identifying interventions that are efficacious in these populations is of great need. *StayingFit* may be particularly appropriate for this population as technology-based interventions generally have lower costs and greater appeal to low-SES communities (Ybarra & Eaton, 2005), and can improve reach in these communities (Bennett & Glasgow, 2009).

It has been proposed that typical research methods (i.e., randomized clinical trials) often stress individual change and do not sufficiently address social or environmental risk factors, particularly important in under-resourced communities (Israel, Schulz, Parker, & Becker, 1998). Community-based participatory research (CBPR), an approach whereby

stakeholders from the community are crucial partners in the work, has been proposed to help mitigate this concern (Wallerstein & Duran, 2010). To attempt to maximize success and sustainability of the *StayingFit* program in the community, a CBPR framework was used in the current studies. Specifically, close partnerships with local health department officials, teachers, and hospital employees were developed and the researchers worked collaboratively with the community members to implement *StayingFit*. All stakeholders made programmatic decisions as a team that took into account the specific needs and challenges unique to the community. This approach was used in the present study to maximize the possibility of program effectiveness in this under-resourced community.

Parental involvement. Parental involvement is critical in treatment studies (Altman & Wilfley, 2014); however school-based interventions do not always include parental components as parents are often difficult to engage (Story, 1999). To address this weakness, parents in Study 1 were provided with a complementary program that addressed the topics their child is learning in *StayingFit* in school and teaches parents how they can help facilitate healthy behavior change at home. This program was made available to parents online, and parents also received weekly print newsletters that were sent home with their children. The goal of including an online parent program was to booster intervention effects and evaluate the Internet as a mode of delivery to reach parents, who may be more likely participate if they can do so from home (Story, 1999).

Targeted populations. Previous research on *StayingFit* provided two program tracks – one to students at a healthy weight, and one to students with overweight/obesity. Study 1 included an extra track to target an additional group: students who are on the upper end of the healthy weight range (i.e., 75^{th}-84^{th} BMI percentile) and who are at high

risk of developing overweight. This group was identified and selected based on prevalence rates found in the previous implementation of *StayingFit* in a high school (Taylor et al., 2012). This study will test the utility of including this additional track.

Aims and Hypotheses

Aim 1: To promote weight loss in overweight children, weight maintenance or loss in children at risk for the development of overweight, and weight maintenance for children at a healthy weight.

Hypothesis 1: Overweight children in the intervention group will show significant decreases in the primary outcome measure (relative weight: BMI z-score) from pre- to post-intervention compared to overweight children who do not receive the intervention (control group).

Hypothesis 2: Children in the high-risk group will maintain or decrease relative weight pre- to post-intervention compared to high-risk children in the control group, who will maintain or increase relative weight.

Hypothesis 3: Healthy weight children in both the intervention and control groups will show no change in relative weight from pre- to post-intervention.

Hypothesis 4: Relative weight across the whole sample will remain stable.

Aim 2: To improve all children's secondary outcomes (i.e., dietary intake, physical activity behavior, body image, sleep, emotional eating, mood, HRQoL, and willingness and self-efficacy to engage in healthy behaviors).

Hypothesis 5: Children across weight categories will show significant improvements in secondary outcomes from pre- to post- intervention compared to children in the control group.

Hypothesis 6: Children with overweight/obesity in the intervention group will show significant improvements in secondary outcomes from pre- to post- intervention compared to children with overweight/obesity in the control group.

Exploratory Aim 1: To evaluate whether student program usage or parental usage of the corresponding parent program is associated with improved child outcomes.

Hypothesis 7: Higher rates of program utilization (child and/or parent) will be associated with greater improvements in the primary outcome.

Exploratory Aim 2: To identify predictors of student outcomes.

Hypothesis 8: Higher levels of child depression, more binge eating behaviors, lower willingness and self-efficacy to engage in healthy behaviors, and an unhealthier home environment will predict poorer primary outcomes.

Study 1 Method

Study 1 Procedure

Two middle schools (School 1 and School 2) were invited to participate in Study 1. Classes in each school were assigned to the intervention group or a wait-list control group using a cluster randomized design. The first school required their students to complete the *StayingFit* program during physical education class once per week. The second school elected to use miscellaneous time during the school day when students were typically allowed to complete homework or outstanding work for class, also once per week.

Randomization. Within each school students were randomized at the class level to the intervention or control group using a stratified randomization procedure (randomized by teacher and grade level). School 1 included twelve physical education

classes. These classes were managed by two teachers and were divided into groups of 6th grade students and groups with mixed-7th and 8th grade students. School 2 consisted of twelve classes, each with a different teacher and separated by grade level. Half of the classes in each school were randomized to the intervention group, and half to the control group (see Figures 1 and 2 for the randomization procedure in each school).

Students were required to complete the program as part of their school curriculum and data was collected as part of this program. De-identified data were requested from the program implementations and analyzed for the present studies. The studies received approval from the Institutional Review Board at Washington University in St. Louis.

Program algorithm. At baseline, student height and weight was measured and used to calculate BMI percentile (based on age and sex according to CDC growth curves; Kuczmarski et al., 2000). Students were sorted into different tracks based on their presenting weight status. Anthropometric and behavioral goals were specified for each track based on the needs of those students. An illustration of the screening algorithm and goals of the program by track is provided in Figure 3.

Data collection. The research team conducted baseline assessments over two days at the beginning of the spring school semester in each school. During the assessments, student height and weight was measured behind screens to ensure privacy. Students completed online assessments under the supervision of teachers and research staff. Baseline assessments were conducted prior to starting *StayingFit.* Mid-point assessments were conducted during Week 8 of the program, and final assessments were collected during Week 16 of the program at the end of the school semester using the same protocol.

Program implementation. Following collection of baseline data, students were sorted into the appropriate program track based on their weight status. Usernames and passwords were used to create individual program logins. Teachers were provided with instructions on how to help the students log on to the program and were given copies of student usernames and passwords in case students forgot this information. The program was initiated the week following baseline assessments and teachers were encouraged to ensure that students were completing one session of the program every week by reminding them to log in to the program and assisting with login difficulties. No other teacher involvement was required. In order to engage parents in the program, kick-off events were planned at both schools. Due to a snow day, the event was only held at School 1. The purpose of these events was to inform parents about the program and to enroll them in the corresponding parent program.

Measures

Demographic, behavioral, and psychosocial measures for all time points were collected via student report on an online survey platform (SurveyMonkey), and the primary outcome (relative weight) was collected at each time point by the research team. Secondary outcomes included energy-balance behaviors (diet and physical activity), as well as psychosocial measures. Behavioral, weight, and body image outcomes were specifically targeted within the *StayingFit* curriculum.

Demographics. At baseline, students reported their date of birth (which was used to calculate age), sex, and racial and ethnic identity. Questions about race and ethnicity were taken from the CDC 2011 Youth Risk Behavior Survey - Middle School (YRBS; Brener et al., 2013).

Primary outcome: Relative weight. Student height and weight were measured in-person by trained personnel. Height was measured to the nearest 0.1cm on a standing stadiometer, and weight was measured to the nearest 0.1kg on a medical grade scale. Height and weight were then used to calculate BMI, BMI percentile, and standardized BMI (zBMI) according to age and sex, based on CDC growth curves (Kuczmarski et al., 2000). Although there are reliability concerns inherent in the measurement of height and weight due to scale and stadiometer differences, objective measurement is considered superior to self-reported height and weight, which is often used in school-based studies (Gorber, Tremblay, Moher, & Gorber, 2007).

Secondary outcomes: Diet and physical activity. Questions from the YBRS were used to assess students' dietary and physical activity behaviors. Eight questions from the YRBS assessed dietary intake over the past seven days, and three questions were used to assess physical activity over the past seven days. Dietary intake questions queried how many times students' ate/drank particular foods (e.g., green salad, fruit juice) over the past seven days. There were seven response options ranging from "Never" to "Four or more times per day", and each variable was analyzed as a separate outcome, following previous methods (Taylor et al., 2012). In regards to physical activity, children were asked how many of the past seven days they were physically active for at least 60 minutes (response range: 0 days – 7 days), and how many hours they watched TV or used a screen on an average school day (seven response options ranging from "I do not watch TV/use a screen" to "Five or more hours per day"). The YBRS was tested in a sample of Midwestern middle school students and estimates of agreement between time points two weeks apart (corrected for chance) ranged from 65-75% for questions related to physical

activity (Zullig et al., 2006). Unfortunately, the nutrition questions were only recently added to the YBRS and therefore reliability and validity studies on these questions have not yet been completed; however, more than 90% of the items on the YRBS were previously shown to have moderate or higher estimates of agreement between time points two weeks apart (i.e., >61%; Brener, Collins, Kann, Warren, & Williams, 1995).

Sleep. In order to assess student sleep quantity and quality, six questions from The International Study of Childhood Obesity and the Environment (ISCOLE) Diet and Lifestyle Questionnaire were used in the current study (Katzmarzyk et al., 2013). Two questions queried the time students go to sleep on weeknights and weekend nights, and the times they wake up in the morning. These responses were used to calculate their time spent sleeping. Previous research has suggested that a reported total time sleeping of less than four or more than twelve hours may be inaccurate (Spruyt, Gozal, Dayyat, Roman, & Molfese, 2011), therefore responses outside of this range were removed. Two additional questions asked students to rate their overall sleep quality and sleep quantity (four response options ranging from "Very bad" to "Very good").

Body image. The Weight Concerns Scale (WCS) is a five-item survey (e.g., "How afraid are you of gaining three pounds?," "Do you ever feel fat?") used to assess weight and shape concerns, and a total score was calculated by summing weighted scores, with higher scores indicating higher weight and shape concerns. Test-retest reliability of the WCS is 0.85 (Killen, Hayward, Wilson, & Taylor, 1994) and a score of ≥ 47 has a specificity of 0.67 and a sensitivity of 0.79 for identifying adolescents who will develop an eating disorder (Jacobi, Abascal, & Taylor, 2004).

Health-related quality of life. In the current study, HRQoL was assessed using the Adapted KIDSCREEN-10 Index questionnaire. This shortened 10-item questionnaire was based on the 27-item KIDSCREEN-27 and has shown good internal consistency (Cronbach's Alpha = 0.82) and test-retest reliability (r = .73; *ICC* = .72; Ravens-Sieberer et al., 2010). Students responded to ten questions regarding aspects of their HRQoL over the past week (e.g., "Have you felt fit and well?," "Have you got on well at school?"), with five possible response options ranging from "Not at all" to "Extremely"; and one additional question about their overall health, "In general, how would you say your health is?", with five response options ranging from "Poor" to "Excellent". Responses were summed and transformed into T-scores based on normative data from an international survey, with higher scores indicating greater HRQoL (Ravens-Sieberer, et al., 2005; The KIDSCREEN Group Europe, 2006).

Emotional eating. Emotional eating was assessed in the current study using the Emotion-Induced Eating Scale, a seven-item survey assessing eating in response to emotions (e.g., "I eat when I am mad", "When I am bored I eat"), with possible responses of "Never or almost never," "Sometimes," or "Usually or always" (Striegel-Moore et al., 1999). Question responses were summed to create a total score, with higher scores indicating greater levels of emotional eating. Internal consistency of this scale is good, with a Cronbach's alpha of 0.78 in a group of girls (Striegel-Moore et al., 1999).

Mood. Mood was measured in the current study using the Mood and Feelings Questionnaire, a 13-item survey that assesses mood over the previous two weeks. Students reported the degree to which statements (e.g., "I felt miserable or unhappy," "I was a bad person") were true of them, with possible responses including "Not true,"

"Sometimes true," or "True". Responses were summed to create a total score, with higher scores indicating greater depressed mood. This questionnaire has high internal consistency (Cronbach's alpha = 0.85), and high criterion validity (Angold et al., 1995).

Willingness and self-efficacy to engage in healthy behaviors. At the time of the study design, no measures existed to assess children's self-efficacy and willingness to engage in the health behavior change promoted in an obesity intervention, thus one was created for the current study. The Student Motivation and Self-Efficacy for Healthy Behavior Questionnaire includes eight items assessing student willingness to engage in the health behaviors suggested by *StayingFit* (e.g., "How willing are you to eat more fruits?") and eight items assessing their confidence in their ability to change those behaviors (e.g., "How sure are you that you can eat more fruits?"), with five response options ranging from "Not at all willing/sure" to "Completely willing/sure". Principal components analyses of the questions related to willingness showed that a single component is sufficient and thus a composite score for willingness was created for use in the current study. A single component score was also created for self-efficacy based on the same approach.

Program usage. Program usage in *StayingFit* was tracked electronically and downloaded from the online program following intervention completion and was analyzed as a predictor of treatment outcome. Three metrics of usage were calculated using established methods (Donkin et al., 2011), and all estimates were based on the proportion of pages the student viewed (number of pages the student viewed divided by number of pages in the program). The following metrics were calculated: 1) the proportion of pages the student viewed (continuous measure), 2) the percentage of

students who completed > 75% of the program (high participation; Beintner, Jacobi, & Schmidt, 2014) or not (dichotomous measure), and 3) the percentage of students who completed the first module or not (dichotomous measure; defined as Sessions 1-3 – "Basics of Eating and Activity"; Donkin et al., 2011). Parent usage of the corresponding program using the same metrics were calculated in the same manner and used as a predictor of student outcomes.

Additional predictors. Several student self-report measures were used to evaluate potential predictors of change in relative weight, including binge eating (Children's Binge Eating Disorder Scale), mood (Mood and Feelings Questionnaire; also included as an outcome), and motivation and self-efficacy to engage in healthy behaviors (Student Motivation and Self-Efficacy for Healthy Behavior Questionnaire, created for the present study; also included as an outcome). A survey was also designed to assess teacher knowledge about healthy eating and activity, and acceptability of *Staying Fit* and was used to account for any variance attributable to the attitudes and beliefs of a student's teacher.

Intervention

StayingFit is a cognitive-behaviorally based online intervention that aims to increase healthy eating and physical activity and improve body image. Behavioral strategies (e.g., self-monitoring, stimulus control) are introduced to facilitate health behavior change. *Staying Fit* has previously been examined in high school settings (Taylor et al., 2012) in an eight-session format. In the current study, the program was adapted to a middle-school population by updating content based on new research and simplifying language and examples within the program to lower the required reading

level to be more appropriate for the middle school age range. Additionally, the session length was shortened to allow for slower reading times (~20 minutes per session) and shorter attention spans. To ensure all content was covered in the shorter session times, the program was extended to 16 sessions.

Program tracks. *StayingFit* utilizes a targeted and universal approach and children receive a program based on their presenting weight status, with three tracks available: Healthy Weight (BMI ≤ 75th percentile)[2], Weight Maintenance (at risk for the development of overweight, BMI between 75th and 84th percentile), and Weight Loss (overweight/obese, BMI ≥ 85th percentile). Content was comparable across tracks because the education provided about healthy eating and activity is relevant to children of all weight statuses. Program tracks differed in the degree to which weight management was discussed and whether and how weight-related goals were introduced. Importantly, the differences between the tracks were minimal to help ensure that students would not be aware of what program they or their peers were receiving to minimize stigma. In addition, a corresponding parent program was provided to parents of students to help facilitate student behavior change, given the documented importance of parental engagement in interventions (e.g., Altman & Wilfley, 2014; Story, 1999).

Statistical Analyses

The primary analytic approach utilized was hierarchical linear modeling (HLM; Heck & Thomas, 2009; Hox, 2010; Raudenbush & Bryk, 2002; Snijders & Bosker, 2012). This approach is appropriate given the longitudinal and hierarchical nature of the data, with time nested in participants nested in classes, resulting in a three-level model.

[2] Students who were classified as underweight (BMI < 5th percentile) received the same program as students in the healthy weight category.

Initial analyses demonstrated that class did not significantly contribute to the models; therefore a two-level model was ultimately used. Missing data, which are common in longitudinal designs, were addressed with maximum likelihood estimation (e.g., Enders, 2010), and unequal spacing between measurement periods was addressed by estimating individual growth curve parameters.

Participants were included in the analyses if they had data for the primary outcome (zBMI; both height and weight) at baseline. Analyses were conducted comparing outcomes for participants in the intervention and control groups. In addition, outcomes for intervention participants in the overweight/obese group were compared to the corresponding group in the control condition to assess specific changes within this population. Several variables were tested as potential predictors/moderators of primary and secondary outcomes, including age, sex, the interaction of age and sex with condition, school, and teacher knowledge and attitudes. Mood, binge eating, and willingness/self-efficacy were tested as predictors of changes in the primary outcome (zBMI). T-tests and chi-square tests were used to test for any baseline differences between groups (i.e., intervention vs. control, students with overweight/obesity vs. students without overweight/obesity, Study 1 vs. Study 2). All analyses were conducted in RStudio version 0.99.473 using R version 3.2.2.

Study 1 Results

Participants

All students in 6th, 7th and 8th grade in two middle schools in the Tri-Lakes Area, MO completed *StayingFit* as part of their school curriculum. Participant characteristics are provided in Table 1. Participants in the control group were significantly younger than

participants in the intervention group ($t(510) = 3.03$, $p < .01$). No significant differences were found between the intervention and control groups on any other demographic factors at baseline. Regarding weight status, only 10% of students fell into the at risk for overweight category, thus specific analyses were not conducted for this group (hypothesis 2), and these students were analyzed as part of the full sample.

Attrition

If a participant had a zBMI (height and weight; primary outcome) measurement at a given time-point, they were considered to have complete data at that time-point. At baseline, 524 (100%) students had complete measurements of height and weight; at mid-point, 301 (57.0%) students had complete measurements of height and weight; and at the final assessment, 366 (69.9%) students had complete measurements of height and weight. Attrition is thus considered 43.0% at the mid-point assessment and 30.1% at the post-intervention assessment. In the intervention group, 266 (100%) students had complete baseline data, 164 (61.7%) students had complete mid-point data, and 170 (63.9%) students had complete post-intervention data. In the control group, 258 (100%) students had complete baseline data, 137 (53.0%) students had complete mid-point data, and 196 (76.0%) students had complete post-intervention data. In School 1, 285 (100%) students had complete baseline data, 245 (86.0%) students had complete mid-point data, and 223 (78.2%) students had complete post-intervention data. In School 2, 239 (100%) students had complete baseline data, 56 (23.4%) students had complete mid-point data, and 143 (59.8%) students had complete post-intervention data. Attrition was significantly greater in School 2 than in School 1 ($t(522) = -7.82$, $p < .001$). Reasons for differential attrition are outlined below.

Program Usage

Mean proportion of pages viewed was 0.34 (*SD* = 0.28), 0% of students completed at least 75% of the program, and 55% of students completed at least the first module.

Parental Engagement

Parental engagement in *StayingFit* was very low, with only one parent signing up to complete the online program. Given low participation, the components of hypotheses 7 and 8 that were reliant on parent data (i.e., parent usage of the program, the home environment) could not be tested.

Sample Characteristics

Baseline means and standard deviations for all outcome variables are shown for the full sample, and for the intervention and control groups in Table 2. There were no differences between the intervention and control group on any outcome at baseline. Baseline means and standard deviations for all outcome variables are shown separately for the overweight/obese group and the non-overweight group in Table 3, and means and standard deviations at both baseline and post-intervention are shown in Table 4. Students with overweight/obesity reported significantly more hours of sleep on a weekday than students in the healthy weight group, with no other baseline differences found (other than zBMI, which is expected to differ given the grouping). A table of correlations between all measures at baseline is shown in Table 5.

Changes in Relative Weight, Behavioral and Psychosocial Outcomes

Change in relative weight. Initial analyses of zBMI examined a three-level model with time nested within participants and participants nested within classes.

Intraclass correlations indicated that only 1.05% of the variability was due to class differences. Given the relatively small number of classes, this part of the model was eliminated and subsequent analyses used a two-level model. In the two-level models, time was included as a predictor at Level 1 and condition was included as a predictor at Level 2, moderating both the Level 1 intercept and Level 1 slope. Possible predictors/moderators (i.e., school, teacher beliefs and attitudes, binge eating, mood, willingness and self-efficacy, program usage, age, sex, and the interaction of age and sex with condition) were also included at level 2. Two models were tested for the primary outcome (zBMI), one model with the slope (time) fixed and one model where time was allowed to vary. There were no meaningful differences between these models. Models for other outcomes could not be fit with the slope allowed to vary. All results reported are for models with the slope fixed. In all models, time was not centered and thus the intercept refers to the value at baseline. Condition was coded with 0 as the control group and 1 as the intervention group.

Individual changes in zBMI over time between conditions are displayed in Figure 4. The intervention showed no effect on zBMI in either the full sample (see Table 6) or the overweight sample (see Table 7). Students in the healthy weight category did not change over time (B = 0.00, $t(688) = 0.84$, $p > .05$). The inclusion of teacher beliefs and attitudes, age, sex, or the interaction of condition with either age or sex in the models did not result in any changes in either the full or overweight samples (ps > .05). Mood (B = 0.00, $t(872) = 0.44$, $p > .05$), program usage (B = 0.00, $t(272) = 0.69$, $p > .05$), binge eating (B = 0.00, $t(878) = -0.58$, $p > .05$), willingness (B = 0.00, $t(863) = 0.63$, $p > .05$),

and self-efficacy (B = 0.00, $t(863)$ = -0.06, $p > .05$) to engage in healthy behaviors were not significant predictors of change in zBMI.

Changes in diet. Following completion of *StayingFit*, participants in the intervention group decreased consumption of fruit juice and other vegetables (see Table 6), whereas participants in the control group increased their consumption of these items (see Figures 5 and 6). No changes were found for fruit, green salad, potatoes, carrots, sugar sweetened beverages (SSBs), or milk. No changes were found on any diet variable for participants in the overweight group (see Table 7). A composite score of all diet variables was also created to test an alternate model of the data, and no significant effects were found for this outcome in either the full or overweight samples (ps > .05). There were no significant predictors or moderators of change in diet over time in either sample (ps > .05).

Changes in physical activity. There was no significant effect of the intervention on reported days with at least 60 minutes of physical activity, or hours spent watching TV or looking at a screen in either the full sample (see Table 6) or the overweight sample (see Table 7). In the overweight sample, there was a significant interaction between age, time, and condition for the number of days completing at least 60 minutes of physical activity (B = 0.01, $p < .05$; see Figure 7). In the intervention group, younger children reported decreased physical activity whereas older children reported increased physical activity. In the control group, younger children reported slightly increased physical activity and older children reported decreased physical activity. There were no other significant predictors or moderators of change in reported physical activity over time in either sample (ps > .05).

Changes in sleep. The intervention did not lead to any significant changes in sleep in either the full (see Table 6) or overweight (see Table 7) sample. In the overweight sample, there was a significant interaction of sex and condition predicting change in sleep quantity ($B = 0.01$, $p < .05$; see Figure 8). In the intervention group, females reported increased sleep quantity whereas males reported decreased sleep quantity, and in the control group males reported increased sleep quantity whereas females reported decreased sleep quantity. There were no other significant predictors or moderators of change in sleep over time in either sample (*ps* > .05). Proportional odds hierarchical linear models were also conducted for sleep quantity and sleep quality (ordinal variables with four response categories). No differences were found between these models and the original models conducted.

Changes in psychosocial outcomes. The interaction of time and condition significantly predicted change in HRQoL in the full sample (see Table 6), but not in the overweight sample (Table 7). Participants in the intervention group increased their HRQoL whereas participants in the control group decreased their HRQoL (see Figure 9). The intervention did not have any effect on mood, emotional eating, or weight and shape concerns in either the full or the overweight sample. There were no significant predictors or moderators of change in psychosocial variables over time in either sample (*p*s > .05).

Changes in willingness and self-efficacy. The intervention did not lead to changes in willingness or self-efficacy to engage in healthy behaviors in either the full (see Table 6) or overweight (see Table 7) sample. There were no significant predictors or moderators of change in willingness or self-efficacy over time in either sample (*p*s > .05).

Follow-Up Diagnostic Analyses

Follow-up diagnostic analyses were conducted for the primary outcome model. The distribution of level 1 residuals, examined using a qq plot, boxplot, and a histogram, were found to be symmetrically distributed but somewhat leptokurtic. The homoscedasticity of level 1 residuals was acceptable. Level 2 residuals were somewhat bimodal and slightly negatively skewed, but generally within acceptable ranges. In order to identify any multivariate outliers, Mahalanobis D^2 distances were plotted and revealed no extreme outliers. Level 2 residuals were unrelated to each other and did not vary as a function of time. Residuals were also unrelated across levels. Two analyses were used to identify outliers that may have been influencing the model (Cook's Distance, DFBETAS), and the model was rerun excluding any outliers identified in these analyses. This showed that no outliers were significantly affecting the models. To account for the slight violation of normality, bootstrap analyses with residual resampling at levels 1 and 2 with 10,000 simulations were conducted and showed results similar to those from the original analyses.

Study 1 Implementation Challenges

There are several challenges to implementing interventions outside of a controlled environment. In Study 1, several factors affected program delivery and completion. First, both schools had multiple snow days (16 days at School 1 and 17 days at School 2) at the start of program implementation that delayed the program start date. Although teachers tried to make up days lost, school closures likely influenced program completion rates. In addition, inclement weather resulted in poor attendance at the parent kick-off event at School 1 and the cancellation of this event at School 2, which likely accounts in part for poor uptake of the parent program. Parental engagement is notoriously difficult to

achieve for school-based interventions (Story, 1999) and particularly in low SES areas, which may also partially account for poor parent uptake rates. In addition, School 1 also experienced several technological problems (e.g., computers breaking, Internet disconnecting) that led to decreased program usage (mean proportion of ages viewed was 0.34). These challenges highlight the importance of researcher flexibility and adaptability when examining an intervention in a community setting that is less controlled than a typical research setting (Israel et al., 1998).

There were also challenges in program implementation at an administrative level. Administrators from multiple levels at School 1 (i.e., Superintendent, Principal, and teachers) were included in program development and anecdotally expressed enthusiasm for the program, which could partially explain lower rates of dropout and attrition at this site. In contrast, program involvement at School 2 was decided at the level of Superintendent, and other administrators and teachers were less involved in decision-making. Consequently, the Principal and teachers may not have been as invested in the program's success. For example, several teachers gave the students the option to opt-out of the program if they wanted to do something different during the allotted time, a potentially critical difference that was unplanned and likely affected program usage rates and differential attrition across schools. These challenges illustrate the importance of school buy-in and are common to community-based participatory research studies (Israel et al. 1998).

Given the implementation challenges encountered in Study 1, and to test *StayingFit* in a non-randomized design that would more closely mirror its typical implementation in a school, *StayingFit* was examined in a non-randomized pre-post

intervention design in Study 2. The purpose of this second study is to evaluate the effectiveness of *StayingFit* while avoiding the implementation challenges encountered in Study 1. Unfortunately, the pre-post nature of Study 2 does not allow us to make any determinations about causation.

Study 2 Method

Procedure

In Study 2, *StayingFit* was implemented to all 6th, 7th, and 8th grade students in a third school using a pre-post design. All procedures in Study 2 were the same as those used in Study 1, except for some minor difference: 1) students were not randomized and all students received the intervention, and 2) the school elected not to make use of the parent program because they were did not want to implement both curricula concurrently. As in Study 1, students in this school were required to complete the intervention during one of their physical education classes once per week.

Data Collection. The study team conducted baseline assessments in one day at the beginning of the Fall semester in School 3. The same procedure was used for data collection as in Study 1, with one difference in time points. For Study 2, data were collected at baseline, post-intervention, and at a 3-month follow-up assessment. The mid-point assessment, necessary for the statistical design in Study 1, was not needed in Study 2.

Program Tracks. In Study 1, an additional track was created for students at risk for the development of overweight (BMI between 75th and 84th percentile); however, in Study 1 very few students fell into this category. This group was therefore combined with

the healthy weight group in Study 2, which led to two tracks: Healthy Weight (BMI < 85th percentile) and Overweight/Obese (BMI ≥ 85th percentile).

Statistical Analyses

In Study 2, all analyses assessed changes across time in the full sample and within the overweight group. Study 2 utilized a pre-post design with three time-points (baseline, post-intervention, and follow-up). Repeated measures ANOVAs were used to assess change across these time-points. If the ANOVA was significant, pairwise *t*-test comparisons were run to examine differences between the time-points. Analyses were conducted in a similar manner to Study 1 (i.e., same predictors, data inclusions strategies, and analyses conducted in the full and overweight samples).

Study 2 Results

Participants

Students in 6th, 7th and 8th grade in a middle school in the Tri-Lakes Area, MO completed *StayingFit* as part of their school curriculum. Participant characteristics are provided in Table 1. No participant characteristics differed between Study 1 and Study 2.

Attrition

At baseline, 307 (100%) students had complete height and weight data; at the post-intervention assessment 272 (88.6%) students had complete height and weight data; and at the 3-month follow-up 247 (80.5%) students had complete height and weight data. Attrition was 11.4% at the post-intervention assessment and 19.5% at the follow-up assessment.

Program Usage

Mean proportion of pages viewed was 0.50 (*SD* = 0.42), with 40% of students completing at least 75% of the program and 59% of the students completing at least the first module.

Sample Characteristics

Baseline means and standard deviations for all outcome variables in Study 2 are shown in Table 8. Baseline differences between Study 1 and Study 2 are also shown in Table 8. Students in Study 2 reported, on average, lower zBMI, lower consumption of SSBs, greater milk consumption, better self-reported sleep quality, lower emotional eating, and greater willingness and self-efficacy to engage in healthy behaviors, compared to students in Study 1. Baseline means and standard deviations for all outcome variables are shown separately for the overweight/obese group and the non-overweight group in Table 3. Students with overweight/obesity reported significantly fewer days completing at least 60 minutes of physical activity, fewer hours of sleep on a weekend day, higher shape and weight concerns, worse mood, and lower HRQoL than the healthy weight group. Relative weight (zBMI) also significantly differed between these groups, although this is to be expected given the grouping. Means for all relative weight, behavioral, and psychosocial variables at baseline, post-intervention, and follow-up are shown in Table 4. A table of baseline correlations between the variables is shown in Table 9.

Changes in Relative Weight, Behavioral and Psychosocial Outcomes

Change in relative weight. Individual changes in zBMI over time are shown in Figure 2. A repeated measures ANOVA and subsequent pairwise comparisons revealed an increase in zBMI from baseline and post-intervention to follow-up in the full sample,

but not from baseline to post-intervention (see Table 10). No significant changes were found in the overweight sample (see Table 11), or in the healthy weight sample ($F(2,234) = 2.47$, $p = 0.09$). There were no significant predictors or moderators of change in psychosocial variables over time in either sample ($ps > .05$).

Changes in diet. In the full sample (see Table 10), participants reported an increase in consumption of green salad from baseline to post-intervention and follow-up, with no change between post-intervention and follow-up. Potato consumption (not including french fries, fried potatoes, or potato chips) also increased significantly between baseline and follow-up (but not between baseline and post-intervention, or post-intervention and follow-up). Finally, SSB consumption increased significantly from baseline to post-intervention and follow-up, with no change between post-intervention and follow-up. There were no changes in consumption of fruit juice, fruit, carrots, other vegetables, or milk. In the overweight sample (see Table 11), there was a significant increase in potato consumption from baseline to follow-up (but not between baseline and post-intervention, or post-intervention and follow-up). There were no changes in consumption of fruit juice, fruit, green salad, carrots, other vegetables, SSBs, or milk. There were no significant predictors or moderators of change in diet over time in either sample ($ps > .05$).

Changes in physical activity. There were no changes in any activity variables for either the full (see Table 10) or overweight (see Table 11) samples. There were no significant predictors or moderators of change in physical activity over time in either sample ($ps > .05$).

Changes in sleep. A repeated measures ANOVA revealed a significant change in hours of sleep on a school day for the full sample (see Table 10); however, pairwise comparisons revealed no significant changes between any of the time points. No other changes were seen for the full sample or the overweight sample (see Table 11). There were no significant predictors or moderators of change in sleep over time in either sample (*p*s > .05).

Changes in psychosocial outcomes. There were no changes in weight and shape concerns, mood, emotional eating, or HRQoL in either the full (see Table 10) or overweight sample (see Table 11). There were no significant predictors or moderators of change in psychosocial variables over time in either sample (*p*s > .05).

Changes in willingness and self-efficacy. In the full sample (see Table 10), there was a significant decrease in overall reported willingness and self-efficacy from baseline to post-intervention and follow-up. There were no changes in these measures from post-intervention to follow-up. In the overweight sample (see Table 11), there was a significant decrease in reported willingness to engage in healthy behaviors from baseline to post-intervention and follow-up, but no change in reported self-efficacy. There were no significant predictors or moderators of change in willingness or self-efficacy over time in either sample (*p*s > .05).

Discussion

Childhood obesity is a pressing public health concern and schools are often highlighted as an important venue through which to intervene, although results of school-based interventions are mixed (Brown & Summerbell, 2009; Katz et al., 2008; Wang et al., 2013). In the present study, *StayingFit* was implemented in three middle schools

using a community-based participatory research framework. The results of the program suggest that *StayingFit*, an online, targeted and universal intervention, is largely ineffective in achieving weight, behavioral, or psychosocial changes in both a cluster-randomized trial and in a pre-post intervention study. These findings stand in contrast to a previous study of *StayingFit,* which demonstrated the effectiveness of the program in reducing self-reported BMI and improving behavioral and psychosocial outcomes in high school students (Taylor et al., 2012). There are several potential reasons for the ineffectiveness of the intervention, including features of the environment and target population (Pickett & Pearl, 2001), the high degree of overweight (Ogden et al., 2014; Whitlock, et al., 2010), insufficient use of behavioral strategies and technology (An et al., 2009; Gliddon, et al., 2015; Han et al., 2010, Lustria, Cortese, Noar, & Glueckauf, 2009), low program completion rates (Beintner et al., 2014; Donkin et al., 2011), limited program duration (Wang et al., 2013), and the age of children coupled with lack of parental engagement (Braet, 2006; Katz et al., 2008; Klesges, Williams, Davis, Buscemi, & Kitzmann, 2012; Lindsay, Sussner, Kim, & Gortmaker, 2006). Overall, the results of the current study demonstrate the challenges of conducting school-based obesity interventions, and the complexity of this public health issue, particularly in under-resourced communities.

Program Implementation

StayingFit was examined in three schools across two studies. Whereas several implementation challenges were encountered in Study 1, there were no unexpected procedural problems, and higher program completion rates, in Study 2. The program was also accepted and appreciated by schools and teachers (barring challenges discussed in

School 2) in both studies. It is therefore feasible to implement an online program for healthy eating and activity in a low-income and rural community. This was likely facilitated by the use of a community-based participatory research approach. Strong partnerships were developed with several key community stakeholders, including representatives of the local hospital, health department, and schools. These relationships were instrumental in the implementation of *StayingFit*. To improve future program effectiveness, it is likely necessary to further expand these collaborations to additional community stakeholders (e.g., local activity centers, health care providers, grocery stores).

Sample Characteristics

Students in the intervention condition were significantly younger than students in the control condition, although the difference (~1.5 months) was so small as to be considered trivial. Students did not differ on any demographic variables between the two studies at baseline. Average zBMI in students in Study 2 was lower than that of students in Study 1. Students in Study 2 also reported greater milk and lower SSB consumption, improved sleep quality, lower emotional eating, and increased willingness and self-efficacy to engage in healthy behaviors compared to students in Study 1, although these differences were relatively small. Poorer socioeconomic status has been linked to poorer dietary intake and worse health behaviors (Hanson & Chen, 2007), which may have contributed to these differences. Specifically, the school in Study 2 had lower levels of free and reduced lunch rates (a proxy for the socioeconomic status of the school; 61.4% in 2014) compared to the schools in Study 1 (73.5% and 75.8%, respectively; Missouri Department of Elementary and Secondary Education, 2014). The rate of free and reduced

lunch for all schools was higher than the national average (51.3% in 2012; National Center for Education Statistics, 2013), highlighting the under-resourced nature of the community.

There were inconsistent findings regarding differences between students with overweight/obesity and those not in this category. Specifically, in Study 1 students with overweight/obesity reported slightly greater quantity of sleep on a school day than their healthy weight peers, which is inconsistent with previous findings suggesting that less sleep is a risk factor for obesity (Chen et al., 2008). In Study 2, students with overweight/obesity reported approximately one day less physical activity per week, half an hour sleep on the weekend, appreciably greater weight and shape concerns, and somewhat poorer mood and HRQoL, all of which are consistent with previous research (Chen et al., 2008; Friedlander et al., 2003; Ottova et al., 2012; Striegel-Moore et al., 1999; Tanofsky-Kraff et al., 2004). Interestingly, there were no differences in dietary intake between the groups, which is contrary to what might be expected (e.g., Roseman, Yeung, & Nickelsen, 2007). It is possible that given the low income and rural location of the communities in this study, all students face similar challenges in accessing and purchasing healthy foods, which impacts the dietary intake of all students (Larson & Story, 2009; Bell et al., 2013), but does not equate to unhealthy weight status in all students. For example, some evidence suggests that as a result of pressures from an obesogenic environment, people who are genetically predisposed toward weight gain already have overweight/obesity while some individuals remain resistant to excess weight gain in spite of these same pressures (Yanovski & Yanovski, 2011).

Effects of *StayingFit* on Relative Weight, Behavior, and Psychosocial Outcomes

Relative weight. The primary outcome of this study was relative weight, which has been difficult to reduce through school-based interventions (Baranowski et al., 2004; Brown & Summerbell, 2009; Han et al., 2010; Katz et al., 2008; Wang et al., 2013). It is clear from the zBMI trajectories for individual participants (see Figure 4) that there was significant variability between participants but little change within participants over time, which is confirmed by the analyses in both Study 1 and Study 2. These findings suggest that *StayingFit* was ineffective in achieving weight change for students. Although unlikely, it is possible that *StayingFit* was successful at preventing weight gain in Study 2, in which students completed more of the program. Specifically, students in the full sample maintained their weight from baseline to post-intervention and gained weight during the follow-up period. Importantly, children with overweight/obesity have been shown to increase their weight over time without intervention (Reilly et al., 2003). Consequently, stabilization of weight as a result of the intervention may be an important finding, particularly as weight stabilization may lead to reductions in relative weight as children grow taller over time (Goldschmidt et al., 2012). However, given the non-randomized design in Study 2 causality cannot be determined. In Study 1, in which group assignment was randomized, the relative weight of students in both the intervention and control groups did not change over time. This finding suggests that the intervention provided no additive effect to weight maintenance, or that enrollment in the control group was sufficient intervention to prevent weight gain. Overall, there is some limited evidence that *StayingFit* prevented weight gain, although, on balance, the intervention did little to affect relative weight.

Dietary intake. In contrast to previous findings, *StayingFit* resulted in few significant changes to dietary intake (Taylor et al., 2012). There was an increase in green salad and potato (not including French fries, fried potatoes, or potato chips) consumption in Study 2, with children with overweight/obesity in Study 2 only increasing potato consumption. In contrast, there were also unhealthy dietary changes, including a decrease in the consumption of 100% fruit juice and "other" vegetables (i.e., not carrots, potatoes, or green salad) in Study 1, and an increase in consumption of SSBs in Study 2. In Study 2, the changes occurred between baseline and follow-up or baseline and post-intervention, with no differences found between the post-intervention and follow-up, suggesting that the results of the intervention, both positive and negative, endured after the intervention was over. Importantly, without a control group, there may have been other factors that contributed to the reported outcomes in Study 2. In addition, it is important to note that the effect sizes of these changes were small, indicating that their significance is limited. Overall, the inconsistent pattern of results for dietary changes and the small size of any significant effects found indicate that any conclusions in this area should be interpreted with caution.

Physical activity and sleep. Findings were limited for physical activity and sleep outcomes, with the only significant effect found for interactions between the intervention and age and sex in the overweight sample in Study 1. Although these findings may indicate that age and sex impact sleep quantity and physical activity, respectively, it is more likely that these are spurious findings given that no other significant results were found for the moderating effect of age or sex, as well as the small size of the effects.

Psychosocial outcomes. There were also limited findings for psychosocial outcomes. In Study 1, HRQoL improved in the intervention group and declined in the control group for the full sample, but not in the overweight sample. HRQoL remained stable in Study 2. Previous research in population-based samples suggests that HRQoL tends to decrease over time without intervention (Palacio-Vieira et al., 2008), and one previous school-based obesity prevention intervention reported stabilizing HRQoL over time (Schetzina et al., 2014), suggesting that programs that focus on healthy eating and activity may mitigate decreases in HRQoL. *StayingFit* showed the same stabilizing effect in Study 2 and may have led to small improvements in HRQoL in Study 1. Future research should clarify this effect and identify and bolster the components of programs that may lead to improvements in HRQoL (Schetzina et al., 2014). Importantly, prior studies suggest that HRQoL is lower in children with obesity compared to their healthy weight peers (Pinhas-Hamiel et al., 2006), therefore achieving improvements in students with overweight/obesity is particularly important, but was not achieved in the present study. In the current study, changes in HRQoL may have been limited in students with overweight/obesity due to the lack of weight loss achieved in this group (Wille, Erhart, Peterson, & Ravens-Sieberer, 2008), as several studies have documented improvements in HRQoL with weight loss (Griffiths, Parsons, & Hill, 2010; Tsiros et al., 2009). It is also important to note that this finding was not replicated in Study 2, and thus the findings should be interpreted with caution. There were no effects of the intervention on other psychosocial outcomes, including mood, weight and shape concerns, and emotional eating in Study 1 or Study 2.

Surprisingly, willingness and self-efficacy in Study 2 decreased from pre- to post-intervention, and these changes were maintained through the follow-up period. In the overweight sample, only willingness decreased and self-efficacy remained constant. It was hypothesized that learning more about healthy eating and activity through *StayingFit* would increase willingness and self-efficacy; however, the opposite was found. It is possible that students felt that making these changes would be difficult and ineffective, particularly given the nature of their community. Alternatively, they may have felt that the behaviors they were encouraged to change were not appealing (Kiviniemi, Voss-Humke, & Seifert, 2007), or that they felt a loss of autonomy (Iso-Ahola, 2013), all of which may explain the reduction in willingness. It is also possible that program content was not specifically targeted to address students' cognitive or affective concerns about engaging in healthy behaviors and was therefore not sufficiently persuasive (Kiviniemi & Rothman, 2010). Some prior research suggests that splitting a behavior into smaller tasks can reduce self-efficacy by making the goal seem too daunting to achieve, or that encouraging the generalization of a behavior to other environments makes the behavior seem overwhelming (Olander et al., 2013). It is possible that by encouraging students to gradually work toward eating and activity goals (e.g., choosing a small diet goal) or encouraging them to engage in behavior change in multiple domains (e.g., engaging in physical activity at home, at school, and in the community), the intervention inadvertently made the behavioral changes appear overwhelming given that multiple steps were required to reach their goals. In contrast, other previous findings suggest that these intervention strategies facilitate behavior change (Altman & Wilfley, 2014; TODAY Study Group, 2010; Wilfley et al., 2010). Reduced self-efficacy may also be

associated with reduced willingness (Kiviniemi et al., 2007), although this relationship could not be tested with the current study design. Further research is needed to explore the factors that influence willingness and self-efficacy and the programmatic changes that could promote improvement in these outcomes.

Summary. Although several small effects were found in Study 1 and 2, it is important to note that the findings were inconsistent between studies. In addition, given the large number of analyses conducted and the small effect sizes**,** the findings should be interpreted with caution. Taken together, it appears that the intervention had no effect on relative weight or behavioral or psychosocial outcomes.

Potential Explanations for Limited Effectiveness

Features of the environment and target population. Low socioeconomic status is related to poorer health behaviors and outcomes, which are compounded by living in a deprived neighborhood (Pickett & Pearl, 2001). For example, people in low-income communities typically have limited access to healthy foods and greater access to unhealthy fast foods (Larson & Story, 2009; Bell et al., 2013), less access to transportation in order to access healthy foods elsewhere, less time to dedicate to shopping for healthy foods and engaging in healthy activities (Evans et al., 2015; Rose et al., 2009; Ver Ploeg et al., 2009), fewer opportunities for safe outdoor activity (Sallis et al., 2009), community attitudes unsupportive of health and health behavior, greater stress, and less social support (Macintyre, Maciver, & Sooman, 1993). A community needs assessment conducted by a local hospital in 2012 reported many of these challenges in the area served by the *StayingFit* intervention (CoxHealth & Breite, 2012). The report noted that one third of the population is near or below the poverty level, residents are

generally medically underserved, and health outcomes are worse than national averages, with obesity identified as a primary area of concern. The report also specified challenges to improving the health of the community as reported by community stakeholders. These factors included lack of basic health education, limited parental responsibility, apathy about health, limited finances, high unemployment, poor living conditions, challenges with transportation, the transient nature of the population, and the environmental quality and built environment (CoxHealth & Breite, 2012), all of which may have been barriers to success of the *StayingFit* intervention. This report highlights the complexity of the health needs of this community and the challenges in intervening effectively.

High degree of overweight. One of the goals of *StayingFit* was to target the intervention to children based on their presenting weight status so that program content could be tailored to the specific needs of each risk group. Given the limited effectiveness of the intervention for the sample of students with overweight/obesity, it does not appear that this approach was effective, and suggests that for targeting to be effective, the program for students with overweight/obesity may need to be more intensive or involve additional components. A potential reason for ineffectiveness of both targeting and the intervention overall is the high degree of overweight in the population. In Study 1, over 40% of the students had overweight/obesity, a proportion that is higher than the national prevalence of 32% (Ogden et al., 2014). Furthermore, a much larger proportion of the Study 1 sample had obesity (24%) than overweight (17%). The high rates and degree of overweight in this population may necessitate a more intense intervention to achieve significant outcomes (Whitlock et al., 2010). These prevalence rates also meant that fewer students were in the "at risk for overweight" category than identified in the

previous study conducted in the Bay Area (Taylor, personal communication, September, 2013), indicating that the program specified for that group was not useful in this population. Overall, future research should examine methods to increase the intensity of the intervention, with a particular focus on factors that may be important to populations with a high degree of overweight.

Insufficient use of behavioral strategies and technology. Behavioral skills are central to effective obesity interventions, and using interactive technology and personal contact has been identified as particularly important to Internet-based interventions (An et al., 2009). Although *StayingFit* utilized interactive behavioral components (i.e., self monitoring logs), it is possible that the technology was not sufficiently sophisticated and students did not use it frequently enough to achieve benefit from it. Future studies should develop more interactive and engaging programming (e.g., utilizing videos, games, etc.) that is adapted and personalized based on students' responses, level of motivation, and interests (Lustria et al., 2009). In particular, factors such as a personal coaching component (Napolitano, Hayes, Bennett, Ives, & Foster, 2013), discussion boards (Gliddon et al., 2015), and identifying peer leaders to promote behavior change (Rulison, Gest, & Oswood, 2015) have been beneficial in prior studies and may improve the effectiveness of the *StayingFit* intervention. In addition, utilizing technology may help bolster the behavioral strategies in the program. For example, smartphone applications may facilitate more frequent and accurate self-monitoring log completion (Wei, Hollin, & Kachnowski, 2011), and could take advantage of existing programs that aim to bolster the availability of mobile devices in low-income communities (e.g., SafeLink Wireless, n.d.).

Low program completion rates. Low program completion rates in the current study likely limited program effectiveness, particularly as most students did not receive the full intervention. Program usage rates were especially low in Study 1 (mean proportion of the program viewed was 0.34 with no students viewing > 75% of the program). Although rates were somewhat higher in Study 2 (mean proportion of pages viewed was 0.50 with 40% of students completing at least 75% of the program), they remain lower than in previous trials of *StayingFit* in school (~90%, Taylor, personal communication, March 15, 2016), although in contrast, a home-based trial of *StayingFit* in Australia demonstrated a positive effect on relative weight change with a mean of only 3 sessions completed (Williams, personal communication, December 12, 2015). In Study 1, the implementation challenges above likely account for some of the low completion rates; however, rates remained low in Study 2, where implementation encountered fewer challenges. One possible explanation is that teachers were not consistently and effectively ensuring that their students completed the program. For example, teachers at School 3 reported to research staff that it was hard to ensure students remained on task, a challenge that should be addressed in future research. Completion rates of Internet-based interventions vary. For example, a meta-analysis of online eating disorder programs identified dropout rates between 1-88% (median of 25%) and completion rates between 20-81% (Beintner et al., 2014), with higher usage related to improved outcomes (Donkin et al., 2011). Although attrition rates in the present study could thus be considered comparable to previous research, completion rates in Study 1 are significantly lower, suggesting particular attention should be paid to bolstering completion in future studies.

Limited program duration. A meta-analysis of school-based interventions reported that the most effective study length is 52-156 weeks (Wang et al., 2013). It is thus possible that the 16-week *StayingFit* intervention was not of sufficient duration to create meaningful changes (Summerbell et al., 2005), particularly given the relatively low program usage rates in Study 1. Future research could explore the use of *StayingFit* for an extended period of time, perhaps over multiple years with content increasing in complexity as the students advance grades.

Age of children and lack of parental engagement. *StayingFit* was previously examined in high school students and showed initial effectiveness in this population. The limited findings in the current study may be related to the younger age of participants. Although some evidence suggests that interventions in schools may be more effective for younger children (Katz et al., 2008), the self-directed nature of the current intervention may have prohibited younger children from participating fully, and younger children may not have had sufficient self-control skills to make behavioral changes necessary to modify weight status (Braet, 2006). In addition, individuals in high school may have greater decision-making power related to their diet and activity choices and therefore may have greater self-efficacy to make changes, whereas the younger children in the current studies were likely still relying on their caregivers to make decisions about diet (e.g., food purchases for the home) and activity (Lindsay et al., 2006). Since parental involvement was either low (Study 1) or not examined (Study 2), participants may have learned about healthy eating and activity but were unable to enact any changes without their parents' assistance.

Parental involvement is likely essential for successfully facilitating behavior change in children (Altman & Wilfley, 2014), and it appears particularly beneficial if parents themselves engage in behavior change (Boutelle, Cafri, & Crow, 2012); however, obtaining parental involvement can be challenging, particularly in school-based interventions (Story, 1999), and lack of parental responsibility was specifically noted as a challenge in this community (CoxHealth & Breite, 2012). In Study 1, significant efforts were made to engage parents in their children's learning and behavior change, including the creation of a corresponding parent program, but engagement was low. Parents were not involved in Study 2 per the school's request. The lack of parental engagement in these studies likely reduced students' ability to engage in behavior change, limiting the potential effectiveness of the intervention. Future studies could include a home-based component consistent with a socio-environmental approach (Wang et al., 2013).

Limitations

There are several limitations to the current studies. The studies were conducted in school settings, which limited researcher control. It is possible that there were confounding effects in the school or environment that limit the ability to make conclusions about the intervention. Further, although Study 1 used a cluster-randomized design, classes were randomized to intervention or control groups within the same school, potentially leading to contamination effects as students in the intervention classes could have discussed easily the program with students in the control classes. In addition, several challenges to implementation were confronted in Study 1, potentially limiting or changing the effects of the intervention. Whereas Study 2 progressed without many of the same challenges, this study had a pre-post design, which limits the ability to determine

causation. Finally, all behavioral and psychosocial outcomes were based on students self-report of the past week or more across multiple time-points, which may be subject to recall bias. This may be particularly important for children, although evidence suggests children are relatively good at self-reporting on their health (Riley, 2004)

Future Directions

Obesity is a complicated and challenging public health issue, and approaches that focus solely on the individual have been largely ineffective, highlighting the need for multi-level and multi-sector interventions that take into account interpersonal, community, and governmental characteristics (Hollar et al., 2010). This approach is particularly warranted in under-resourced communities where intervention is particularly needed (Summerbell et al, 2005). A benefit of the *StayingFit* intervention is that it is easy to disseminate to under-resourced communities; however, it seems likely that multiple strategies in many domains are necessary to achieve effectiveness, with the school remaining an important locale through which to intervene (Hollar et al., 2010). Potential program modifications include, 1) improving the efficacy of *StayingFit* through greater program length, advanced technology, individual coaching, and peer networking; 2) increasing parental engagement and involvement (e.g., home visits to help parents create changes in the environment, working with parents to develop more acceptable interventions); 3) providing teachers with additional support to enhance program completion (e.g., training in the program content and components); 4) linking with community partners (e.g., providing information at grocery stores and cafeterias about the nutritional quality of foods that is consistent with what the students are learning in *StayingFit,* providing fitness activities at a reduced price to program users); and 5)

creating closer links with health care delivery systems (e.g., use the school-based intervention as a screening system to link students to more intensive care; create a platform for sharing consistent health messaging through providing smartphones (e.g., SafeLink Wireless, n.d.)). Importantly, a community-based participatory research framework should be used to support the development of community partnerships, sustainable interventions, and to reduce health inequity in the community (Israel et al., 1998; Wallerstein & Duran, 2010).

Conclusion

Overall, *StayingFit* had limited or no effectiveness in achieving changes in relative weight, health behaviors, or psychosocial outcomes. Reasons for limited effectiveness may include the challenging nature of the population and environment, insufficient use of technology, limited program length and completion, and low parental engagement. The lack of effectiveness of *StayingFit* highlights the complexity of childhood obesity and the challenge in creating effective interventions in school settings, which, although a promising and important avenue for intervention, remains a difficult task. In order to improve the effects of the *StayingFit* intervention, it is likely necessary to bolster the program intensity by increasing its duration, harnessing parental involvement through home-based components, making the program more interactive with personal coaching and support, and supporting environmental changes in the community. Further work is needed to better understand how to design and implement multi-level interventions that can create meaningful changes in under-resourced communities.

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Table 1

Participant Characteristics in Study 1 and Study 2

Characteristic	Study One			Study Two
	Full Sample (*N*=524)	Intervention (*n*=266)	Control[a] (*n*=258)	Full Sample[b] (*N*=238)
Race *n* (%)				
Caucasian/White	427 (88.0)[c]	214(86.6)	213 (89.5)	207(87.0)
Other	58 (12.0)	33 (13.4)	25 (10.5)	31 (13.0)
Ethnicity *n* (%)				
Hispanic	39 (7.4)	17 (6.4)	22 (8.5)	19 (8.0)
Non-Hispanic	485 (92.6)	249 (93.6)	236 (91.5)	219(92.0)
Sex *n* (%)				
Male	266 (50.8)	137 (51.5)	129 (50.0)	123(51.7)
Female	258 (49.2)	129 (48.5)	129 (50.0)	115(48.3)
Child age at baseline, *M (SD)*				
Years	13.11 (0.98)	13.18 (0.91)	13.04 (1.03)*	13.22(0.67)
Baseline Weight Category *n* (%)				
Underweight[d]	11 (2.1)	7 (2.6)	4 (1.6)	5(2.1)
Healthy Weight	251 (45.8)	112 (42.1)	128 (49.6)	151(63.4)
At-risk for overweight	56 (10.7)	28 (10.5)	28 (10.9)	NA[e]
Overweight/Obese	217 (41.4)	98 (44.7)	119 (38.0)	82(34.5)

Notes.

[a]Significant differences between intervention and control groups noted with asterisk.

[b]No significant differences were found between Study 1 and 2 on any characteristics.

[c]Due to some missing data, the total number reported in the Race category does not equal the total in the study. Percentages were reported as percentage of the data collected.

[d]Students who were identified as underweight received the same program as the healthy weight students.

[e]In Study 2, students who were previously considered at-risk for overweight were included in the healthy weight category.

*$p < .05$

Table 2

Means and SDs of Relative Weight, Behavioral, and Psychosocial Variables in the Full Sample, Intervention, and Control Groups at Baseline in Study 1

Outcome	Full Sample					Intervention					Control					
				Range					Range					Range		t-*value* (Intervention
	N	*Mean*	*SD*	Min	Max	*n*	*Mean*	*SD*	Min	Max	*n*	*Mean*	*SD*	N	Mean	vs. Control)
Relative Weight																
zBMI	524	0.70	1.09	-2.88	2.75	266	0.74	1.13	-2.65	2.75	258	0.66	1.05	-2.88	2.65	0.79
Diet																
Fruit Juice	377	3.03	1.71	1	7	194	3.11	1.76	1	7	183	2.95	1.65	1	7	0.96
Fruit	397	3.42	1.70	1	7	209	3.38	1.73	1	7	188	3.47	1.67	1	7	-0.53
Green Salad	397	2.45	1.54	1	7	209	2.46	1.54	1	7	188	2.45	1.55	1	7	0.08
Potatoes	397	2.18	1.25	1	7	209	2.11	1.25	1	7	188	2.26	1.25	1	7	-1.20
Carrots	397	2.43	1.66	1	7	209	2.40	1.62	1	7	188	2.47	1.72	1	7	-0.45
Other Vegetables	397	3.06	1.69	1	7	209	3.08	1.73	1	7	188	3.03	1.64	1	7	0.26
Sugar Sweetened Beverages	397	2.86	1.73	1	7	209	2.77	1.62	1	7	188	2.96	1.84	1	7	-1.10
Milk	397	3.73	1.80	1	7	209	3.70	1.88	1	7	188	3.76	1.72	1	7	-0.31
Physical Activity																
Days Completing >60 Minutes of Physical Activity	369	5.80	2.15	1	8	194	5.77	2.16	1	8	175	5.84	2.15	1	8	-0.30
Hours of TV on School Days	396	3.30	1.73	1	7	207	3.33	1.73	1	7	189	3.26	1.74	1	7	0.42
Hours of Screen Time on School Days	396	3.69	1.98	1	7	207	3.67	1.94	1	7	189	3.71	2.04	1	7	-0.24
Sleep																
Hours of Sleep on a School Day	361	8.47	1.35	4.00	12.00	188	8.41	1.39	4.00	12.00	173	8.55	1.30	5.00	11.50	-0.98
Hours of Sleep on a Weekend	313	9.33	1.86	4.00	12.00	164	9.36	1.83	4.00	12.00	149	9.29	1.90	4.00	12.00	0.33
Sleep Quantity	380	3.01	0.78	1	4	201	3.00	0.81	1	4	179	3.01	0.76	1	4	-0.14
Sleep Quality	380	3.06	0.80	1	4	201	3.03	0.78	1	4	179	3.08	0.83	1	4	-0.65
Psychosocial Variables																
Weight and Shape Concerns	394	29.37	23.34	0.00	100.00	206	29.33	23.96	0.00	100.00	188	29.41	22.70	0.00	100.00	-0.04
Emotional Eating	391	10.45	3.37	7	21	204	10.30	3.21	7	21	187	10.60	3.54	7	21	-0.89
Mood	387	5.25	6.34	0	26	202	5.06	6.27	0	26	185	5.45	6.43	0	26	-0.60
Quality of Life	336	46.21	10.06	22.40	83.81	202	45.33	9.59	23.97	83.81	185	47.18	10.50	22.40	83.81	-1.78
Willingness and Self-Efficacy to Engage in Healthy Behaviors																
Willingness	378	3.50	1.13	1	5	196	3.47	1.15	1.00	5.00	182	3.54	1.11	1	5	-0.58
Self-Efficacy	378	3.58	1.19	1	5	196	3.58	1.20	1.00	5.00	182	3.58	1.19	1	5	-0.01

Table 3

Means and SDs of Relative Weight, Behavioral, and Psychosocial Variables of the Non-Overweight and Overweight Groups at Baseline in Study 1 and Study 2

Outcome	Study 1							Study 2						
	Non-Overweight Group			Overweight/Obese Group			*t-value* (Non-Overweight vs. Overweight/Obese)	Non-Overweight Group			Overweight/Obese Group			*t-value* (Non-Overweight vs. Overweight/Obese)
	n	*Mean*	*SD*	*n*	*Mean*	*SD*		*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	
Relative Weight														
zBMI	307	-0.04	0.75	217	1.75	0.44	34.51***	156	0.02	0.74	82	1.70	0.47	21.27***
Diet														
Fruit Juice	250	2.99	1.75	127	3.11	1.64	0.65	155	2.85	1.56	81	3.12	1.68	1.21
Fruit	250	3.50	1.70	147	3.28	1.70	-1.27	155	3.48	1.54	81	3.52	1.41	0.21
Green Salad	250	2.51	1.55	147	2.36	1.52	-0.93	155	2.45	1.52	81	2.37	1.53	-0.39
Potatoes	250	2.19	1.26	147	2.16	1.23	-0.28	155	2.39	1.44	81	2.12	1.14	-1.57
Carrots	250	2.46	1.71	147	2.39	1.59	-0.43	155	2.30	1.47	81	2.23	1.63	-0.29
Other Vegetables	250	3.12	1.69	147	2.95	1.69	-0.93	155	3.26	1.59	81	3.25	1.66	-0.05
Sugar Sweetened Beverages	250	2.87	1.71	147	2.84	1.76	-0.19	155	2.43	1.45	81	2.58	1.57	0.74
Milk	250	3.75	1.88	147	3.69	1.67	-0.33	155	4.01	1.74	81	4.15	1.75	0.57
Physical Activity														
Days Completing >60 Minutes of Physical Activity	238	5.92	2.13	131	5.60	2.20	-1.32	146	6.33	1.98	77	5.40	2.60	-2.73**
Hours of TV on School Days	249	3.24	1.72	147	3.39	1.75	0.85	124	3.03	1.64	54	3.37	1.67	1.25
Hours of Screen Time on School Days	249	3.58	1.94	147	3.88	2.04	1.43	124	3.45	1.88	54	3.54	1.91	0.28
Sleep														
Hours of Sleep on a School Day	225	8.35	1.39	136	8.68	1.26	2.38*	147	8.52	0.98	76	8.35	1.07	-1.19
Hours of Sleep on a Weekend	198	9.39	1.85	115	9.23	1.89	-0.71	134	9.47	1.39	65	8.94	1.52	-2.38*
Sleep Quantity	236	3.01	0.80	144	2.99	0.76	-0.24	151	3.07	0.66	76	3.00	0.73	-0.67
Sleep Quality	236	3.04	0.81	144	3.08	0.79	0.40	151	3.23	0.58	76	3.21	0.72	-0.15
Psychosocial Variables														
Weight and Shape Concerns	247	28.42	23.12	147	30.96	23.70	1.04	151	22.96	19.33	76	41.01	21.78	6.11***
Emotional Eating	245	10.48	3.46	146	10.39	3.23	-0.25	148	9.84	2.59	72	10.08	2.48	0.66
Mood	242	5.44	6.54	145	4.92	6.00	-0.79	141	3.91	5.68	71	5.62	6.06	1.97*
Quality of Life	241	46.28	10.90	146	46.11	8.54	-1.80	145	46.94	8.86	72	42.88	8.07	-3.38***
Willingness and Self-Efficacy to Engage in Healthy Behaviors														
Willingness	235	3.48	1.15	143	3.55	1.10	0.59	140	3.82	0.96	70	3.83	0.88	0.06
Self-Efficacy	235	3.54	1.20	143	3.65	1.18	0.84	140	3.96	0.97	70	3.90	0.93	-0.65

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Means and SDs of Relative Weight, Behavioral, and Psychosocial Variables in Study 1 and Study 2 at Baseline, Post-Intervention, and Follow-Up (Study 2 only)

Outcome	Study 1										Study 2						
	Intervention					Control											
		Baseline		Post-Intervention			Baseline		Post-Intervention			Baseline		Post-Intervention		Follow-Up	
	n	*Mean*	*SD*	*Mean*	*SD*	*n*	*Mean*	*SD*	*Mean*	*SD*	*n*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Relative Weight																	
zBMI	266	0.74	1.13	0.72	1.12	258	0.66	1.05	0.64	1.04	238	0.60	1.04	0.57	1.02	0.63	0.96
Diet																	
Fruit Juice	194	3.11	1.76	2.88	1.74	183	2.95	1.65	3.11	1.90	236	2.94	1.60	2.98	1.59	2.87	1.55
Fruit	209	3.38	1.73	3.00	1.54	188	3.47	1.67	3.45	1.73	236	3.49	1.49	3.53	1.38	3.63	1.53
Green Salad	209	2.46	1.54	2.34	1.56	188	2.45	1.55	2.52	1.57	236	2.42	1.52	2.59	1.55	2.55	1.48
Potatoes	209	2.11	1.25	2.19	1.18	188	2.26	1.25	2.36	1.41	236	2.30	1.35	2.71	1.48	2.54	1.44
Carrots	209	2.40	1.62	2.25	1.74	188	2.47	1.72	2.32	1.53	236	2.28	1.52	2.53	1.54	2.40	1.56
Other Vegetables	209	3.08	1.73	2.72	1.64	188	3.03	1.64	3.12	1.70	236	3.25	1.61	3.11	1.48	3.23	1.58
Sugar Sweetened Beverages	209	2.77	1.62	3.02	1.69	188	2.96	1.84	2.98	1.75	236	2.48	1.49	2.50	1.51	2.79	1.63
Milk	209	3.70	1.88	3.80	1.84	188	3.76	1.72	3.92	1.90	236	4.06	1.74	3.96	1.75	3.99	1.75
Physical Activity																	
Days Completing >60 Minutes of Physical Activity	194	5.77	2.16	5.65	2.16	175	5.84	2.15	5.82	2.31	217	6.18	2.05	5.53	2.15	6.10	1.89
Hours of TV on School Days	207	3.33	1.73	3.84	1.79	189	3.26	1.74	3.57	1.89	178	3.13	1.65	3.24	1.51	3.20	1.66
Hours of Screen Time on School Days	207	3.67	1.94	3.85	2.03	189	3.71	2.04	3.57	2.04	178	3.48	1.89	3.37	1.63	3.52	1.89
Sleep																	
Hours of Sleep on a School Day	188	8.41	1.39	8.35	1.27	173	8.55	1.30	8.45	1.34	223	8.46	1.01	8.53	1.11	8.21	1.33
Hours of Sleep on a Weekend	164	9.36	1.83	9.01	1.82	149	9.29	1.90	9.19	1.74	199	9.30	1.45	9.15	1.53	9.20	1.45
Sleep Quantity	201	3.00	0.81	2.97	0.75	179	3.01	0.76	3.20	0.67	227	3.04	0.68	3.07	0.69	2.96	0.73
Sleep Quality	201	3.03	0.78	3.09	0.76	179	3.08	0.83	3.20	0.75	227	3.22	0.63	3.16	0.67	3.08	0.67
Psychosocial Variables																	
Weight and Shape Concerns	206	29.33	23.96	28.92	23.96	188	29.41	22.70	27.55	25.96	227	29.00	21.87	29.05	22.68	30.30	23.69
Emotional Eating	204	10.30	3.21	9.99	2.85	187	10.60	3.54	9.89	3.19	220	9.92	2.55	10.37	3.26	10.68	3.17
Mood	202	5.06	6.27	5.07	5.96	185	5.45	6.43	4.92	6.17	212	4.49	5.85	4.85	6.43	6.04	7.30
Quality of Life	202	45.33	9.59	45.15	11.16	185	47.18	10.50	44.92	9.18	196	45.59	8.79	43.66	10.19	43.61	10.87
Willingness and Self-Efficacy to Engage in Healthy Behaviors																	
Willingness	196	3.47	1.15	3.37	1.20	182	3.54	1.11	3.58	1.07	210	3.83	0.93	3.55	1.14	3.47	1.06
Self-Efficacy	196	3.58	1.20	3.38	1.26	182	3.58	1.19	3.70	1.10	210	3.95	0.95	3.67	1.08	3.52	1.04

Table 5

Correlations of Relative Weight, Behavioral, and Psychosocial Variables at Baseline in Study 1

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)	17)	18)	19)	20)	21)	22)
1) zBMI	---																					
2) Fruit Juice	-0.01	---																				
3) Fruit	**-0.14**	**0.51**	---																			
4) Green Salad	-0.06	**0.41**	**0.49**	---																		
5) Potatoes	-0.01	**0.29**	**0.26**	**0.43**	---																	
6) Carrots	-0.07	**0.42**	**0.46**	**0.44**	**0.34**	---																
7) Other Vegetables	-0.08	**0.42**	**0.54**	**0.53**	**0.34**	**0.5**	---															
8) Sugar Sweetened Beverages	-0.04	**0.24**	**0.19**	**0.23**	**0.26**	**0.23**	**0.11**	---														
9) Milk	-0.05	**0.34**	**0.31**	**0.18**	**0.16**	**0.31**	**0.33**	**0.16**	---													
10) Days w/ 60 Min PA	-0.1	**0.11**	0.13	0.08	-0.02	0.08	**0.13**	0.01	**0.17**	---												
11) TV on School Day	-0.04	-0.02	0.01	-0.01	0.01	0.01	-0.1	**0.17**	0.01	-0.1	---											
12) Screen on School Day	0.02	-0.06	-0.05	-0.09	-0.02	-0.04	-0.08	**0.18**	-0.04	-0.05	**0.2**	---										
13) Hours of Sleep on School Day	**0.15**	-0.02	0.08	-0.05	-0.04	0.04	-0.01	0	0.03	-0.05	-0.05	**-0.13**	---									
14) Hours of Sleep on Weekend Day	0.02	-0.07	-0.02	-0.04	**-0.14**	-0.05	-0.02	-0.02	-0.04	0.03	-0.04	**-0.14**	**0.34**	---								
15) Sleep Quantity	-0.01	0.09	0.04	0.01	0.1	0.04	0.01	0.09	0.09	0.06	0	-0.04	**0.3**	**0.2**	---							
16) Sleep Quality	0	0.02	-0.01	-0.04	0.07	0.04	0.01	-0.06	0.04	0.03	0	-0.06	**0.22**	**0.14**	**0.67**	---						
17) Weight and Shape Concerns	-0.02	0.01	0	0.03	-0.04	-0.06	-0.01	-0.06	**-0.1**	-0.08	0.09	0.01	**-0.13**	-0.03	**-0.23**	**-0.2**	---					
18) Emotional Eating	-0.03	0.05	0.07	**0.15**	**0.12**	**0.1**	0.1	**0.13**	0.05	-0.06	0.05	0.09	0.01	0.09	**-0.22**	**-0.25**	**0.16**	---				
19) Mood	-0.06	0.01	0.04	0.01	0.01	-0.03	0.05	0.01	0.01	-0.06	0.03	0.09	**-0.16**	-0.11	**-0.27**	**-0.31**	**0.39**	**0.42**	---			
20) Willingness	-0.02	0.02	0.09	0.04	0.02	0.03	**0.11**	-0.08	-0.05	**0.13**	-0.05	**-0.16**	0.09	0.09	**0.12**	**0.13**	**0.19**	-0.1	0	---		
21) Self Efficacy	0.01	0.02	0.08	-0.01	0.03	0.03	0.09	-0.09	-0.03	**0.15**	-0.1	**-0.18**	0.1	0.09	**0.19**	**0.18**	**0.16**	**-0.17**	-0.08	**0.84**	---	
22) Quality of Life	-0.07	0.07	**0.12**	0.06	0.04	0.1	**0.14**	0.04	0.08	**0.25**	-0.01	-0.02	**0.12**	0.05	**0.26**	**0.21**	**-0.24**	**-0.21**	**-0.5**	**0.13**	**0.13**	---

* Bold indicates $p < .05$

Table 6

Study 1 Hierarchical Linear Model Results in the Full Sample

		Intercept		Time		Condition		TimeXCondition		
	Number of Observations	*B*	*Standard Error*	*B*	*Standard Error*	*B*	*Standard Error*	*B*	*Standard Error*	Residual variances
Relative Weight										
zBMI	1191	0.67***	0.07	0.00	0.00	0.08	0.09	0.00	0.00	0.02
Diet										
Fruit Juice	849	2.93***	0.12	0.00	0.00	0.12	0.17	-0.01*	0.00	3.01
Fruit	907	3.46***	0.12	0.00	0.00	-0.07	0.16	0.00	0.00	2.83
Green Salad	907	2.40***	0.10	0.00	0.00	-0.01	0.14	0.00	0.00	2.13
Potatoes	907	2.25***	0.09	0.00	0.00	-0.12	0.12	0.00	0.00	1.60
Carrots	907	2.44***	0.11	0.00	0.00	-0.05	0.16	0.00	0.00	2.60
Other Vegetables	907	3.01***	0.11	0.00	0.00	0.02	0.16	-0.00*[a]	0.00	2.68
Sugar Sweetened Beverages	907	3.01***	0.12	0.00	0.00	-0.25	0.17	0.00	0.00	2.87
Milk	907	3.82***	0.13	0.00	0.00	-0.13	0.17	0.00	0.00	3.33
Physical Activity										
Days Completing >60 Minutes of Physical Activity	853	5.84***	0.16	0.00	0.00	0.01	0.21	0.00	0.00	4.39
Hours of TV on School Days	907	3.31***	0.13	0.00b	0.00	-0.03	0.17	0.00	0.00	3.29
Hours of Screen Time on School Days	907	3.78***	0.14	0.00	0.00	-0.15	0.19	0.00	0.00	4.05
Sleep										
Hours of Sleep on a School Day	872	8.50***	0.09	0.00	0.00	-0.11	0.13	0.00	0.00	1.62
Hours of Sleep on a Weekend	756	9.26***	0.14	0.00	0.00	0.11	0.19	0.00	0.00	3.02
Sleep Quantity	905	3.00***	0.05	0.00**[b]	0.00	0.02	0.07	0.00	0.00	0.57
Sleep Quality	905	3.06***	0.05	0.00	0.00	-0.01	0.07	0.00	0.00	0.54
Psychosocial Constructs										
Weight and Shape Concerns	905	29.84***	1.62	-0.02	0.02	-1.37	2.23	0.02	0.03	511.07
Emotional Eating	899	10.69***	0.22	-0.01	0.00	-0.53	0.30	0.00	0.00	9.92
Mood	893	5.79***	0.44	0.00	0.01	-0.83	0.61	0.00	0.01	40.19
Health-Related Quality of Life	893	46.99***	0.71	-0.02	0.01	-1.39	0.98	0.03*	0.01	99.55
Willingness and Self-Efficacy to Engage in Healthy Behaviors										
Willingness	881	3.52***	0.08	0.00	0.00	-0.05	0.11	0.00	0.00	1.18
Self-Efficacy	881	3.58***	0.08	0.00	0.00	0.02	0.11	0.00	0.00	1.29

***$p < .001$, **$p < .01$, * $p < .05$

[a] Non-rounded value: -0.0042

[b] Non-rounded value: 0.0018

Table 7

Study 1 Hierarchical Linear Model Results in the Overweight/Obese Sample

		Intercept		Time		Condition		TimeXCondition		
	Number of Observations	*B*	*Standard Error*	*B*	*Standard Error*	*B*	*Standard Error*	*B*	*Standard Error*	Residual variances
Relative Weight										
zBMI	476	1.76***	0.05	0.00	0.00	-0.01	0.06	0.00	0.00	0.01
Diet										
Fruit Juice	284	3.18***	0.21	0.00	0.00	-0.20	0.29	0.00	0.00	2.82
Fruit	341	3.53***	0.20	0.00	0.00	-0.36	0.26	0.00	0.00	2.73
Green Salad	341	2.35***	0.17	0.00	0.00	-0.01	0.23	0.00	0.00	2.08
Potatoes	341	2.21***	0.14	0.00	0.00	-0.12	0.18	0.00	0.00	1.27
Carrots	341	2.48***	0.18	0.00	0.00	-0.12	0.24	0.00	0.00	2.23
Other Vegetables	341	3.13***	0.19	0.00	0.00	-0.25	0.25	0.00	0.00	2.45
Sugar Sweetened Beverages	341	3.01***	0.22	0.00	0.00	-0.21	0.28	0.00	0.00	2.95
Milk	341	4.08***	0.22	0.00	0.00	-0.53	0.29	0.00	0.00	3.31
Physical Activity										
Days Completing >60 Minutes of Physical Activity	311	5.49***	0.28	0.00	0.00	0.25	0.37	0.01	0.01	4.84
Hours of TV on School Days	341	3.44***	0.22	0.00	0.00	-0.11	0.29	0.00	0.00	3.34
Hours of Screen Time on School Days	341	4.04***	0.24	0.00	0.00	-0.19	0.32	0.00	0.00	3.54
Sleep										
Hours of Sleep on a School Day	327	8.65***	0.15	0.00	0.00	0.06	0.20	0.00	0.00	1.40
Hours of Sleep on a Weekend	281	9.00***	0.24	0.00	0.00	0.26	0.31	0.00	0.00	3.08
Sleep Quantity	339	2.98***	0.09	0.00	0.00	0.08	0.11	0.00	0.00	0.58
Sleep Quality	339	3.11***	0.09	0.00	0.00	-0.04	0.12	0.00	0.00	0.50
Psychosocial Constructs										
Weight and Shape Concerns	341	33.53***	2.86	-0.03	0.03	-4.56	3.75	0.02	0.05	448.30
Emotional Eating	338	10.80***	0.35	-0.01	0.00	-0.88	0.46	0.00	0.01	8.43
Mood	335	5.45***	0.77	0.01	0.01	-0.62	1.02	-0.01	0.01	37.87
Health-Related Quality of Life	338	46.99***	0.71	-0.02	0.01	-1.39	0.98	0.03	0.01	85.08
Willingness and Self-Efficacy to Engage in Healthy Behaviors										
Willingness	334	3.64***	0.13	0.00	0.00	-0.17	0.17	0.00	0.00	1.02
Self-Efficacy	334	3.71***	0.14	0.00	0.00	-0.10	0.18	0.00	0.00	1.17

***$p < .001$, **$p < .01$, * $p < .05$

Table 8

Means and SDs of Relative Weight, Behavioral, and Psychosocial Variables at Baseline in Study 2 and baseline differences between Study 1 and Study 2

Outcome	Study 1					Study 2					
				Range					Range		*t-value* (Study
	N	*Mean*	*SD*	Min	Max	*N*	*Mean*	*SD*	Min	Max	1 vs. Study 2)
Relative Weight											
zBMI	524	0.70	1.09	-2.88	2.75	238	0.60	1.04	-2.23	3.09	14.73***
Diet											
Fruit Juice	377	3.03	1.71	1	7	236	2.94	1.60	1	7	0.64
Fruit	397	3.42	1.70	1	7	236	3.49	1.49	1	7	0.58
Green Salad	397	2.45	1.54	1	7	236	2.42	1.52	1	7	0.81
Potatoes	397	2.18	1.25	1	7	236	2.30	1.35	1	7	0.26
Carrots	397	2.43	1.66	1	7	236	2.28	1.52	1	7	0.22
Other Veg	397	3.06	1.69	1	7	236	3.25	1.61	1	7	0.14
SSBs	397	2.86	1.73	1	7	236	2.48	1.49	1	7	2.92**
Milk	397	3.73	1.80	1	7	236	4.06	1.74	1	7	-2.30*
Physical Activity											
Days Completing >60 Minutes of Physical Activity	369	5.80	2.15	1	8	217	6.18	2.05	1	8	-1.09
Hours of TV on School Days	396	3.30	1.73	1	7	178	3.13	1.65	1	7	1.08
Hours of Screen Time on School Days	396	3.69	1.98	1	7	178	3.48	1.89	1	7	1.22
Sleep											
Hours of Sleep on a School Day	361	8.47	1.35	4.00	12.00	223	8.46	1.01	5.33	11.00	0.11
Hours of Sleep on a Weekend	313	9.33	1.86	4.00	12.00	199	9.30	1.45	4.75	12.00	0.21
Sleep Quantity	380	3.01	0.78	1	4	227	3.04	0.68	1	4	-0.64
Sleep Quality	380	3.06	0.80	1	4	227	3.22	0.63	1	4	-2.82**
Psychosocial Variables											
Weight and Shape Concerns	394	29.37	23.34	0.00	100.00	227	29.00	21.87	0.00	91.67	0.20
Emotional Eating	391	10.45	3.37	7	21	220	9.92	2.55	7	20	2.16*
Mood	387	5.25	6.34	0	26	212	4.49	5.85	0	24	1.47
Quality of Life	336	46.21	10.06	22.40	83.81	196	45.59	8.79	25.36	83.81	0.79
Willingness and Self-Efficacy to Engage in Healthy Behaviors											
Willingness	378	3.50	1.13	1	5	210	3.83	0.93	1	5	-3.72***
Self-Efficacy	378	3.58	1.19	1	5	210	3.95	0.95	1	5	-4.13***

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 9

Correlations of Relative Weight, Behavioral, and Psychosocial Variables at Baseline in Study 2

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)	17)	18)	19)	20)	21)
1) zBMI	---																				
2) Fruit Juice	0.06	---																			
3) Fruit	-0.07	**0.35**	---																		
4) Green Salad	-0.02	**0.36**	**0.42**	---																	
5) Potatoes	-0.06	**0.33**	**0.44**	**0.42**	---																
6) Carrots	0.03	**0.35**	**0.47**	**0.57**	**0.48**	---															
7) Other Vegetables	-0.02	**0.45**	**0.41**	**0.46**	**0.48**	**0.42**	---														
8) Sugar Sweetened Beverages	0.09	0.03	**0.13**	0.08	**0.19**	0.12	0.12	---													
9) Milk	0.01	**0.29**	**0.26**	**0.17**	**0.27**	**0.25**	**0.35**	0	---												
10) Days w/ 60 Min PA	**-0.15**	**0.16**	**0.19**	0.12	**0.22**	0.13	**0.35**	-0.07	**0.26**	---											
11) TV on School Day	0.1	0	-0.02	-0.1	0	0	0.03	0.05	-0.03	-0.09	---										
12) Screen on School Day	0.08	-0.12	-0.07	-0.11	0	-0.12	0.08	-0.02	0.05	0.07	**0.22**	---									
13) Hours of Sleep on School Day	**-0.15**	0.08	0.19	0.15	0.11	**0.14**	0.1	0.02	0.04	-0.01	-0.09	-0.06	---								
14) Hours of Sleep on Weekend Day	**-0.21**	0.01	0	0.06	0.03	0	0.05	-0.08	0.04	0.05	-0.09	0	**0.28**	---							
15) Sleep Quantity	-0.04	0.02	0.09	0.06	-0.05	0.05	0.12	**-0.14**	0.07	0.06	-0.03	-0.05	**0.24**	0.1	---						
16) Sleep Quality	-0.05	0.1	**0.14**	0.05	0.05	0.02	**0.19**	**-0.14**	**0.16**	0.12	-0.1	-0.02	0.12	0	**0.61**	---					
17) Weight and Shape Concerns	**0.4**	0.11	-0.12	0.04	-0.11	-0.03	-0.06	-0.02	-0.13	-0.05	0	0.02	**-0.2**	-0.06	**-0.22**	-0.13	---				
18) Emotional Eating	0.04	0.03	-0.1	0.02	-0.05	-0.07	0	0.02	-0.01	-0.13	0.07	0.08	**-0.15**	-0.01	**-0.17**	-0.13	**0.29**	---			
19) Mood	0.15	0.13	**-0.2**	0.02	-0.13	-0.05	**-0.2**	0.14	**-0.2**	-0.1	0.08	0.04	**-0.23**	0.06	**-0.36**	**-0.36**	**0.48**	**0.33**	---		
20) Willingness	0	-0.02	**0.14**	0.07	-0.1	0.05	0.05	**-0.29**	0.11	**0.21**	0.07	0	0.04	-0.02	**0.19**	0.13	0.11	-0.08	-0.15	---	
21) Self Efficacy	-0.08	0.09	**0.18**	0.13	0.01	0.1	**0.16**	**-0.24**	0.09	**0.2**	0.02	-0.01	0.07	0.08	**0.25**	**0.22**	0.02	**-0.14**	**-0.22**	**0.81**	---

* Bold indicates $p < .05$

Table 10

Study 2 ANOVA Results in the Full Sample

Dependent Variable	*df*	*F*	*p*	Baseline		Post-Intervention		Pairwise Comparisons*	Follow-Up			
				M	*SD*	*M*	*SD*	*p-value* (Baseline vs. Post-Intervention)	*M*	*SD*	*p-value* (Baseline vs. Follow-Up)	*p-value* (Post-Intervention vs. Follow-Up)
Relative Weight												
zBMI	2, 368	5.88	< .01	0.55	1.02	0.56	1.01	0.84	0.63	0.96	< .05	< .01
Diet												
Fruit Juice	2, 188	.075	.48									
Fruit	2, 188	1.97	.14									
Green Salad	2, 188	5.44	< .01	2.21	1.37	2.60	1.57	< .05	2.68	1.54	< .01	.57
Potatoes	2, 188	3.51	< .05	2.26	1.32	2.55	1.40	.19	2.68	1.40	< .05	.39
Carrots	2, 188	2.37	.10									
Other Vegetables	2, 188	1.19	.31									
Sugar Sweetened Beverages	2, 188	5.01	<.01	2.28	1.32	2.38	1.40	< .05	2.79	1.55	<.05	.55
Milk	2, 188	1.72	.18									
Physical Activity												
Days Completing >60 Minutes of Physical Activity	2, 142	1.53	.22									
Hours of TV on School Days	2, 136	0.03	.97									
Hours of Screen Time on School Days	2, 136	0.66	.52									
Sleep												
Hours of Sleep on a School Day	2, 148	3.13	<.05	8.68	0.74	8.69	1.00	0.99	8.47	1.16	0.13	0.56
Hours of Sleep on a Weekend	2, 114	1.30	.28									
Sleep Quantity	2, 166	0.30	.74									
Sleep Quality	2, 166	1.81	.17									
Psychosocial Constructs												
Weight and Shape Concerns	2, 158	2.03	.14									
Emotional Eating	2, 150	2.79	.06									
Mood	2, 133	0.57	0.57									
Health-Related Quality of Life	2,141	2.57	0.08									
Willingness and Self-Efficacy to Engage in Healthy Behaviors												
Willingness to Engage in Healthy Behaviors	2, 128	10.20	<.001	3.98	0.82	3.42	1.16	<.001	3.46	1.10	<.001	0.8
Self-Efficacy to Engage in Healthy Behaviors	2, 128	8.90	<.001	4.00	0.96	3.51	1.12	<.001	3.46	1.09	<.001	0.8

* Pairwise comparisons were only conducted when the ANOVA was significant

Table 11

Study 2 ANOVA Results in the Overweight/Obese Sample

Dependent Variable	*df*	*F*	*p*	Pairwise Comparisons								
				Baseline		Post-Intervention		*p-value* (Baseline vs. Post-Intervention)	Follow-Up		P-value (Baseline vs. Follow-Up)	*p-value* (Post-Intervention vs. Follow-Up)
				M	*SD*	*M*	*SD*		*M*	*SD*		
Relative Weight												
zBMI	2, 105	1.33	.27									
Diet												
Fruit Juice	2, 59	0.77	.47									
Fruit	2, 59	0.08	.92									
Green Salad	2, 59	1.93	.15									
Potatoes	2, 59	4.84	.01	2.05	0.94	2.44	1.05	0.19	2.90	1.62	0.02	0.39
Carrots	2, 59	1.22	.30									
Other Vegetables	2, 59	0.62	.54									
Sugar Sweetened Beverages	2, 59	2.63	.08									
Milk	2, 59	0.42	.66									
Physical Activity												
Days Completing >60 Minutes of Physical Activity	2, 43	0.36	.70									
Hours of TV on School Days	2, 38	0.63	.54									
Hours of Screen Time on School Days	2, 38	0.56	.58									
Sleep												
Hours of Sleep on a School Day	2, 44	1.15	.33									
Hours of Sleep on a Weekend	2, 37	0.99	.38									
Sleep Quantity	2, 52	0.09	.91									
Sleep Quality	2, 52	0.77	.47									
Psychosocial Constructs												
Weight and Shape Concerns	2, 50	1.27	.29									
Emotional Eating	2, 46	0.86	.43									
Mood	2, 43	0.22	.81									
Health-Related Quality of Life	2, 45	0.24	.79									
Willingness and Self-Efficacy to Engage in Healthy Behaviors												
Willingness to Engage in Healthy Behaviors	2, 38	4.31	.02	4.16	0.65	3.63	1.00	<.001	3.61	1.04	<.001	0.8
Self-Efficacy to Engage in Healthy Behaviors	2, 38	3.04	.06									

NA - Pairwise comparisons were only conducted when the ANOVA was significant

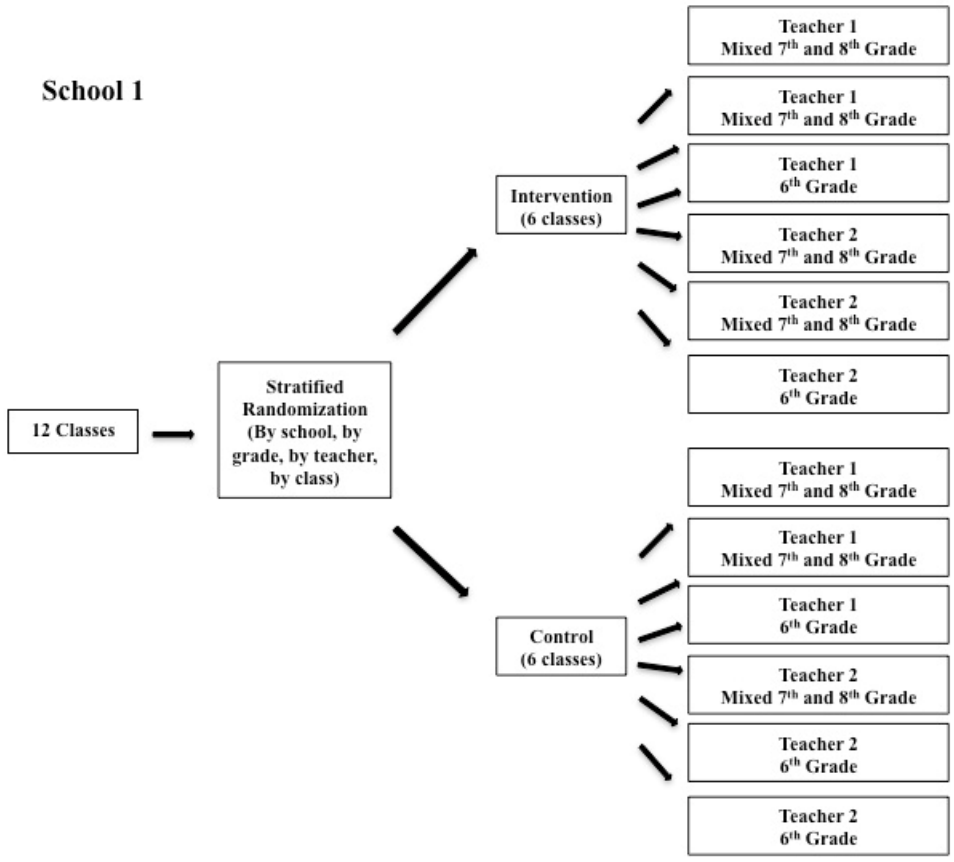

Figure 1: Cluster randomization of classes to condition in School 1.

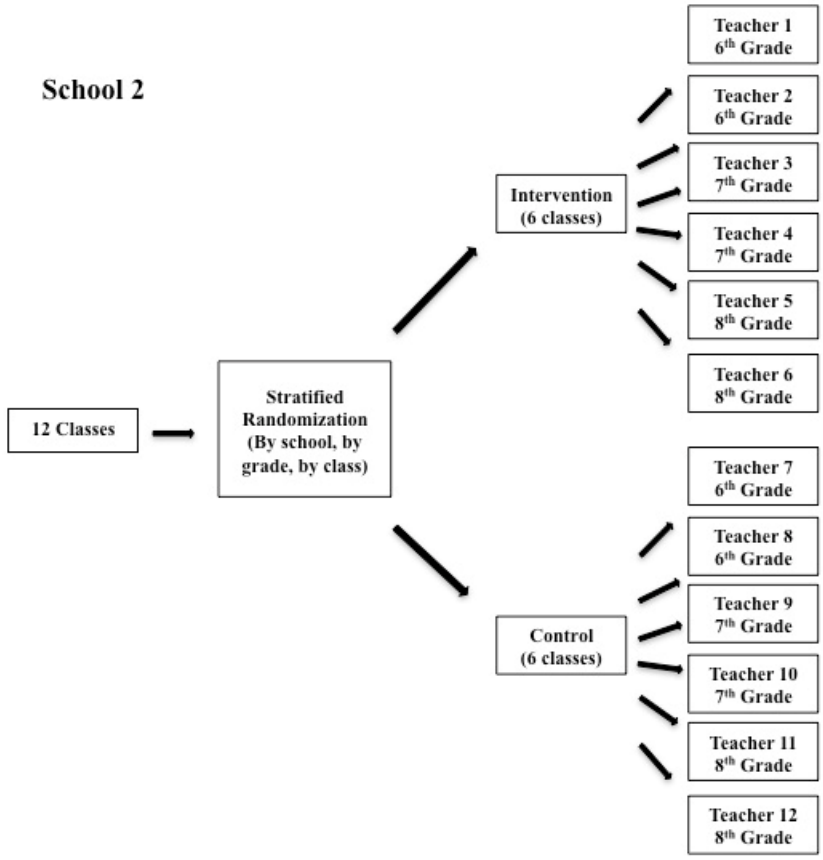

Figure 2: Cluster randomization of classes to condition in School 2.

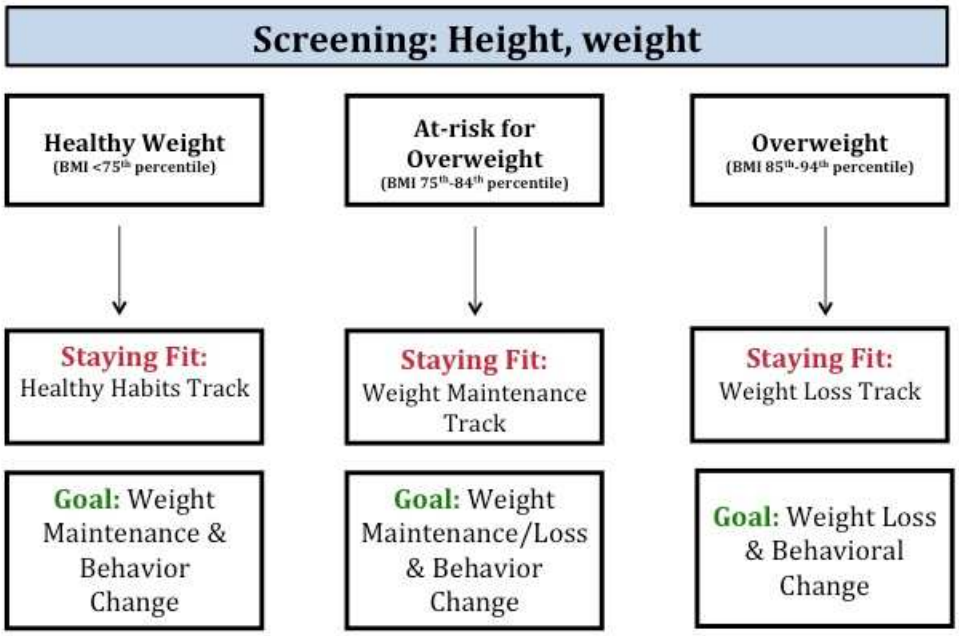

Figure 3: Screening algorithm and program goals by track.

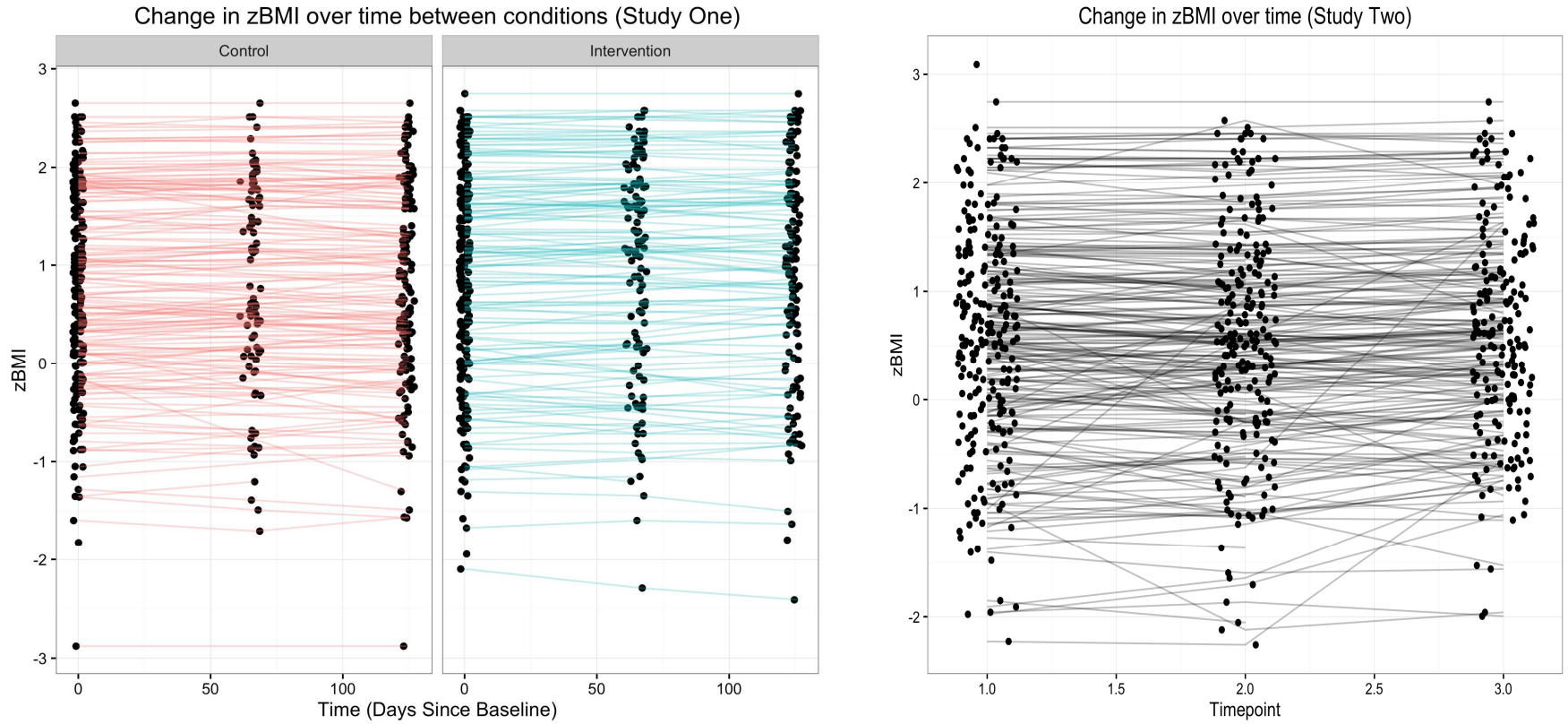

Figure 4: Change in zBMI over time in Study 1 and Study 2

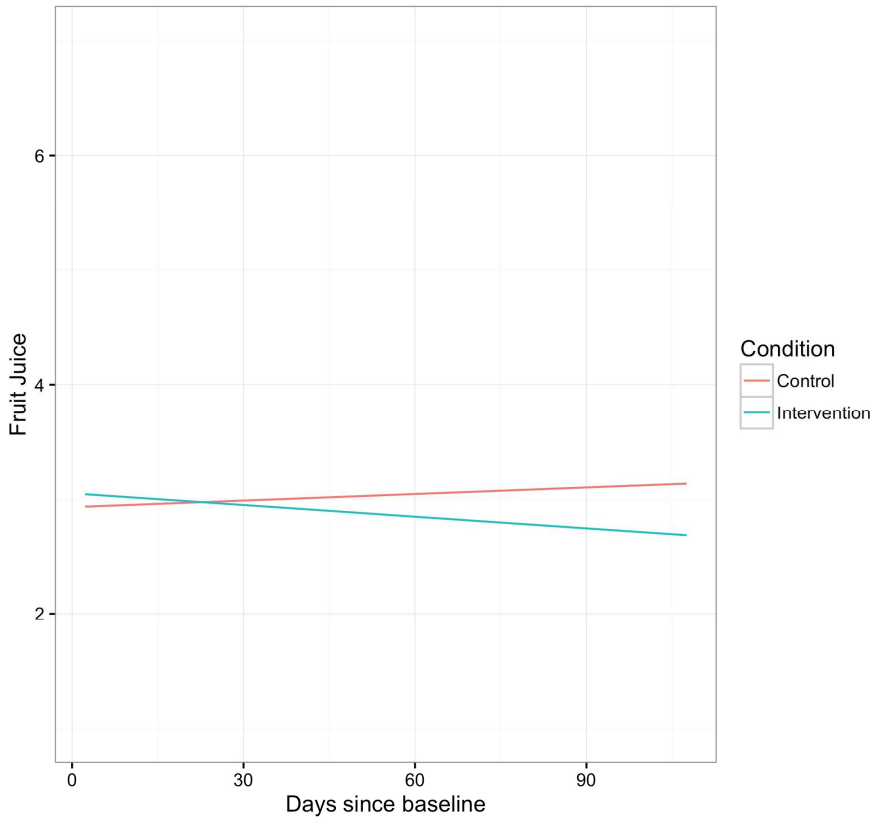

Figure 5: Consumption of fruit juice as a function of time and condition.

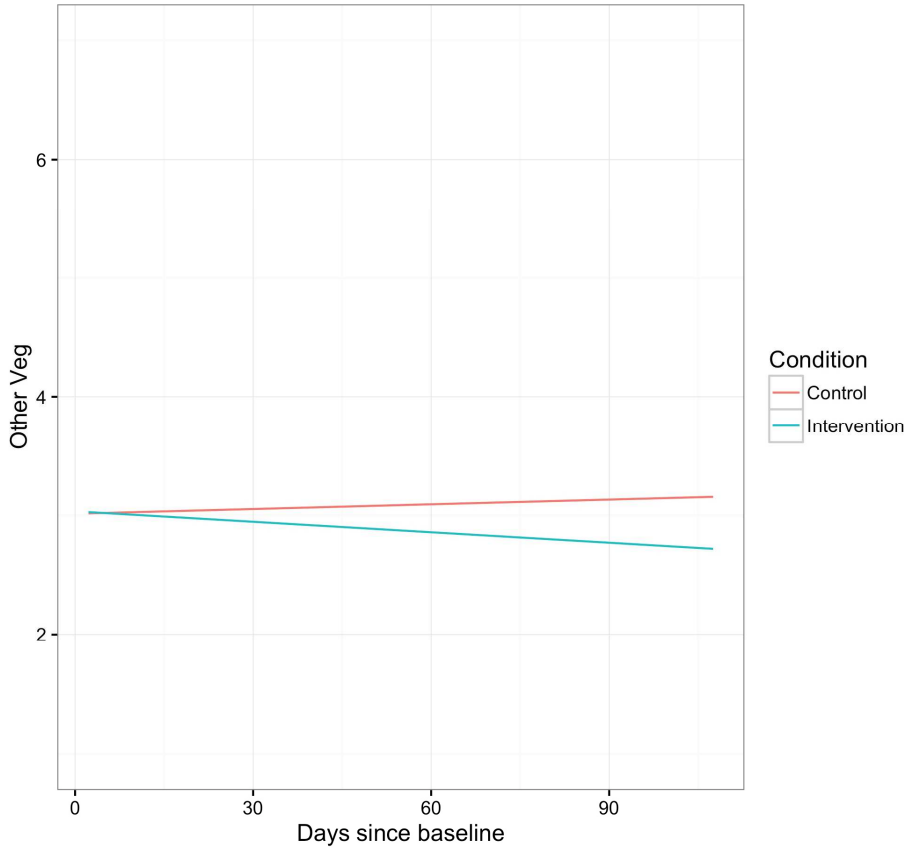

Figure 6: Consumption of other vegetables as a function of time and condition.

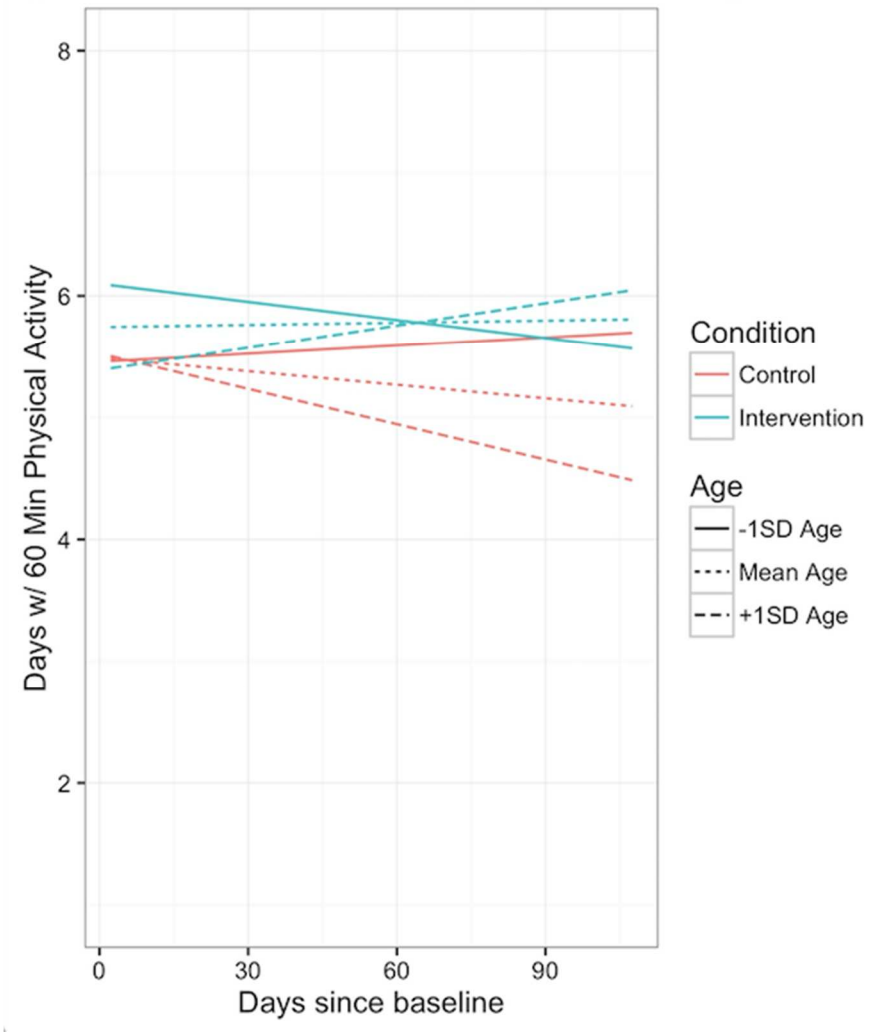

Figure 7: Physical activity among students with overweight/obesity as a function of age, condition, and days since baseline.

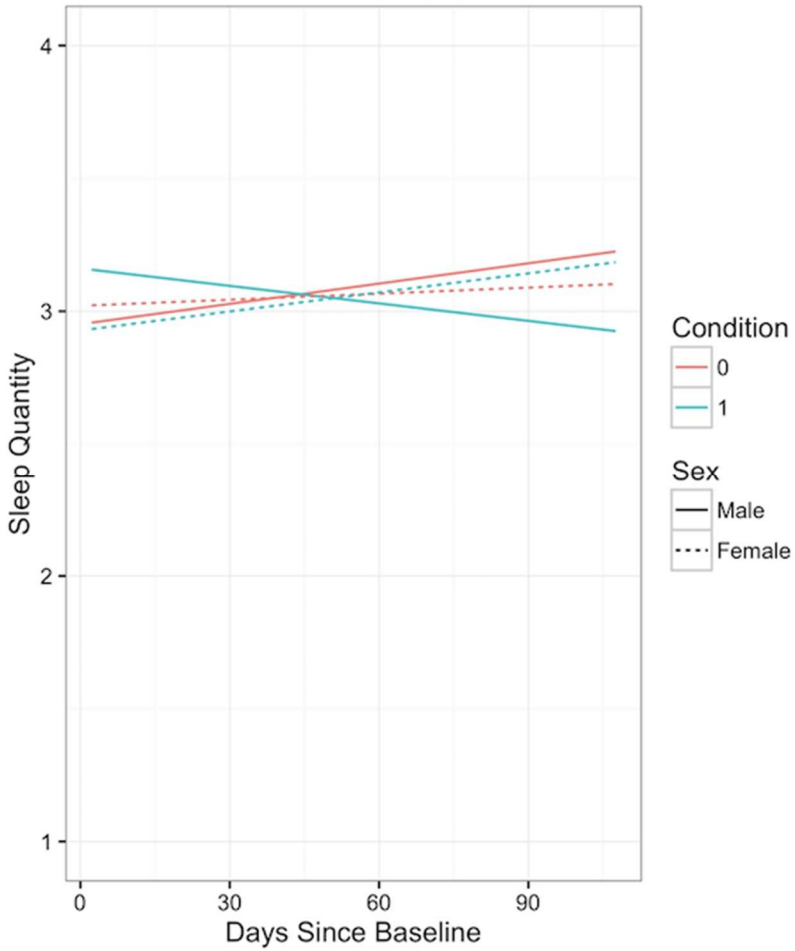

Figure 8: Sleep quantity among students with overweight/obesity as a function of sex, condition, and time since baseline.

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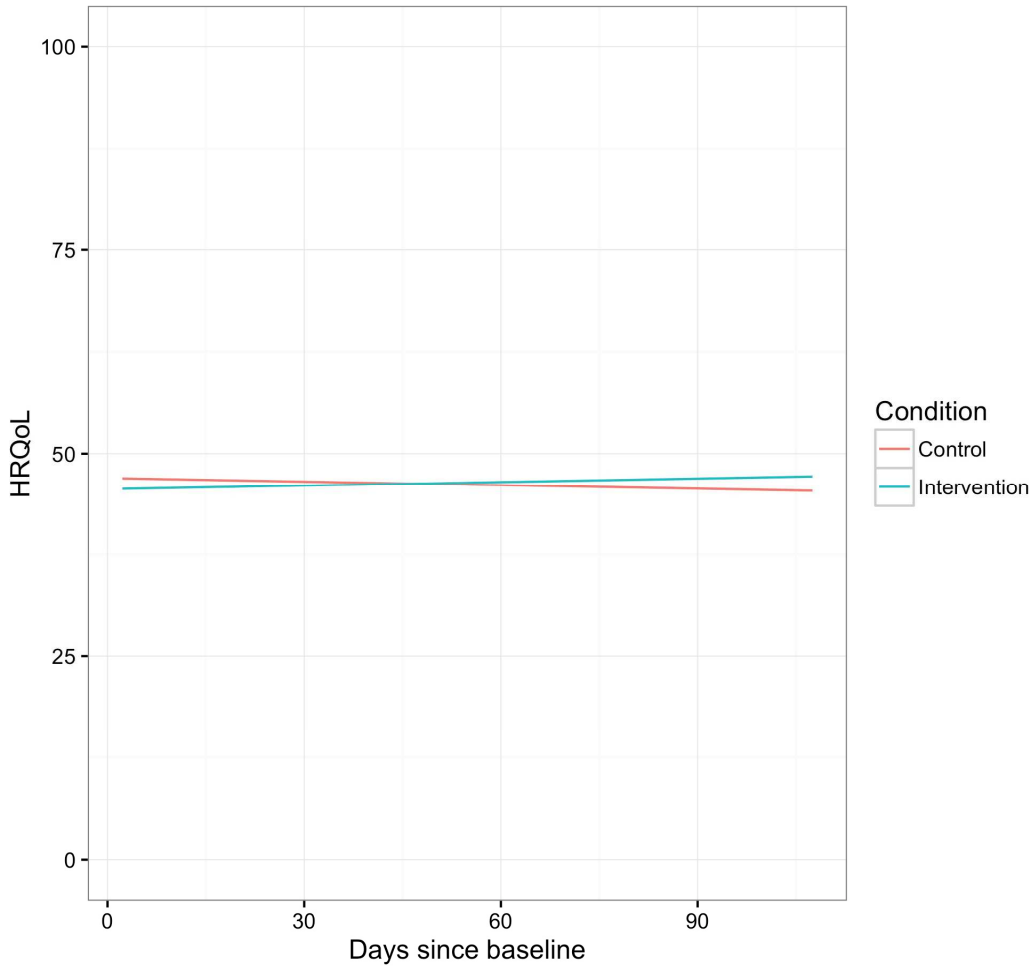

Figure 9: Health-related quality of life as a function of time and condition.