Project L.E.A.N.: An After-school Health and Exercise Project for Elementary School Children in El Paso, Texas

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PROJECT L.E.A.N.: AN AFTER-SCHOOL HEALTH AND EXERCISE PROGRAM FOR ELEMENTARY SCHOOL CHILDREN IN EL PASO, TEXAS.

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2009
PROJECT L.E.A.N.: AN AFTER-SCHOOL HEALTH AND EXERCISE PROGRAM FOR
ELEMENTARY SCHOOL CHILDREN IN EL PASO, TEXAS.

by

HENDRIK DE HEER, MS

DISSERTATION
Presented to the Faculty of the Graduate School of
The University of Texas at El Paso
in Partial Fulfillment
of the Requirements
for the Degree of
DOCTOR OF PHILOSOPHY

Department of Psychology
THE UNIVERSITY OF TEXAS AT EL PASO
May 2009
PREFACE

This dissertation project was conducted with support from the Center for Border Health Research through the Paso del Norte Health Foundation Pilot Research Grants 2008-2009 cycle in the sum of $74,542.
ACKNOWLEDGEMENTS

Project L.E.A.N. wouldn’t have been possible without the help of a large number of people. First of all, I would like to acknowledge Dr Osvaldo ‘Ozzie’ Morera for his continuous help and support over the past four years. Second, my committee members, Dr Cohn, Pederson, Crites and Cooper, who have all made significant contributions to the conceptualization, development or implementation and analysis of the current project and Penny Graves and Zenaida Olivas for their invaluable contributions. I would like to thank the Paso del Norte Health Foundation for the funding opportunity, EPISD, the school principals and the PE teachers for their cooperation and support. Especially, I would like to acknowledge Don Disney, Mary Lou Long, Coach Flores, Coach Farley, Coach Crooks, Coaches Vargas, Roldan, Castillo, Paniagua, Coaches Murillo and Guerrero, Coaches McLaughlin, Romero and Howse, Coaches Gutierrez, Acosta, Hoggan, Coaches Bohls, Macias and Candelaria, and Principals Martinez, Brezinski and Fraga, Llanos, Lachmann, Mendoza, Ferris and Stone.

The project staff including Anita Gutierrez, Laura Guillengomez, Jose Valles, Alex Gandara, Roberto Sifuentes, Ricardo Soto, Michael Perez, Fernando Barraza, Jessica Hernandez, Marina Sigala, Elisabet Galan, Yvonne Sanchez, Chad Beaven, Ned Licon, Noe Velarde, Jennifer Flores, Jennifer Campos and Graciela Medina as they were the true heart of project L.E.A.N. Thanks to the kids for your enthusiasm and willingness to participate in our project, stay healthy! I thank the Tb Photovoice project and Eva Moya for allowing me to learn many things about conducting a program. Finally, I thank my wife Brooke who has supported me through this project and put up with me through stressful times. I thank my family (especially my parents) for their unconditional support, words of wisdom and encouragement they have always provided me with.
ABSTRACT

INTRODUCTION: After-school activities provide valuable opportunities for health promotion activities that do not interfere with the regular school day, especially in minority populations with higher rates of obesity and type 2 diabetes. The current study is an evaluation of an after-school health education and physical activity program conducted in nine elementary schools in 2008 in El Paso, Texas. METHODS: The intervention consisted of a 10-12 week (twice a week) after school program consisting of a pilot (with two experimental schools) and main intervention (six schools each including a control and experimental group). The main outcome variables were Body Mass Index, aerobic capacity health knowledge and intentions to eat healthy. RESULTS: Participants \(n=1103\) were predominantly socio-economically disadvantaged Hispanic 3\textsuperscript{rd} to 5\textsuperscript{th} graders. The intervention was successful in recruitment, implementation and retention of participants (82 percent retention rate). The pilot study \(n=172\) found a significant reduction in Body Mass Index, increased aerobic capacity, but no significant increases in health knowledge and intentions to eat healthy. In the main intervention, experimental group participants \(n=323\) reduced their BMI at post test, but this reduction was not significantly larger than the control group \(n=608\). Intervention group participants significantly increased their intentions to eat healthy foods compared to control group participants, but no differences for health knowledge were found. DISCUSSION: While the findings in regards to changes in health indicators were modest, all findings were in the expected direction. The current project provides evidence for a strong need and desire to participate in projects that are accessible and address primary prevention of chronic diseases within a population that has a high prevalence of risk factors and limited access to care.
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1.1 Childhood Obesity and its consequences

Currently, an estimated two thirds of adults in the US are considered overweight (with a Body Mass Index (BMI) of over 25 kg/m$^2$) or obese (BMI > 30 kg/m$^2$) (National Center for Health Statistics, 2008), which is approximately 20 percent higher compared to rates of 25 years ago. Over the past several decades, rates of obesity and being overweight have increased sharply for children and adolescents as well (Hedley, Ogden, Johnson, Carroll, Curtin et al., 2004). In 2003-2004, according to the National Health and Nutrition Examination Survey (NHANES; NCHS, 2008) an estimated 17.4 percent of children ages 12 to 19 were considered overweight or obese. Moreover, an estimated 18.8 percent of children 6 to 11 years old were considered overweight or obese (NCHS, 2008). Further, children are becoming overweight at a younger age, as almost a quarter of pre-school children are currently overweight or at-risk for becoming overweight (Hedley, et al., 2004). Given that about 70% of overweight children continue to be overweight in adulthood (Magarey, Daniels, Boulton, & Cockington, 2003), obesity is expected to continue to be a major public health challenge.

Being overweight has been associated with genetic, cultural, and environmental factors (Crawford, Story, Wang, Ritchie, & Sabry, 2001; Deckelbaum & Williams, 2001). Given the rapid recent increase of obesity prevalence, it has been argued that lifestyle changes and environmental circumstances play a major role in the high prevalence of obesity-related diseases such as type 2 diabetes in western society (Schulz, Bennett Ravussin, Kidd, Kidd, Esparza, Valencia, 2006). Several factors have been related to the increased prevalence of overweight,
obesity and development of type 2 diabetes in recent years including being overweight (Long, O’Brien, MacDonald, Leggett-Frazier, Swanson, Pories, 1994), lack of physical activity (Mayer-Davis, D’Agostino, Karter, Haffner, Rewers, Saad et al., 1998) increased amounts of sedentary behavior (Anderson & Butcher, 2006; Paxon, Donahue, Orleans, & Grisso, 2006), increased accessibility and affordability of highly palatable, enriched foods that are high in fat and sugar (Marshall, Hoag, Shetterly, & Hamman, 1994; Paxon, Donahue, Orleans & Grisso, 2006) and low fiber diets (Salmeron, Manson, Stampfer, Colditz, Wing & Willet, 1997) as well as a reduction in access to healthy foods such as fruits and vegetables and increased amount of food consumption outside of the home.

For adults, potential consequences of obesity have included high blood pressure, high cholesterol and diabetes mellitus, an increased risk of coronary heart disease, cardiovascular disease and higher mortality rates (Calle, Thun, Petrelli, Rodriguez, & Heath, 1999). Childhood and adolescent obesity has also been associated with serious medical problems in later life, including high blood pressure, high cholesterol, development of type 2 diabetes, coronary heart disease and death from all causes (Dietz, 1998).

1.2. Obesity among Hispanic Children

The Hispanic population in the US has increased from approximately 20 million in 1990 to approximately 44.3 million in July 2006. Hispanics are the largest minority group in the US, with an annual growth rate of over 3%, compared to 1% for the rest of the US population. Hispanics are estimated to comprise over 100 million by the year 2050 (US Bureau of the Census, 2007).

A greater proportion of Hispanic children are overweight and obese compared to national averages for their respective age groups (Centers for Disease Control and Prevention (CDC),
2007). Being overweight for children ages 2-19 is defined as having a Body Mass Index of over the 85th percentile for their age and gender and being obese is defined as having a BMI of over the 95th percentile for their age and gender (NCHS, 2003). For example, according the CDC growth charts, the national average BMI for 9 year old boys is 16.1. A 9-year old boy who has a BMI between 19.1 and 21.0 is considered overweight (over the 85th percentile) and a 9-year old boy with a BMI over 21.0 is classified as obese (NCHS, 2003). Hispanic boys’ ages six to eleven years old are considered overweight at higher rates (25.6%) than any other non adult age group (CDC, 2004, data released February 2007). Hispanic girls ages 6-19 show higher prevalence of overweight (18.5%) compared to non-Hispanic White girls (12.9%), but lower overweight prevalence compared to African American girls (23.2%) (Hedley et al., 2004).

Further, recent studies reported an increasing number of low-income Mexican American children diagnosed with type 2 diabetes (Glaser & Jones, 1998; Treviño, Hale, Hernandez, & Yin, 2001; Treviño, Hernandez, Yin, Garcia & Hernandez, 2005). Also, low levels of physical activity were reported in low income Mexican American children (Hansen & Bodkin, 1993; Long et al., 1994; O’Sullivan, 1982; Treviño Pugh, Hernandez, Menchaca, Ramirez, Mendoza., 1998) and higher levels of self reported sedentary behavior in Hispanic children and adolescents compared to national averages (CDC, 2007). Of the Hispanic youth with type 2 diabetes, it was found that most were Mexican American, most were overweight, most were unaware of their disease, and all came from low-income households (Treviño et al., 2005).

1.3 Obesity prevention programs

Despite recent increases in prevalence of being overweight and development of type 2 diabetes among children, evidence for successful treatments for obesity has been limited. Even for adults, reported success rates have been small and virtually all patients regain their lost
weight (Jefferey et al., 2000). Obesity treatments for children and adolescents have yielded similar effects, though behavioral family-based interventions have resulted in longer-lasting weight loss effects (Epstein, Valoski, Wing, & McCurley, 1990; Flodmark, Ohlsson, Ryden, & Sveger, 1993). Another complicating factor in the treatment of obesity has been the fact that only about 10% of obese children and adolescents seek weight loss treatment (French, Perry, Leon, & Fulkerson, 1994).

In their meta-analysis of 64 studies aimed at reduction or prevention of overweight among children, Stice, Shaw and Marti (2006) reported that about 21% of the studies and adolescents found statistically significant reductions in Body Mass Index. This success rate was comparable to effects found for HIV programs, where 22% of programs successfully increased condom use (Logan, Cole, & Leukefeld, 2002). Similarly, 25% of programs aimed at eating disorders were successful in reducing current and future eating pathology (Stice & Shaw, 2004). Programs aimed at quitting smoking, have reported a much higher rate (60%) of significant intervention effects (Skara & Sussman, 2003). Further, the mean weighted effect size for obesity prevention programs ($r = .04$) (Stice, Shaw & Marti, 2006) has been found to be similar to the effect sizes observed for prevention programs for other public health problems, such as smoking cessation programs ($r = .07$; Hwang, Yeagley, & Petosa, 2004), reported substance abuse ($r = .05$; Tobler, Roona, Ochshorn, Marshall, Streke, & Stackpole, 2000), HIV programs aimed at increasing condom use ($r = .05$; Logan et al., 2002), and eating disorder programs aimed at reducing current and future eating pathology ($r = .12$; Stice & Shaw, 2004).

1.4 Components of obesity prevention and intervention programs

Stice, Shaw and Marti (2006) reported that childhood obesity prevention programs have consisted of: 1) multifocal cardiovascular disease prevention programs targeting obesity along
with other CVD risk factors (e.g., hypertension and smoking); 2) prevention programs focusing on the prevention of obesity or weight gain; 3) interventions designed to solely increase physical activity; and 4) eating disorder prevention programs that promoted use of healthy weight-management skills. Stice et al. (2006) evaluated several important moderating variables (including type of program) and their association with treatment effects. Potential influential variables for obesity and overweight prevention programs related to program efficiency include a) participant features, b) intervention features, c) delivery features and d) design features. These influential variables are discussed below as they played a role in the design of the current study.

1.4.1. Participant features

1.4.1.1. Participant Ethnicity: The Hispanic population

Given the elevated rates of obesity compared to other ethnicities, interventions specifically targeting Hispanics (or other at-risk minorities) would be expected to show larger effect sizes as there is a greater opportunity to show an effect (Kimm, Barton, Obarzanek, McMahon, Sabry, Waclawiw et al., 2001). On the other hand, there is some evidence that being overweight and obese are more accepted in the Hispanic (and African American) culture and that less body dissatisfaction may influence effects of obesity prevention and intervention programs (e.g. Cash & Fleming, 2002a). However, Stice et al. (2006) found that participant ethnicity was not a significant predictor of program efficiency. However, caution may be warranted when interpreting this finding as only a very small number of studies in the meta-analysis included Hispanic participants.
1.4.1.2. At-risk populations

In behavioral medicine research, a variety of intervention programs aimed at high risk populations have been evaluated in terms of effectiveness. These programs were targeted at a range of health behaviors. Stronger effects for at-risk populations compared to populations not considered at risk have been found for programs aimed at reducing eating pathology (Killen, Taylor, Hammer, Litt, Wilson, Rich, et al. 1993), depression (Clarke, Hawkins, Murphy, Sheeber, Lewinsohn & Seeley, 1995), anxiety (Lowry-Webster, Barrett, & Dadds, 2001), behavior problems (Stoolmiller, Eddy & Reid, 2000), and substance abuse (Murphy, Duchnick, Vuchinich, Davison, Karg, Olson et al., 2001). However, reviews including multiple studies have argued that additional research is needed to determine whether these programs are more effective (Gottfredson & Wilson, 2003). From the obesity prevention field, interventions have been implemented with a variety of individuals at increased risk for future weight gain including Black and Hispanic individuals, students with CVD risk factors (e.g., hypertension) and overweight or obese individuals. While one review (not employing meta-analytic techniques) comparing targeted and universal obesity prevention programs concluded that selected interventions may be more effective in reducing obesity (Resnicow, 1993), the meta-analysis by Stice et al. (2006) did not find a significant effect for at-risk status of sample.

1.4.1.3. Participant Age

Since Hispanic boys’ ages 6-11 are overweight at higher rates than any other non-adult age group (CDC, 2007), interventions aimed at this age group may be important. In terms of effectiveness, previous research has reported that obesity prevention programs aimed at both adolescents and pre-adolescents are more effective compared to children (Stice et al., 2006) Substance abuse programs aimed at middle aged school youth have been found to be more
effective than programs aimed at elementary school children (Gottfredson & Wilson, 2003). Explanations for these findings may be that for younger children, program components like educational modules may be more challenging. In addition, the main outcome variable (BMI) may be more likely to be variable due to natural development. Stice et al. (2006) actually found that programs conducted with children were slightly more effective than programs aimed at adolescents.

1.4.2. Intervention features

1.4.2.1. Duration of treatment and length of follow up

A previously published meta-analysis of prevention programs for eating disorders suggested that longer duration interventions produced larger effects than very brief interventions (Stice & Shaw, 2004). However, from the substance abuse literature, Gottfredson and Wilson (2003) argued that ‘longer is not necessarily better.’ They argued that there was no difference in effect size between interventions that were relatively brief (less than 4.5 months) as compared to those programs that were longer. Further, Stice et al. (2006) found that brief programs (less than 4 months) targeted at obesity and overweight prevention had larger effect sizes compared to longer programs. Stice et al. (2006) hypothesized that this finding may be related to strength of delivery (see Tobler, 2000), where newer programs may elicit more enthusiasm and dedication by those involved. This was also supported by the finding by Stice et al. (2006) that pilot studies were found to have larger effect sizes as compared to larger intervention programs. Stice et al. (2006) concluded that there was no relation between length of follow up and magnitude of effect size. It has to be noted that the average follow up time in their meta-analytic review of 64 studies was only approximately 2 months.
1.4.2.2. Number of behavioral targets

Deciding which behavioral targets to focus on is an essential feature of any intervention program. On the one hand, focusing on multiple target behaviors and developing a multifaceted approach toward behavior change is appealing. For example, targeting obesity by attempting to increase health knowledge, physical activity, parent involvement, the school cafeteria and school based education may be expected to elicit the largest changes. However, evidence evaluating comprehensive programs comprised of multiple components including nutrition education, parental involvement, cafeteria involvement and physical activity such as the Coordinated Approach To Children’s Health (CATCH) do not support the notice of effectiveness of such multifaceted programs in terms of changing BMI (Resnicow & Robinson, 1997). The comprehensive CATCH program did show positive changes in terms of self-reported nutrition intake (Resnicow & Robinson, 1997). In addition, Stice et al. (2006) concluded that programs focused on a smaller number of behavioral targets elicited larger effect sizes compared to multifaceted approaches.

1.4.2.3. Parental involvement

As the family is largely expected to determine a child’s dietary intake and strongly influence their activity pattern, it has previously been hypothesized that parental involvement may be major and necessary component of obesity prevention programs (Story, 1999). For example, the CATCH comprehensive health program included a parental involvement component. However, while there is some preliminary evidence that obesity treatment programs may be more effective when at least one parent is involved (Golan, Weizman, Apter, & Fainaru,
1998), Stice et al. (2006) did not find parental involvement to be a significant predictor of obesity treatment efficiency in terms of BMI reduction.

1.4.2.4. Teachers

Prior studies have also proposed that intervention programs may be more effective when taught by trained interventionists compared to elementary or middle school teachers (Baranowski, Cullen, Nicklas, Thompson & Baranowski, 2002). Reasons for this are hypothesized to be related to the schedule of a classroom teacher, which is already busy and focused on a different priority: academic success. However, this hypothesized effect may depend largely on the amount of training and skills of the interventionists conducting the programs. Stice et al. (2006) did not find a significant effect for ‘teacher.’ In other words: whether the intervention was conducted by a teacher or by an ‘interventionist’ was not significantly related to effect size in terms of BMI change.

1.4.2.5. Physical Activity and Sedentary Behavior

The energy balance model stipulates that if energy intake is lower than energy used, BMI is likely to be reduced. Thus, increased physical activity is expected to be associated with weight loss and decreased risk for future weight gain (Wadden, Vogt, Foster, & Anderson, 1998). Therefore, most obesity prevention programs either recommend or include some kind of physical activity component. An extension of the increased activity concept is that a reduction in amount of sedentary behavior (such as TV viewing, internet usage or playing video games) would be related to an increase in activity and thus to a reduction of weight gain. Baranowski et al., (2002) indicated that programs focused on reducing sedentary behavior were more effective.
Stice et al. (2006) compared obesity prevention programs that included a physical activity component to programs that did not and programs that incorporated a component focused on reducing sedentary behavior and programs that did not. They found that while inclusion of a physical activity component was not associated with larger effect sizes, programs aimed at reducing sedentary behavior were. Stice et al. (2006) recommended future studies to address this paradox.

1.4.2.6. Dietary Improvements

Changes in dietary intake have been proposed as a major cause of the increased rates of obesity and being overweight among children as their diet consists of too many fatty foods and reduced amounts of fruits and vegetables (Ludwig, Peterson, & Gortmaker, 2001). In addition to physical activity, a reduction in fat and sugar intake and an increase in fruit and vegetable intake has been associated with a decreased risk for future weight gain (Epstein, Gordy, Raynorm, Beddome, M., Kilanowski & Paluch, 2001). Stice et al. (2006) compared programs that directly manipulated dietary change as part of the intervention and those that did not, where the most common programs consisted of interventions that directly changed the nutritional content of school lunches (e.g., Donnelly, Jacobsen, Whatley, Hill, Swift, Cherrington et al., 1996; Luepker, Perry, McKinlay, Nader, Parcel, Stone, et al., 1996). They did not find an effect for direct manipulation of the diet, and Stice et al. (2006) hypothesize that in the programs that mandate dietary changes, overcompensation may occur outside of the class time.
1.4.3. Delivery and design features

1.4.3.1. Pilot Studies

Stice et al. (2006) argued that effect sizes for pilot studies were often larger than for intervention trials, possibly due to less scientific rigor or increased strength of implementation of the new program. However, these effects may be moderated by selection of participants (more often in a pilot trial, participants are self selected) and the fact that pilot studies generally focus on fewer behavioral targets (which has been positively associated with outcomes).

1.4.3.2. Random Assignment and recruitment method

In order to reduce for random error variance, random assignment of participants is expected to produce larger effect sizes. Stice et al. (2006) found that there was no significant effect for random assignment to condition, but a strong effect for self selection. Participants that actively self selected in the intervention showed stronger effects, as compared to participants recruited into universal programs.

1.4.3.3. Interactive vs. didactive delivery

Interactive programs are programs that emphasize interaction with the instructor and among the participants, which is hypothesized to engage participants in the material to a greater extent compared to programs that employ more traditional lecture methods. In the substance abuse prevention literature, interactive programs have shown much larger effect sizes compared to non-interactive programs with regard to prevalence reduction rates (Tobler, 2000), a finding confirmed from the eating disorder literature (Stice & Shaw, 2004). Stice et al. (2006), however, did not find interactive obesity prevention programs to have significantly larger effect sizes compared to solely didactive obesity prevention programs. Also, in substance abuse prevention
programs, Gottfredson and Wilson (2003) concluded that there was no influence of role of the person delivering the intervention on effect sizes. However, while Gottfredson and Wilson (2003) stated that inclusion of a peer involvement component was related to larger effect sizes, a meta-analysis by Tobler (1997) did not find this effect.

1.4.4. Summary

In sum, programs that are relatively brief, targeted at a limited number of health behavior components, targeted at high risk adolescents and which are interactive in nature appear to be most effective. Furthermore, programs where participants are young (children), where they are self selected into the intervention and which are pilot tested may show larger effects. Finally, family involvement (Stice et al., 2006), the role of the individual delivering the intervention and length of follow up appear not to be related to strength of effect, whereas influence of Hispanic ethnicity, and inclusion of a physical activity component remain debatable. Using these findings, the objective of the current project was to develop an after-school health education and physical activity program that was experimentally sound and based on prior research.

1.5 Prior Research involving Hispanics

Only two studies in the meta-analysis of 64 studies addressing childhood obesity programs by Stice et al. (2006) included at least 50% Hispanic children. The first study was conducted by Nader, Sallis, Abramson, Broyles, Patterson and Senn (1992) and included 208 Mexican American and non- Hispanic white families. The Nader et al. (1992) study involved an interactive family intervention that included mandated increases in physical activity and a psychoeducational component aimed at promoting a healthy diet. The main dependent variables in the study were BMI, blood pressure, cholesterol, diet and physical activity. While the
intervention produced dietary changes, these were found especially in Anglo-Americans and were maintained for 1 yr after the intervention. No changes on BMI were found. In addition, Nader et al. (1992) reported that intervention effects on reported behaviors and physiological measures tended to disappear by 48 months and that the intervention was less effective in changing physical activity and fitness for Mexican American families.

The second study included in the meta-analysis was an unpublished manuscript by Matheson, Robinson and Killen (2005) of 61 Mexican American boys and girls. The intervention consisted of an interactive psycho-educational program with parental component designed to improve health and prevent obesity. The main dependent variable was BMI, but no changes in BMI were found.

1.5.1. The Bienestar curriculum

Several studies have been aimed at modification of risk factors for underserved Hispanic populations. Treviño et al. (1998) developed the Bienestar (‘well-being’) health program in an effort to develop a culturally tailored health promotion program in response to the increasing numbers of low-income Mexican American children at-risk for type 2 diabetes (Glaser & Jones, 1998; Hale & Danney, 1998; Neufel, Raffel, Landon, Chen, & Vadheim, 1998). The program consists of several components, including a health education component, an after-school component, a parent involvement component and a school cafeteria program (Treviño et al., 1998). These components are analogous to other comprehensive health programs (e.g. CATCH). Unlike other programs, the Bienestar program is bilingual (English and Spanish) and certain activities are culturally tailored toward the Mexican American culture.

Treviño, Marshall, Hernandez and Ramirez (2001) have found that the Bienestar program has had positive effects in terms of reducing dietary fat intake and increasing fiber intake.
Treviño et al., (1998) also found that participation in the program for an eight month period resulted in change in body composition as measured by BMI and in increased physical fitness as measured by the modified Harvard step test (Keen & Sloan, 1958), where a child’s heart rate is measured during and after a physical activity test where the participant steps on and off a box continuously for three minutes.

Of further value to the current project, the Bienestar curriculum was implemented in several school districts with a very similar demographic constitution as the area (El Paso, Texas) of the current project. The mean income of their participants was low, the percentage of Hispanic participants was very high and the age of students was in the range of the age of interest for the current project (mean age was 9.75 years). Moreover, the recruitment and retention rates were high (over 560 students across nine schools in Treviño et al., 2005 with a retention rate of 78%) and while their analyses ignored the nested structure of the data, the mean BMI of control students increased by 0.82 kg/m$^2$ (from 19.18 to 19.90 kg/m$^2$) over an 8 month period, whereas the mean BMI of intervention group participants decreased by 0.31 kg/m$^2$ (from 19.23 to 18.92 kg/m$^2$).

1.5.2. The ‘CATCH Kids Club’: an After-School Program

Another study that included a large percentage of Hispanic students, but that did not measure Body Mass Index (and was therefore not included in the meta-analysis by Stice et al.(2006) was a study by Kelder, Hoelscher, Barroso, Walker, Cribb and Hu (2005). They conducted a study in 16 elementary schools in San Antonio, Texas and El Paso, Texas based on the Coordinated Approach to Children’s Health (CATCH) program. The study consisted of a 6 month long health education and physical activity program that incorporated materials from the CATCH curriculum. The study found that children in experimental schools spent more time
doing moderate to vigorous physical activity (MVPA) as compared to children in control schools. In addition, the study found self-reported dietary intake increases in consumption of fruits, fruit juice, vegetables, beans and a reduction in sweets consumption. Even though sample sizes were very small and not all differences between experimental and control group participants were statistically significant, effect sizes were at least equal to Cohen’s $d$ of 0.55 (Kelder et al., 2005). In addition, an increase in nutrition knowledge ($d=1.01$), health knowledge (Cohen’s $d=1.95$) and reduction of TV viewing (Cohen’s $d=-0.87$) were found, but also an increase in amount of videogames played during the week (Cohen’s $d=0.83$) and during the week (Cohen’s $d=0.29$).

Limitations of the study included that the sample sizes in the El Paso schools were very small (approximately ten children per location) and attrition rates were almost 40%. Further, the study did not incorporate any physical fitness measurement. In order to assess whether the self-reported nutrition intake and increased observed activity actually led to increased physical fitness, assessment of physical fitness would have been necessary. No outcome measures of body composition such as Body Mass Index or other indicators of physical fitness were included to validate the findings of the self-reports.

A promising feature of the study by Kelder et al. (2005) was that the program was conducted in an after-school setting. Due to increased pressure to perform well on academics and standardized examinations, school districts are reluctant to release class time for health promotion-related activities (Kelder, Mitchell, McKenzie, Derby, Strikmiller & Luepker, 2003; Parcel, Perry, Kelder, Elder, Mitchell, Lytle et al., 2003) and after-school activities are a potentially valuable alternative for health promotion activities without taking class time away from an already busy school day. The pressure to increase performance on standardized
examinations may even be higher in border areas, where limited English proficiency is higher, and the average socio-economic status of students is lower than national and state averages.

### 1.6 The Current Study

Even though the study by Kelder et al. (2005) demonstrated some success in terms of self-reported nutrition intake and observed physical activity intensity, it has not led to structural implementation of an after school health and exercise program in El Paso Independent School District (EPISD) or any other school district in El Paso.\(^1\)

At the time of the study, there were no other after-school physical activity and/or health education programs available for children in elementary schools in El Paso, nor was there additional knowledge available regarding other programs conducted in an after-school setting that involved a large population of Hispanic children.

Thus, despite the fact that Hispanics are the fastest growing minority in the United States, little is known about structural, accessible and inexpensive obesity prevention programs for children and adolescents (or adults) in this population. Given the high rates of poverty and the general lack of access to health care along the United States/Mexico border (US Mexico Border Health Commission, 2003), the Healthy Border 2010 report stipulated that it is important to focus on primary prevention strategies through pragmatic, culturally relevant interventions along the U.S./Mexico Border. The current study proposes to incorporate recommendations from the literature outlined above into the design of the current study, with the purpose of developing an accessible and inexpensive obesity prevention program for children conducted in an after-school setting.

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\(^1\) Based on email reply by Dr Kelder, contact with Donald Disney of EPISD and Norma Aros from program CATCH
1.6.1. Study Overview

The current study reports the findings of a project that extends the prior research by Kelder et al. (2005) and Treviño et al. (1998; 2005) and takes into account the recommendations from Stice et al. (2006). The current project is a randomized trial that proposes to evaluate the efficiency and feasibility of a 10-12 week after school program that implements exercise sessions based on the Coordinated Approach to Children’s Health (CATCH) physical exercise program taught by student teachers from the UTEP PETE program (see Heath & Coleman, 2003) and health education modules of the Bienestar program taught by Community Health Workers (Treviño et al., 2005).

The current study was conducted in two phases. The first phase consisted of a pilot-test, where 160 third to fifth graders were recruited from 2 elementary schools (Mesita Elementary and Aoy Elementary). Following the pilot testing, a total of 931 third to fifth graders (608 control and 323 experimental) were recruited from seven elementary schools in EPISD (six of which also included control group participants). The experimental group participants were offered an after school program consisting of health and exercise classes and control participants received an informational packet. Children were recruited with each school’s principal’s affidavit, as well as parental consent and children’s assent.

The main outcome variables in the project were the After School Student Questionnaire (Kelder et al., 2005) to assess self-reported dietary intake and sedentary behavior as well as BMI and several other indicators of physical fitness (aerobic capacity and muscular strength) measured by the FitnessGram® protocol described in more detail below.

Following the recommendations by Stice et al. (2006), the program was relatively brief, was interactive, did not include a family component and was targeted at a group of students that
is at high risk for development of type 2 diabetes. Furthermore, to assess the impact of a pilot study as compared to a main intervention, a pilot study was included in the design. Finally, while Stice et al. (2006) recommended focusing on a limited number of behavioral targets, the current study focused on both physical fitness and dietary intake.

1.6.2. Study Objectives

1. Develop an after school exercise and health program for elementary school children (ages 8-12) that emphasizes moderate to vigorous activity and nutrition knowledge.

2. Assess program effectiveness by the incorporation of clinical measures adapted from the FitnessGram® program (Body Mass Index, aerobic capacity, muscular strength, and flexibility), while controlling selected demographics (age, sex, grade level) and school level variables.

3. Build on the findings of the previous pilot study by Kelder et al., (2005) regarding the self-reported nutrition intake (the After School Student Questionnaire measures (ASSQ-Appendix 1) with a larger sample size as the Kelder et al., (2005) study was underpowered.

4. Initiate the building of an infrastructure for structural implementation by testing an after-school program within the largest school district in El Paso (El Paso Independent School District) and cooperation with the University of Texas at El Paso’s student teacher (PETE) program. An overarching goal of the current dissertation is was to evaluate effectiveness of Community Health Workers in collaboration with Student teachers, in achieving the first three stated objectives.
1.6.3. Hypotheses

1) By the 4 month post-test, experimental group participants will have significantly increased their aerobic capacity as measured by the number of laps ran in the PACER test.

2) By the 4 month post-test, experimental group participants will have significantly reduced their Body Mass Index (BMI) compared to control group participants.

3) By the 4 month post-test, experimental group participants will have significantly increased nutrition knowledge as measured by the After School Student Questionnaire (ASSQ) compared to control group participants. Health knowledge was defined as the ability to choose the healthier of two options presented.

4) By the 4 month post-test, experimental group participants will have significantly increased their intentions to eat healthy as measured by the After School Student Questionnaire (ASSQ) compared to control group participants. Intentions to eat healthy food are defined as the willingness to choose the healthier of two options presented.

CHAPTER 2: METHODS

2.1 Study Setting

About two thirds of Hispanics in the U.S. identify themselves to be of Mexican descent (US Bureau of the Census, 2007) and most Hispanics live in Border States. With a combined population of over 2.5 million, the El Paso-Ciudad Juarez area is one of two major metropolitan areas (the other being San Diego- Tijuana) along the U.S.-Mexico border. According to the 2005 Behavioral Risk Factor Survey (CBHR, 2005), the major health problems reported in the El Paso area were overweight and obesity. Further, the El Paso area is characterized by a high number of
uninsured individuals as 46.2% of Hispanics report not having any health insurance (CHBR, 2005). In El Paso, diabetes mortality rates are more than 50% higher than state and national averages (Texas Department of State Health Services, 2006).

However, despite their financially disadvantaged position and limited access to care, the Hispanic population in the border area shows comparable CVD mortality rates to national averages (labeled the ‘Hispanic Paradox’) (Sorlie, Backlund, Johnson, & Rogot, 1993). However, recent epidemiological reports suggest that the mortality rates due cardiovascular disease (CVD) for Hispanic populations is equal, and in some instances, greater as compared to non-Hispanic whites in Texas (Goff, Nichaman, Chan, Ramsey, Labarthe & Ortiz, 1997; Pandey, Labarthe, Goff, Chan & Nichaman, 2001).

2.1.1. EPISD characteristics

With 92 campuses (11 high school, 15 middle school and 56 elementary schools) and expanding rapidly, the El Paso Independent School District (EPISD) is the seventh largest school district in the state of Texas. The school district serves over 62,000 students, encompasses 253 square miles and has an annual operating budget of $446 million. While the school district has access to substantial resources, the resources of the population it serves are limited as 62.0% could be classified as economically underserved in 2008. In other words, there is a great need for accessible and affordable programs. Similar to the population of El Paso, 81.2% of students in El Paso Independent School District was identified to be of Hispanic descent in 2008 (EPISD, 2008).
2.2 Study Design

The study consisted of a pilot study and a main intervention portion. A pilot study was conducted at two schools in the spring of 2008 to assess the feasibility of the project. The study design of the main intervention is presented in Figure 1. As graphically indicated, the main intervention included intervention and control participants within the same school. This design preference was chosen over having separate control and participant schools.\textsuperscript{2} Aside from practical advantages, a consequence of this design feature is that the effect of the intervention can be assessed with a reduction in random error. When control group participants and experimental group participants are in different schools, assessment of the intervention effect is confounded with between school differences. This random error can, in part, be eliminated by having control and experimental group participants in each school. The disadvantage of this approach, is the potential diffusion of the intervention, which could lead to bias in the treatment effect. If these threats to internal validity are not necessarily present, then this should be the preferred design. It was judged that for the current study, given the setting of the intervention after regular school time, treatment diffusion was less likely to occur.

2.3 Participants

2.3.1. Pilot Study

Total enrollment in the pilot study exceeded initial estimates of $n=80$ as actual enrollment was $n=172$. The schools enrolled in the pilot study were of somewhat different demographic makeup. In school 1 (see Table 1) 97.7\% of students was of lower socio-economic status, 87.5\% of students were of limited English proficiency and 99.3\% of students were of Hispanic descent.

\textsuperscript{2} Personal Communication with Dr Stephen Raudenbush, April 2008
In school 2 on the other hand, only about half (53.2%) of students were of disadvantaged socio-economic background, only 34.8% of students had limited English proficiency and 78.0% were of Hispanic descent.

Two different recruitment methods were tried out during the pilot intervention. In School 1, the intervention was opened to everyone from 2nd to 5th grade (as urged by the participating PE teachers), which resulted in a sample of 131 students. In School 2, children who did not perform well on the school’s physical fitness assessment the semester before were given an informed consent form by the PE teacher, which resulted in recruitment of 41 children.

2.3.1. Recruitment and characteristics of Schools

Schools were recruited by the author of this manuscript, by approaching the front office of each school in an attempt to set up a meeting with either the principal or the PE teachers. Multiple visits were required with each school before the principal and the PE teachers agreed to adapt the program and the required paperwork for the school districts was completed. The pilot schools were recruited through a contact (the PE teacher and nurse) within each school. Two of the main intervention schools had implemented a prior after-school tennis program with the University of Texas at El Paso (UTEP) Physical Education Teacher Education (PETE) program. A total of nine schools were approached before six schools were confirmed for participation and the principal gave his/her affidavit.

The demographic characteristics of the schools selected for participation in the program are very similar to those of the school district: about two thirds of the children can be classified as financially underserved, and about 80% are of Hispanic descent. However, there is significant variability between schools in terms of demographic characteristics. Specifically, schools number two (pilot), seven and eight were all much higher in socio-economic status compared to
the other schools (% SES indicating the percent that were financially underserved). These same schools (one, seven and eight) were much lower in percent of students with limited English proficiency and somewhat lower in percent students of Hispanic background (even though school five was also a bit lower).

2.3.2. Recruitment of Participants

Participants for the study included 3rd, 4th and 5th graders recruited with parental consent (Spanish and English consent forms were reduced to 8th grade reading level according to Flesch-Kincaid statistics) and children’s assent from six elementary schools in the El Paso Independent School District. Recruitment was initiated during PE classes, as were baseline measurements. All children also completed an assent form that was reduced to 3rd grade Flesch-Kincaid reading level. Interest for the intervention by those that were invited was large, especially at the schools that were low in socio-economic status. Enrollment characteristics by school are described in Table 2. The number of students allowed was limited to approximately 55, which generally meant that about 40 children were present at the after-school program. As can be seen in Table 2, every school was at the maximum number of students allowed, except for the two schools with the highest socio-economic status (schools seven and eight).

At each school, two classrooms at third grade, fourth grade and fifth grade were randomly invited to take part in the intervention. If the number of recruited participants was still low after the first week, additional classrooms were subsequently invited until the number of 40 children in the intervention was approached.

Even if children that were invited did not take part in the intervention, they were still provided with a consent form for the control group. Thus, children that were invited to the intervention, but did not participate could still be control group participants. To facilitate
returning of consent forms for control participants, a raffle ticket was given to each child that brought back their consent form (regardless whether their parent agreed or did not agree their child to participate in our measurements or not). These recruitment methods proved to be successful as about half of all 3rd to 5th graders in the six schools completed both the pre and post test measurements of our project, which resulted in a total sample size of 931.

2.4. Procedures

2.4.1. Teachers

Stice et al. (2006) mentioned that magnitude of intervention effects did not appear to be influenced by whether classroom teachers or trained interventionists taught the intervention. Given the limited effect of knowledge about teacher efficiency in weight reduction programs, the current study decided to attempt to build a combination of teachers that would provide a mixture of appropriate skills and community contact. Community health workers have worked in a variety of health settings under a variety of job titles and have recently been recognized as their own job category for the 2010 census. They work within the community they come from and thus can function as a valuable link between the community, intervention personnel and the research team. Health education is an area where several clinics in El Paso (e.g. Clinica San Vicente) currently employ community health workers. Thus, community health workers were hired to teach the Bienestar health education curriculum of the intervention.

Second, the UTEP Physical Education Teacher Education (PETE) program trains kinesiology and education teachers to become certified Physical Education teachers. Senior level student teachers are generally well educated and skilled in teaching Physical Education, as they have already completed a part of their required internship and/or observation hours at several elementary, middle or high schools. The current program offered another opportunity for them to
gain experience in teaching PE in an after-school setting. Because teaching PE was their career choice, the student teachers were expected to be motivated and were paid a small stipend for their work. A total of four student teachers were hired for the pilot study, and 11 more were hired for the main intervention portion of the study. Given the extremely high volunteer turnover rates reported in the Kelder et al. (2005) study, it was decided to pay the student teachers a small stipend to ensure proper program implementation and increase safety for the children.

Additional requirements included that at all times a bilingual student teacher had to be present at a school, all teachers’ backgrounds were checked by both UTEP and EPISD, one person had to have current CPR certification and all students were required to have currently valid first aid certification. To further ensure safety, at all times three people (two student teachers, one community health worker) were present at an after-school session. This resulted in a maximum participant to teacher ratio of about 1:15 (1 teacher for every 15 children).

Following recommended amount of training by Kelder et al. (2005), community health workers and student teachers were trained for a minimum of two four-hour training sessions. One session covered the physical activity component based on the CATCH (Coordinated Approach to Children’s Health) Physical Activity program and the second session covered the Bienestar health component.

2.4.2. Description of experimental Condition

The intervention group was measured at pre test and post test on the following dependent variables: Body Mass Index (BMI), aerobic capacity (the PACER test, see Welk & Blair, 1991), and the After-school Student Questionnaire (ASSQ; Kelder et al., 2005), which was intended to measure health knowledge, intentions to eat healthy food, self reported previous day food intake and self reported sedentary behavior. The intervention group was offered a 10 week, twice a
week after-school sessions that included a health component and a physical activity component. During the 10 weeks, sessions took place between 3:15 p.m. and 4:30 p.m. and each session consisted of a 20 minute health education component from the Bienestar health workbook, followed by 45 minutes of activities based on the CATCH program. The total number of sessions conducted at each school equaled 20. Treviño et al. (2005) recommended a 16 lesson plan for covering the nutrition, physical activity, self image and diabetes modules of the Bienestar lesson plan. They estimated each lesson to take approximately 20 minutes to complete. To ensure coverage of the entire curriculum, 20 sessions were available to cover the 16 lessons. Every second week, children received a small incentives for their continued participation (e.g. a small football, a notebook, a pen, a jump rope etc.).

2.4.3. Description of Control Condition

All control children were assessed through completion of the same dependent variables at baseline and at 4 months: BMI, aerobic capacity and the ASSQ (Kelder et al., 2005) and provided with the same incentive package the intervention participants receive at the start and at the end of the intervention. After 12 weeks (2 weeks after program conclusion), the children were measured again by the same measurement protocol and were provided with a small incentive for their participation.

2.5 Materials

2.5.1. CATCH Physical Activity Curriculum

The physical activity component of the after-school program was based on the CATCH physical activity curriculum. According to Kelder et al. (2005), the CATCH PE program used in the CATCH Kids Club study had four main objectives:
1. Involvement of students in at least 30 min of daily physical activity;

2. Involvement of students in MVPA for at least 40% of daily physical activity time;

3. Providing students with many opportunities to participate and practice skills in physical activities that could be carried over into other times of the day and maintained later in life;

4. Providing students with a variety of enjoyable physical activities.

The physical activities chosen were chosen before the pilot study in collaboration with the student teachers. Through their training in the UTEP PETE program, all students had been exposed to the CATCH PE box with hundreds of 6x 8 inch cards. In addition, the schools also implemented the CATCH program at the time of the study, which increased the likelihood of the children being familiar with the games that were selected by the student teachers. As the overall objectives of the study were related to reduction in BMI and an increase in aerobic capacity, greater emphasis was placed on cardiovascular activity and aerobic recreation games. However, student teachers were free to repeat a certain activity if the students reacted well to it. Student teachers were told to focus on engaging the children in a large amount of Moderate to Vigorous Physical Activity and to leave nobody out of the games.

2.5.2. Bienestar Health Education Curriculum

The Bienestar Health Program is based on Social Cognitive Theory (Bandura, 1986). Treviño et al. (1998) indicates that the idea behind the program is that personality characteristics such as health beliefs, intentions to eat healthy and health knowledge, dynamically interact with other determinants of health including social factors (health behaviors at home, at school, after-school care, and the school cafeteria), and behavior (dietary fat intake, dietary fiber intake, and physical activity). The Bienestar program was designed to influence personality characteristics,
social factors, and behaviors with the aim of decreasing dietary fat, increase dietary fiber consumption and promote participation in moderate to vigorous physical activities. Program activities were bilingual and consisted of a parent education and involvement program, a classroom health and physical education curriculum, a student after-school health club, and a school cafeteria program. For the current program, only the health education curriculum was adapted, which consists of a 12-16 lessons plan incorporating health modules, such as ‘eating fruits and vegetables,’ ‘reading food labels’ and ‘what is diabetes.’ Every child received a colorful bilingual health education workbook covering these modules. Each health education lesson was structured with two parts: the first part consisted of one or a few pages of explanations of a new concept, followed by an exercise such as a puzzle where children had to use the knowledge they just gained to complete the exercise.

For the current project, the 4th grade health education materials were chosen. A teacher’s guide accompanied the materials, which provided the teacher with additional information on the topic and possible questions to ask the children to stimulate thought and discussion about their health habits.

2.6 Measures

Measurements were obtained at baseline and at 4 month follow up. The demographic form instructs students to indicate their age, gender, ethnicity, grade level and was included in the After-School Student Questionnaire (see Appendix 1). In addition to demographic information, the study collected data on self report dietary information and on several indicators of physical fitness. The following measures, which are both empirically and theoretically based, were used for pre and post-assessment in the original study.
The dependent variables of interest consisted of two main physical fitness indicators (Body Mass Index and aerobic capacity, measured by the PACER test; Welk & Blair, 1991) as well as the self-reported nutrition indicators used by Kelder et al. (2005). Specifically, for the current study, we were interested in the measurement of the two composite scales used by Kelder et al. (2005): health knowledge (10 two-item questions) and intentions to eat healthy (8 two-item questions).

2.6.1. Demographic Characteristics

The demographic characteristics consisted of age, gender, grade level and ethnicity. However, indicating ethnicity was a problematic variable for most students, as (see Table 3) almost 60 percent of students did not know their ethnicity, did not complete the question or answered ‘other’. Therefore, the individual variable ethnicity was not incorporated in any of the conducted analyses.

2.6.2. FitnessGram Measurement protocol

Data from the FitnessGram® (Welk & Blair, 1991) test battery was collected pre- and post-test on all subjects. The FitnessGram® test consists of measuring aerobic capacity (with the PACER test) and body composition as measured by Body Mass Index (BMI) as well as a number of muscular strength and flexibility exercises by the project staff in collaboration with the school’s PE teachers. For the current project, only the scores on the PACER test for aerobic capacity and BMI were used. The FitnessGram® protocol is completed by all 3rd to 5th graders as mandated by the state of Texas since 2007 twice a year, in September and in April.

The FitnessGram® test battery has been developed with the aim of assessing children’s health status with a set of measures that are easily administered, reliable (e.g. Ihmels, Welk,
McClain, and Schaben, 2006) and that have shown convergent validity with other measures of physical fitness such as body fat (for BMI) and the one mile run test (aerobic capacity) as indicators of VO$_{2_{\text{max}}}$.

The FitnessGram® protocol specifies healthy standards, which are based on a combination of expert opinions, current data, known relationships, theoretical perspectives, and similar relationships were used to set the best standard (Welk & Blair, 2008). These ‘Criterion Referenced Fitness Standards,’ indicate that if the set standards that are considered healthy for each child’s age and gender are not achieved, the child is likely at a health risk.

Height and weight were measured using a Tanita-BF 215 portable electronic scale with height rod and Body Mass Index was calculated by the formula: weight in kg/ (height in meters)$^2$ and expressed in kg/m$^2$. The PACER test is a running exercise which is highly correlated with aerobic capacity (Welk & Blair, 2008). Participants run up and down a court that is 15 meters or 20 meters in length. Every time the other side is reached a beep sounds, which is the signal to turn around and run to the other side. The running level starts slow, but speeds up every minute. A student runs until they cannot make it to the other side of the court anymore before the beep sounds two times. The second time they cannot reach the other side in time, the exercise has been completed.

2.6.3. After-School Student Questionnaire (ASSQ) (Appendix 1)

The ASSQ is a self administered 58 item questionnaire (which takes approximately 30 minutes to complete), designed to measure behavioral and psychosocial variables targeted by the intervention. ASSQ items were adapted from the CATCH Kids Club program (Kelder et al., 2005). All scales have been shown to have adequate values of internal consistency with values of Cronbach’s alpha of over .60 (see Hoelscher, Day, Kelder and Ward, 2003; Edmundson, Parcel,
According to Edmundson, Parcel, Feldman, Elder, Perry and Johnson (1996), the internal consistency was adequate for subscales: food preferences (or food intentions) with a Cronbach’s alpha of .76 for both 3rd and 5th graders; and for dietary knowledge and healthy food intentions (alpha of .76 for 3rd graders and .78 for 5th graders). The two scales consisted of 8 type items (dietary knowledge) and 10 items (nutrition intentions). The items consisted of two answer options, an unhealthier and a healthier option. An example question of dietary knowledge was: “Which one of these two foods do you think is healthier, a) whole wheat bread or b) white bread?” Next to each food option was a picture of the food. An example item of the food intentions subscale was: “If you were at the movies, which one would you pick: a) popcorn with butter or b) popcorn without butter.” Again, next to each option a graphical representation of the food was printed.

Further, self reported sedentary and active behavior was assessed through a series of questions such as “How much TV do you watch during the week?” with response options ranging from “less than 1 hour a day” to “more than 4 hours a day.” Again, students circled their answer and next to each question, a graphical representation was placed to facilitate understanding of the concepts. Initially, a Spanish version of the ASSQ was not available. However, the document was translated by the UTEP translation department prior to the main intervention portion of the study.

### 2.6.4 School Level Variables

School level variables included SES; which was defined as percentage of socio-economically disadvantaged students in the school. Second, ETHNICITY, was a measure of the
percentage of students of Hispanic descent at the school. Third, LANGUAGE, was defined as
the percentage of children in the school that were of limited English proficiency (EPISD, 2008).
These variables were assumed to potentially influence the effects at the individual level across
schools differing in SES, ETHNICITY or LANGUAGE. However, these variables were very
highly correlated: the correlation between ethnicity (percent Hispanic) and language (percent
limited English proficiency) approached one ($r = 0.931, p = .000$), while the correlation between
ethnicity and socio-economic status was very high as well ($r = 0.887, p = .000$). Even the correlation
between socio-economic status and language was almost 0.80 ($r = 0.791, p < .000$). Given the high
correlation between the factors, multicollinearity was assessed through regression analyses in
SPSS 16.0 (SPSS Inc.). The Variance Inflation Factor (VIF) of over 10 is indicative of
significant multicollinearity among the predictors. When a regression was run of the outcome
variables BMI, aerobic capacity, health knowledge and Intentions to eat healthy, on the predictor
variables SES, ETHNICITY and LANGUAGE, it was clear that significant multicollinearity
existed among the predictors, as the VIF exceeded 10 for every second indicator variable
included in the analyses. Therefore, it was decided to include only one of the school level
variables in each of the analyses.

2.7. Power Analyses

2.7.1. Effect size rationale

Of the clinical measures in the study (physical fitness, muscular strength, flexibility,
endurance and Body Mass Index), effect sizes due to exercise and health programs are generally
very small in children. As Stice et al. (2006) report in their meta-analytic review: the mean
weighted effect size Cohen’s $d$ for Body Mass Index for weight loss programs (which included
studies with overweight children, overweight adolescents and healthy children and adolescents)
was .07. However, among the successful programs, the mean weighted effect size was .40, which approaches a medium size effect.

The study by Kelder et al. (2005) reported effect sizes of Cohen’s $d$ equal to and over .55 on all the subscales of the ASSQ with the exception of consumption of French fries. Therefore, the power analysis for the current study were motivated by the effect size estimates reported by ASSQ measures reported by Kelder et al. (2005) and the Stice et al. (2006) meta-analytic review.

### 2.7.2. Power and sample size

Influential factors in determining power and sample size for the current study include level of significance $\alpha$ (set at .05), the number of sites ($J$), the number of participants per site ($n$), the variance of the treatment effect (set at medium size variance of .10), the intraclass correlation coefficient $\rho$, the effect size $\delta$ and the proportion explained variance by potential covariates.

Raudenbush and Liu (2000) and Raudenbush (1997) argued in their analysis of optimal design for cluster randomized trials that the number of clusters ($J$) is more crucial in HLM than the number of participants per group ($n$). For example, power increases as the variance of the treatment effect decreases. They also argued that the importance of number of participants in increasing power depends strongly of the variance of the treatment effect. If the variance is large, number of participants per cluster is less important for increasing power. Simultaneously, however, if treatment by site variance becomes large, the main effect becomes less interesting and the influence of moderating variables becomes an important issue.

In addition, Raudenbush (1997) recognized the cost associated with a large number of sites and the limitation this effort places on a study. Raudenbush and Liu (2000) proposed .05, .10 and .15 as values for small, medium and large variances. In a similar fashion, an intraclass coefficient $\rho > 0$ would produce a negatively biased estimate of the standard error of the
treatment contrast, resulting in a liberal test of significance and a confidence interval that is too small (Raudenbush, 1997). Previous research (e.g. Murray & Blitstein, 2003; Janega, Murray, Varnell, Blitstein, Birnbaum & Lytle 2004) has shown population level intraclass correlations for youth diet and alcohol prevention programs to be about .02.

Figure 2 plots the number of subjects per cluster against the power achieved for effect sizes of $\delta = .30$, $\delta = .40$ and $\delta = .50$ respectively, using software developed Liu, Spybrook, Congdon, Martinez & Raudenbush (2006). For an effect size $\delta = .30$, and a number of participants per cluster of $n=35$, the resulting power would be .398. For $\delta = .40$ and 35 participants per cluster, the power is .617, while for $\delta = .50$, and 35 participants per cluster, the power is .802. It has to be noted, that this analysis does not include any explained variance by potential covariates.

2.7.3. Inclusion of covariates

A covariate that explains a substantial part of the variance in a study is likely to increase the precision of the regression estimates at the school level, thereby increasing power. Porter and Raudenbush (1987) provide an example where adding a single covariate has the same effect of increasing precision than doubling the sample size. Bloom (2005) also notes that including a pretest as a covariate for explaining cognitive achievements in adults accounted for 73% of the variance between clusters and 48% of the variance within clusters. Garner and Raudenbush (1991) found that prior academic achievement accounted for over 90% of the variance in educational attainment within neighborhoods.

Figure 3 adds a covariate (in the proposed study, a pretest) that explains 50% of the variance. Figure 4 adds a covariate that explains 75% of the variance, and lowers the intraclass correlation from .05 to .02. Results are summarized in Table 4. As can be seen in Figure 3, if a
covariate explains 50% of the variance in the treatment effect, 19 participants per school for 12 schools will have a power of .801 to detect an effect with a Cohen’s $d$ of .50. Using the values found in research in educational settings as a benchmark, the proportion variance explained by adding pretest values as covariates will likely be greater than .50, and the current design likely had enough power to detect effects in the range Cohen’s $d$ of .30 to .40.

2.8. Data Analysis Strategy

2.8.1. Study Design

As students are nested within their respective school (and classroom), the design of the current study is a nested or hierarchical design. Our variables of interest may describe characteristics of an individual, but this individual may be part of a larger group. In turn, at the group level, there may also be variables of interest.

For research projects, traditional estimation techniques have been limited in their ability to accurately model hierarchical models. Several potential problems may occur if hierarchical structures are estimated by traditional linear models. The most commonly known limitation is the failure to take into account the violation of independence of scores of people that are nested within the same unit or group. Children within the same school, for example, are more likely to be similar to each other compared to children from a school from a different neighborhood. Further, the intervention effect of a treatment that was conducted on a classroom level, is more likely to be more similar for children within the same classroom. For example, characteristics of intervention are likely to have been more similar for children within the same classroom, resulting in some kind of shared experience which may be associated with outcomes of an intervention. The failure to take into account the interdependence of scores may result in underestimation of standard errors and lead to liberal test statistics (Raudenbush & Bryk, 2002).
Second, heterogeneity of regression is often considered a nuisance or violation of an assumption to conduct linear modeling. However, heterogeneity of regression coefficients may be of considerable interest for nested structures. Third, aggregation bias occurs when different characteristics may have different effects on different levels of analysis. For example, a students’ socio-economic status may be associated with a treatment effect. However, the socio-economic status of the school may also be associated with the effect of an intervention. This was not the case, however, in the current project, as there were no variables that were assessed at both the individual and the group level.

Hierarchical linear models (HLM) also called random-coefficient models, mixed models or multilevel models (Raudenbush & Bryk, 2002) take into account different levels of nesting within the data structure. Each of the levels of the hierarchical structure is represented by their own submodel, and specify how models how variables at one level affect variables at another level (Raudenbush and Bryk, 2002).

2.8.2. The Analyses
All data were analyzed using software (HLM 6) developed by Raudenbush, Bryk and Congdon (2000). For the current project, the HLM modeling consisted of two levels: a student level and a school level. Students are nested within each school.

For each model in the current project, an equation is defined, for which there are two levels. Level 1 is the individual level (the child or participant level for i participants) which is the heart of the model. The outcomes (Yij) are specified on the individual level (for example, Body Mass Index) and are a function of an intercept (β0j), effects associated with covariates such as age (Xi1j, X2ij etc.) or indicators of group membership (intervention group membership) and a random effect for each individual r1j (the difference between each individual and their group
mean, possibly controlling for covariates). Level 2 is the school level (for \(j\) schools) and intercept \(\beta_{0j}\) and coefficients \(\beta_{ij}\) are treated as outcomes at the school level.

The analysis for the current project has been conducted in three steps:

**Step 1:** The simplest hierarchical model is analogous to 1-way Analysis of Variance (ANOVA) with random effects. This model is considered *fully unconditional* and is described by the equation:

\[
\text{Level 1} \quad Y_{ij} = \beta_{0j} + r_{ij} \quad \text{where}
\]

\(\beta_{0j}\) = the intercept (the expected mean for a student in school \(j\))
\(r_{ij}\) = the unique effect of person \(i\) who is nested within school \(j\)

\[
\text{Level 2} \quad \beta_{0j} = \gamma_{00} + u_{0j} \quad \text{where}
\]

\(\gamma_{00}\) = the grand mean
\(u_{0j}\) = the unique effect of school \(j\)

The subscript \(j\) allows for each school to have a different mean. As we have no predictor variables included at either level 1 (student level) or level 2 (school level), no slope is specified and thus \(\beta_{ij}\) is set to zero (and thus not shown) in the level 1 model. The models were estimated for the following dependent variables: BMI, aerobic capacity, health knowledge and intentions to eat healthy.

First, the fully unconditional model provides us with useful information about the mean of all students at post test; it gives us a point estimate (and a confidence interval) for the grand mean \(\gamma_{00}\). The mean of the post test is assessed, rather than the baseline mean, as a model with only post test values provides an estimate as to how much variability there is in scores at the post
test. This variability will then be reduced in subsequent models that have the same outcome variable (post test value of the dependent variable), and take into account covariates (at the individual level and/or school level). The amount of variability reduced (or proportion variance explained) can then be assessed due to inclusion of certain variables (such as experimental group membership, age, sex etc.). Further, the unconditional model with the post test only as outcome provides information about the differences within and across schools in post test values; it gives us estimates of within group variability ($\sigma^2$) and between group variability ($\tau_{00}$). This model is often used as a first step in hierarchical models (Raudenbush & Bryk, 2002).

As a second part of the first step, the analyses of the unconditional model were then repeated with change variables of the outcomes (Change in BMI, Change in aerobic capacity, Change in health knowledge and change in intentions to eat healthy) to assess whether these changes were different from zero across the sample of all participants (to test the $H_0$: Change $Y_{ij} = 0$). The change scores (e.g. change BMI) were included in the same table as the fully unconditional model on the baseline score (e.g. BMI baseline).

**Step 2:** The second set of models (separately for each outcome variable BMI, aerobic capacity, health knowledge, healthy food intentions) that were estimated are a set of models incorporating the post-test values of the dependent variables as outcomes again. These models had a variable denoting group membership (experimental or control, indicated by the value 0 for controls and 1 for experimental on variable $X_1$) and controlled for the pre-test of the outcome variable (variable $X_2$). These models are analogous to one-way Analysis of Covariance (ANCOVA). The difference between the traditionally used ANCOVA and the Hierarchical
Linear Model (HLM) analogy is that in HLM, the group effect \( u_{0j} \) is not fixed, but random across groups.

Again, the equations used for these models are specified at two levels: Level 1 is the individual level and the school level (level 2). The outcomes (Yij) are specified on the individual level and a function of an intercept (\( \beta_{0j} \)), effects associated with covariates such as age (\( X_{1ij} \), \( X_{2ij} \) etc.) and a random effect for each individual \( r_{ij} \) (the difference between each individual and their group mean, controlling for covariates). The covariate for the pre-test is grand mean centered (\( X_{2ij} - \bar{X}_{..} \)). As is the case in linear regression analyses, in HLM models, it is essential to be able to precisely understand the meaning of the intercept and the coefficients. In order to facilitate interpretation of coefficients, grand mean centering subtracts the mean value of X of each participants' score (Xij). Now, the intercept \( \beta_{0j} \) is the expected mean for the participant who has a mean score on the grand mean centered Xij variable (e.g. if the X variable is age, then for the model with \( Y_{ij} = \) post test BMI, the intercept would the expected post test BMI for the person whose age equals the mean age).

The equations are:

**Level 1:**

\[
Y_{ij} = \beta_{0j} + \beta_{1j} (X_{1ij}) + \beta_{2j} (X_{2ij} - \bar{X}_{..}) + r_{ij} \quad \text{where}
\]

- \( \beta_{0j} \) = the mean outcome for each school j adjusted for baseline differences in the Xij
- \( r_{ij} \) = the unique effect of person i who is nested within school j
- \( X_{1j} \) = the variable indicating group membership (1= experimental, 0= control)
- \( X_{2j} \) = the covariate for the pre test value of the outcome

**Level 2:**

\[
\beta_{0j} = \gamma_{00} + u_{0j} \\
\beta_{1j} = \gamma_{10} \\
\beta_{2j} = \gamma_{20}
\]
where,

\( \gamma_{00} \) = the grand mean across schools \\
\( \gamma_{10} \) = average slope across schools of intervention participation to the outcome \\
\( \gamma_{20} \) = average slope across schools of posttest on pretest \\
\( u_{0j} \) = random variation between schools in terms of outcome intercept (or: the unique effect of school j on the mean intercept)

**Step 3:** The final step in the HLM analyses involves a series of *conditional* models (BMI, aerobic capacity, health knowledge, healthy food intentions) which include both *individual level variables and school level variables*. These are the *full model* estimates. Due to the limited number of level 2 units (6 schools, including each experimental and control participants), statistical power to detect treatment effects may be too limited to include a large number of level 1 and level 2 variables simultaneously (see Raudenbush & Bryk, 2002)

The level 1 variables that were included in the analyses were age, gender, pre-test value and a variable denoting group membership (experimental or control). Due to multicollinearity among the level 2 variables SES (percentage of socio economically disadvantaged children in the school), ETHNICITY (percentage of children in the school that are of Hispanic descent), and LANGUAGE (the percentage of children in the school of limited English proficiency), only SES was included as a level 2 predictor. SES was grand mean centered.

The following equations were used to estimate the full model at level 1 and level 2:

**Level 1:**

\[
Y_{ij} = \beta_{0j} + \beta_{1j} (X_{1ij}) + \beta_{2j} (X_{2ij} - \bar{x}_{2..}) + \beta_{3j} (X_{3ij} - \bar{x}_{3..}) + \beta_{4j} (X_{4ij} - \bar{x}_{4..}) + r_{ij}
\]

\( \beta_{0j} \) = the mean outcome for each school j adjusted for baseline differences in the covariates
\[ r_{ij} = \text{the unique effect of person } i \text{ who is nested within school } j \]

\[ X_{1ij} = \text{Exp or control} \]

\[ X_{2ij} = \text{Age, grand mean centered} \]

\[ X_{3ij} = \text{Sex (0=male, 1=female)} \]

\[ X_{4ij} = \text{Pre-test outcome variable, grand mean centered} \]

**Level 2:**

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} W_{1j} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} + \gamma_{11} W_{1j} \]

\[ \beta_{2j} = \gamma_{20} + \gamma_{21} W_{1j} \]

\[ \beta_{3j} = \gamma_{30} + \gamma_{31} W_{1j} \]

\[ \beta_{4j} = \gamma_{40} + \gamma_{41} W_{1j} \]

**Where**

\( \gamma_{00} = \text{the grand mean across the schools (or the mean } Y_{ij} \text{ for school } j \text{ with a mean score on SES)} \)

\( \gamma_{01} = \text{mean post test BMI difference (or mean aerobic capacity difference, health knowledge difference, intentions to eat healthy difference) across schools based on their SES} \)

\( \gamma_{10} = \text{average experimental group participation- Post BMI regression slope across schools} \)

\( \gamma_{11} = \text{mean difference in experimental group participation-Post BMI slopes across schools different in SES} \)

\( \gamma_{20} = \text{average age- post BMI slope across schools} \)

\( \gamma_{21} = \text{mean difference in age-Post BMI slopes across schools different in SES} \)

\( \gamma_{30} = \text{average gender-post BMI across schools} \)

\( \gamma_{31} = \text{mean difference in gender-Post test BMI slopes across schools different in SES} \)

\( \gamma_{40} = \text{average pre test BMI- post test BMI slope across schools} \)
\( \gamma_{41} = \) mean difference in pre-test BMI- Post test BMI slopes across schools different in SES
\( u_{0j} = \) the unique effect of school j

\( W_{ij} = \) School level variable Socio economic status (SES)

2.9. Assessing Assumptions in HLM

As in linear regression and ANOVA, Hierarchical Linear Models estimation techniques are based on several assumptions. Following Raudenbush and Bryk (2002), the following assumptions were tested for all fitted models:

1. Each individual error term \( r_{ij} \) is independent and normally distributed with a mean of 0 and a variance of \( \sigma^2 \) for every level 1 unit i (each student) within each level 2 unit j (each school)

2. The level 2 residuals (\( u_{0j} \) and if applicable \( u_{1j} \) and \( u_{2j} \) etc.) are normally distributed, each with a mean of 0 and a variance \( \tau_{qq} \).

3. The level 1 predictors \( X_{ij} \) (for example age, gender, pre test value and in the current project, experimental group membership) are independent of \( r_{ij} \)

4. There is homogeneity of variance of random level 1 \( u_{0j} \) and \( u_{1j} \) etc. effects across level 2 units

5. The errors at level 1 are independent of the residual school effects \( u_{0j} \) (and if applicable) \( u_{1j} \)

6. Indicators that are not included in the model specified at level 1 (for example, if student age is not included in the model) are not associated with the level 2 variables (for example SES). Also, whatever level 2 variables are not included in the specified level 2 model are not related to the level 1 variables in the model
Prior to evaluation of the assumptions, data were screened for outliers with SPSS frequencies and box-whisker-plots in HLM 6 (Raudenbush, Bryk & Congdon, 2000). Outliers were defined as having a value that was three standard deviations or more below or above the respective group mean. In case of an outlier, the individual case was examined for potential data errors and if necessary, the original data files were examined to evaluate whether the entry was a mistake or not. If there was no substantial ground to consider the entry a mistake, the values were kept in the analyses.

The assumption of normally distributed data and error terms for the level 1 variables was examined through a series of Q-Q plots of level 1 residuals, where observed values were plotted against expected values. No strong deviations from normality were found in the residuals for any of the models examined at level 1. Normality of level 2 residuals was examined through plotting of the Mahalanobis distance of the residual level 2 file (see Raudenbush, Bryk, Cheong, Congdon & Du Toit, 2004 for more details) against the residual variable ‘chipct’ which denotes the expected values of the order statistic for a sample size J selected from a population of groups (schools in our project) which follow a chi-square distribution. If the Q-Q plot follows a 45 degree line, we have evidence that the random effects are distributed \( v \)-variate normal (Raudenbush, Bryk, Cheong, Congdon & du Toit, 2004) where \( v \) is the number of random effects per unit. These plots can also assist us detect outliers at the level 2 units as well. None of the level 2 residual plots indicated strong deviation from normality.

Further, homogeneity of error variance was tested for every model. Consequences of violations of the homogeneity of variance at the level 1 model would be mild and even standard errors have been found to be quite robust (Raudenbush & Bryk, 2002) as long as potentially randomly varying slopes are specified as fixed (Kasim & Raudenbush, 1998). In addition,
heterogeneity of variance may actually be of interest to the study. Heterogeneity of variance may have several causes that should be explored in further detail in case of violation of homogeneity of variance assumption: 1) the assumption of normal distribution has been violated (e.g. there is a distribution that is heavily skewed), 2) there is bad data (e.g. coding mistakes) or 3) one or more level 1 variables have been treated as fixed effects, but should vary randomly across level 2 units and 4) one or more level 1 variables have been omitted.

Several of the specified models including BMI and aerobic capacity as outcome variables showed significant violation of the assumption of homogeneity of variance at level 1. To account for this, all models were estimated with fixed, rather than randomly varying slopes and potential underlying causes were examined. Following the recommendations by Raudenbush and Bryk (2002) for examination of causes of heterogeneity of variance, the data were assessed for potential violations of the normality assumption in level 1 variables, which was not the case. Second, since data were previously screened for errors and outliers, the likelihood that the violations were due to bad data seemed unlikely as well. Third, all random effects were fixed in the models, which eliminated the possibility that fixed effects were erroneously specified as random as a cause of the significant heterogeneity of variance. Finally, omission of an important level 1 variable was considered as a possible cause. However, the models included all level 1 predictors for which data was available, except for the demographic variable participant ethnicity (not to be confused with school ethnicity). As mentioned, children in the sample were not able to accurately report their own ethnicity (see Table 3) as many of the participants reported ‘don’t know’ or ‘other’ when asked for their ethnicity.

Finally, it was examined whether inclusion of an additional predictor variable in the specified conditional models would be appropriate through procedures outlined by Raudenbush,
Brye, Cheong, Congdon and Du Toit (2002), where empirical bayes’ residuals (part of the level 2 residual file) were plotted against a possible additional level 2 variable. Given the limited number of level 2 units and the high correlations among the potential level 2 variables, however, for the current project it was chosen to be conservative in our attempts to increase the complexity of the model at the school level and to only estimate the models with one level two predictor (school socio-economic status).

CHAPTER 3: RESULTS

3.1. Pilot Study Results

The total sample size for the pilot study was \( n=172 \) (\( n=131 \) in school 1 and \( n=41 \) in school 2). In the pilot study, 52% of the sample were boys, and the mean age was 9.28 years (SD=1.22). Several interesting correlations were found at baseline displayed in Table 5. Due to the large number of comparisons, caution is warranted interpreting significant correlations as small correlations may be due to chance alone. As expected, BMI was strongly negatively related to aerobic capacity (\( r=-.634, p=.000 \)) as students higher in BMI had lower aerobic capacity. Further, intentions to eat healthy (\( r=-.351, p=.028 \)) was negatively related to aerobic capacity. Surprisingly, health knowledge (\( r=.344, p=.018 \)) was positively associated with BMI. In other words: at baseline, students who were knowledgeable of which foods were healthy actually had higher BMI’s. Also, consumption of sweets and fats was negatively associated with healthy knowledge (\( r=-.331, p=.007 \)) and intentions to eat healthy (\( r=-.390, p=.000 \)). Finally, TV viewing during the week, (\( r=-.254, p=.034 \)) was negatively associated with intentions to eat healthy, and TV viewing during the weekend was negatively associated with both health knowledge (\( r=-.375, p=.002 \)) and intentions to eat healthy (\( r=-.485, p=.000 \)).
The mean BMI of students in the pilot schools at baseline was 23.20 (SD=5.33 kg/m²) and at 4 month posttest it was 23.01 (SD=5.30), \( t = 2.09, p = 0.041, d = 0.10 \), which was a reduction of about 0.20 kg/m². In addition, 60 percent of the participants reduced their BMI from pre test to post test. Further, aerobic capacity significantly \( (p<0.01) \) increased from baseline (22.6 laps, SD=11.0 laps) to post test (26.0 laps; SD=14 laps), \( d=0.27 \). Nutrition knowledge increased from 5.7 out of 10 answers correctly answered at baseline (SD=2.6) to 7.2 correctly answered items (SD=2.8) at post test \( (p=0.078, d=0.53) \). All self reported dietary intake (except for fruit) changed in the expected direction, but except for consumption of French Fries, none were large enough to reach statistical significance. Results of the paired-samples’ t-tests are summarized in Table 6.

3.1.1. Feasibility, reliability of scales

Even though most students preferred to conduct school work in English, at pilot testing, it was evident that a Spanish version of the ASSQ was needed. The UTEP translation department translated the ASSQ before the onset of the main intervention. The Spanish version was used in the main intervention and 23.5 percent of students chose the Spanish version of the ASSQ survey. Second, some of the words used in the ASSQ exceeded the language level of our grade level. Thus, each word in the original survey that exceeded the reading level of 3rd grade was changed into a simpler version that was considered appropriate for 3rd graders. For example, the original ASSQ asks: “Do you ever eat high fiber cereal?” The words fiber and cereal may not be known by all 3rd to 5th graders. If this was the case, either the difficult words were changed into simpler ones or an explanation was added explaining the more difficult concepts in simpler words. Also, a ‘don’t know’ option was added. It may be important to be conservative in our estimates of knowledge of younger children, as for example, only about 25 percent of children answered ‘Hispanic or Mexican’ on the question what their ethnicity was, whereas almost 90
percent of the children in the schools in the intervention were Hispanic according to school characteristics.

Cronbach’s alpha’s of the pilot study were 0.612 for the intentions to eat healthy scale at baseline and $\alpha = 0.647$ at post-test. The health knowledge scale had an initial internal consistency reliability at baseline of $\alpha = 0.733$ and $\alpha = 0.777$ at post-test. All other indicators were single item measures, and thus no internal consistency could be calculated.

To assess test-retest reliability of the survey instrument, a subsample of children was provided with a shorter version of the survey two days after the initial baseline measurements. Because only subsets of items were correlated, correlations may have been a bit lower than expected. The subset of health knowledge items (4 items) had a correlation of $r = 0.53$, $p = 0.002$ between baseline and two days later. The subset of health intentions items (4 items) had a correlation of $r = 0.40$, $p = 0.20$.

3.1.2. Regression Analyses

Finally, a number of linear regression analyses were conducted with the purpose of exploring the influence of school membership and demographic variables such as age and gender. Regression analyses were conducted for BMI, aerobic capacity and health knowledge and are reported in Table 7. The post BMI was predicted from the participants’ age, gender and school membership. Overall model R-square was .987. Both gender and school membership were predictors of change in Body Mass Index. Boys in the intervention reduced their BMI by $0.506 \text{ kg/m}^2$ compared to girls, $\beta = -0.506$, $t = -2.826$, $p = .006$. Also, school membership was a significant predictor of BMI change, $\beta = -0.508$, $t = -2.621$, $p = .011$.

In sum, while results of the pilot study were encouraging in terms of BMI reduction and aerobic capacity and health knowledge increase, caution is warranted when interpreting these
results, as there was no control group available. Also, certain effects were estimated with limited sample sizes. For the ASSQ, internal consistency reliabilities appear adequate, but test-retest reliabilities were not high.

3.2. Baseline Characteristics of the Intervention Study

3.2.1. Main Intervention: Demographic characteristics

Demographic characteristics of the participants in the main intervention (n= 931) are described in Table 3. Mean age is approximately 9.6 years ±1 year for the entire sample even though experimental group participants are slightly younger. Both groups had an equal percentage of males (51.6%) and females (48.4%). Experimental group third grade boys had a lower score on the aerobic capacity test (PACER) at baseline on p<.05 compared to the control group third grade boys. While health knowledge increased with each grade level for both boys and girls, intentions to eat healthy appear to be fairly stable across grade levels. Because ethnicity was poorly defined as a self-report measure, it was not adapted as an individual level variable. As listed in Table 3, only 26% of students identified themselves as Hispanic or Mexican, while according to the school district (EPISD, 2008), over 60% of students in all schools in the intervention were of Hispanic descent and in half the schools at least 98% of the students were of Hispanic descent.

Several interesting correlations were observed at baseline. As expected, higher BMI was negatively associated with aerobic capacity, r = -.389, p = .000. Further, as was found in the pilot study, children higher in BMI had more knowledge about healthy foods (defined as the ability to choose the healthier of two options) r = .168, p = .000, and an increased self reported willingness to choose the healthier of two options (intentions to eat healthy) r = .220, p = .000. The correlations are provided in Table 8.
For descriptive purposes, several paired samples’ t-tests were conducted to assess changes from pre-test to post-test for the group as a whole and for the experimental and control group separately and/or by school for baseline values (see Tables 9-11). Mean BMI decreased significantly for all students, from 19.98 (SD= 4.36) to 19.84 (SD= 4.27), \( t = 4.451 \), \( p = .000 \). The decrease, however, was larger for experimental group participants who reduced their BMI by an average of 0.200 kg/m\(^2\) (exactly the same reduction found as in the pilot test) compared to control group participants who reduced their BMI by 0.116 kg/m\(^2\). Following the CDC standards for being overweight and obese, at baseline, 52.6 percent of the total sample had a healthy BMI, while 21.6 percent was overweight (defined as over the 85\(^{th}\) percentile) and 25.6 percent obese (over the 95\(^{th}\) percentile). At posttest, interestingly, (just like in the pilot test) 60 percent of the intervention group reduced their BMI, compared to 50 percent of the control group. For the total sample, 6.9 percent of participants positively changed their risk status from either 95\(^{th}\) percentile to 85\(^{th}\) percentile or from 85\(^{th}\) percentile and above to normal weight status. In turn, 3.9 percent of participants worsened their at-risk status from normal to overweight (over 85\(^{th}\) percentile or from overweight to obese (over 95\(^{th}\) percentile).

Aerobic capacity defined as number of laps run in the PACER test increased 3.83 laps (from 21.26 at baseline to 25.09 at post test) for experimental group participants, \( t = 5.70, p = .000 \) and 2.32 laps for the control group (from 21.95 to 24.28), \( t = 4.95, p = .000 \).

Changes for health knowledge were modest, as the increase in health knowledge for experimental group participants was 0.24 correct answers (from 6.68 to 6.92), \( t = 1.09, p = .280, ns \) and 0.18 correct answers for the control participants (from 6.39 to 6.58), \( t = 1.25, p = .214 \). Finally, the experimental group showed a significant increase in intentions to eat healthy from 4.48
healthy choices (out of eight) at baseline to 4.92 healthy choices at posttest ($t=2.294, p=.023$), whereas the control group did not.

### 3.3. Main Intervention HLM models

As mentioned, for each model in the current project, an equation is defined, where the outcomes ($Y_{ij}$) are specified on the individual level (for example, Body Mass Index) and are a function of an intercept ($\beta_{0j}$) and a random effect for each individual $r_{ij}$ (the difference between each individual and their group mean). Level 2 is the school level (for $j$ schools) and intercept $\beta_{0j}$ and coefficients $\beta_{ij}$ are treated as outcomes at the school level. No Level 2 coefficients are specified for the first step of the analyses.

The **fully unconditional** and is described by the equation:

$$Y_{ij} = \beta_{0j} + r_{ij}$$

$\beta_{0j}$ = the intercept (the expected mean for a student in school $j$)

$r_{ij}$ = the unique effect of person $i$ who is nested within school $j$

where $\beta_{0j} = \gamma_{00} + u_{0j}$

$\gamma_{00}$ = the grand mean

$u_{0j}$ = the unique effect of school $j$

Two models were assessed for each outcome variable in the unconditional model: a) the post test value as outcome model without any predictors specified and b) the change from pre test to post test value as outcome without any predictors specified. The fully unconditional model with post test as outcome variable can answer questions such as:

- What is the grand post test mean and the 95% confidence interval?
- Are there significant differences across schools in terms of post test mean?
The change model was added as it can answer the following question:

- Was the change from pre test to post test for the outcome variable significantly different from 0?

### Step 2: Conditional models (pre-test and group indicator)

The conditional models evaluated in step 2 estimate the post test values while controlling for pre-test values, and assessed the effects of experimental group participation on change in outcome variables. In other words: the conditional models provide information about the treatment effects. Several questions can be answered by these conditional models including:

- What is the average regression slope from outcome variables on experimental group participation? In other words: does participation in the intervention lead to a significantly higher or lower post test outcome value controlling for pre test values?
- How much do intercepts vary from school to school?
- Do regression slopes vary from school to school? (is it a random or a fixed effect?)

The equations used for estimation of the conditional model were:

### Step 3: Fully Conditional Models (Level-1 and Level 2)

Several interesting additional hypotheses can be addressed with the full model. At level 1, the main effects of experimental group participation, age and gender can now be estimated controlling for the other covariates.

For the level 2 variables, the following questions can be addressed:

- Does SES significantly predict the intercept? (if so, coefficient gamma 01 would have been significant)
- Does SES significantly predict the slope between experimental group participation (Exp) and the value on the post test outcome? Do high SES schools differ from low SES schools in terms of strength of association between experimental group participation and Post test outcome, controlling for Pre-test outcome, Age and Sex. (if so, coefficient $\gamma_{00}$ would have been significant). In other words: is the treatment effect different for schools differing in SES?

- How much variation in the intercepts and slopes can be explained from the level 2 variables?

### 3.3.1 HLM Models BMI

#### 3.3.1.1. Unconditional model for BMI

The results for the fully unconditional model including Body Mass Index as the outcome variable and no predictors specified at level 1 or at level 2, are displayed in Table 12. The point estimate for post test BMI was $M= 19.678$ kg/m$^2$ (SE=0.343). Also displayed in Table 12, are the baseline estimates for each school in the main intervention. The values range from a Mean of $M= 18.67$ for school 8 to $M= 20.67$ for school 6. Further, there was significant variation between schools in BMI (variance =0.54, $\chi^2$ (df=5) = 22.70, $p$=.001). The 95% confidence interval for the mean intercept ranged from 18.22 kg.m$^2$ to 21.12 kg/m$^2$. The intraclass correlation coefficient was 0.030, which is the proportion of variance between schools (3.0%). Finally, the sample means appear to be reliable as indicators of the true school means, as reliability = 0.766.

Interestingly, for the fully unconditional model with change scores, the experimental group showed a significant reduction in BMI from pre to post test ($\gamma = -.160$, $t$ (df=5) = -2.787, $p$=.039 (for the $H_0 : \text{Change} =0$), whereas the control group did not, $\gamma = -.118$, $t$ (df=5) = -0.899, $p$=.410.
### 3.3.1.2. Conditional model I for BMI controlling for pre-test and group indicator

The results for the conditional model including post test Body Mass Index as the outcome variable and the pre-test value of BMI and a variable indicating group membership as predictors specified at level 1, are displayed in Table 13. The point estimate for BMI at post test controlling for pre-test is \( M = 19.70 \text{ kg/m}^2 \) (SE=0.103). The 95% confidence interval for the mean intercept of BMI at post test ranged from 19.41 kg.m\(^2\) to 20.08 kg/m\(^2\).

Further, baseline estimates for each school at post test ranged from a Mean of \( M = 19.51 \) for school 5 to \( M = 20.06 \) for school 7. Further, there was significant variation between schools in BMI (variance =.039, \( \chi^2 (df=5) = 36.24, p=.000 \)). Baseline value was a strong predictor of post test value, \( \gamma =0.964, t= 70.53, p=.000 \). The group indicator variable was not a significant predictor of post test BMI, \( \gamma =.0064, t=.069, ns \). The residual variability was very small, as \( \sigma^2 = 0.699 \).The intraclass correlation coefficient was 0.053. Finally, the sample means appear to be reliable as indicators of the true school means, as reliability = 0.851.

### 3.3.1.3. Full Conditional model for BMI including level 1 and level 2 predictors

The results for the conditional model including post test Body Mass Index as the outcome variable and the pre-test value of BMI, age, gender and a variable indicating group membership as predictors specified at level 1, are displayed in Table 14. The level 2 predictor SES (percent socio-economically disadvantaged students in the school) is included in the full model. The point estimate for BMI at post test controlling for all level 1 variables and SES at level 2 is \( M = 19.66 \text{ kg/m}^2 \) (SE=0.069).

Further, baseline estimates for each school at post test ranged from a Mean of \( M = 19.37 \) for school 6 to \( M = 20.18 \) for school 7. Further, there was significant variation between schools in BMI (variance =.010, \( \chi^2 (df=4) = 10.10, p=.038 \)). The 95% confidence interval for the mean
intercept of BMI at post test ranged from 19.46 kg/m$^2$ to 19.86 kg/m$^2$. School SES was a significant predictor of intercept, $\gamma = -0.0094$, $t = -3.659$, $p = .034$. In other words, for every unit increase in percent socio economically disadvantaged students at a school, there was a .0094 kg/m$^2$ decrease in post test BMI, controlling for pre-test BMI, experimental group participation, age and gender. Thus, for a student at school 4 (SES: 96.3 percent disadvantaged) compared to school 7 (23.3 percent socio-economically disadvantaged), the difference would be $73 \times (-0.095) = -0.70$ kg/m$^2$.

While the group indicator variable was not a significant predictor of post test BMI, $\gamma = -0.017$, $t = -.023$, $ns$, school SES was marginally predictive of the association between experimental group participation and Post BMI, controlling for other covariates, $\gamma = 0.0054$, $t = 1.901$, $p = .057$. In other words, a one unit increase in school SES (indicating a higher percentage of socio-economically disadvantaged students), resulted in a 0.005 increase in effect of group participation on post test BMI, controlling for other covariates and pre-test BMI. Thus, for a student at school 4 (SES: 96.3 percent disadvantaged) compared to school 7 (23.3 percent socio-economically disadvantaged), the effectiveness of participation in the intervention on post test BMI, controlling for pre-test BMI would be different. The effect of participation would be $73 \times 0.005 = 0.35$ kg/m$^2$ stronger for the student in school 4 (the poorer school) compared to school 7. Baseline value was a strong predictor of post test value, $\gamma = 0.964$, $t = 112.83$, $p = .000$. The residual variability was very small, as $\sigma^2 = 0.675$. The intraclass correlation coefficient was: 0.015. Finally, the sample means reliability was 0.593.

3.3.2. HLM Models Aerobic Capacity (PACER)

3.3.2.1. Unconditional Model for Aerobic Capacity (PACER)
The results for the fully unconditional model including aerobic capacity as the outcome variable and no predictors specified at level 1 or at level 2, are displayed in Table 15. The point estimate for Aerobic capacity at baseline was $M = 23.78$ laps (SE=1.60).

Also displayed in Table 15, are the baseline estimates for each school in the main intervention. The values range from a Mean of $M = 19.80$ for school 5 to $M = 30.27$ for school 3. Further, there was significant variation between schools in Aerobic capacity (variance = 13.54, $\chi^2$ (df=5) = 60.54, $p=$.000). The 95% confidence interval for the mean intercept ranged from 15.59 laps to 30.97 laps. The intraclass correlation coefficient was: 0.069, which is the proportion of variance between schools (6.9%). Finally, the sample means appear to be reliable as indicators of the true school means, as reliability = 0.875.

For the model with the aerobic capacity change variable as outcomes, for both groups there was a marginal increase at posttest, where the experimental group increased the number of laps by $\gamma = 2.45$, $t$ (df=5) = 2.500, $p=$.053 (for the $H_0$: Change =0), and the control group, $\gamma = 1.88$, $t$ (df=5) = 0.826, $p=$.071. In other words: both groups seem to slightly increase their aerobic capacity scores from pre-test to post-test.

### 3.3.2.2. Conditional model I for Aerobic Capacity (PACER)

The results for the conditional model including post test aerobic capacity as the outcome variable and the pre-test value of aerobic capacity and a variable indicating group membership as predictors specified at level 1, are displayed in Table 16. The point estimate for aerobic capacity at post test controlling for pre-test is $M = 23.42$ laps (SE=1.01). The 95% confidence interval for the mean intercept of aerobic capacity at post test ranged from 22.24 laps to 30.88 laps.

The baseline estimates for each school at post test ranged from a Mean of $M = 18.91$ for school 8 to $M = 26.52$ for school 3. Further, there was significant variation between schools in
aerobic capacity (variance = 4.72 $\chi^2$ (df=5) = 31.42, $p=.000$). Baseline value was a strong predictor of post test value, $\gamma =0.800, t= 25.36, p=.000$. While being in the experimental group was associated with a 0.74 lap increase at posttest controlling for baseline values, this difference was not significant. The group indicator variable was not a significant predictor of post test aerobic capacity, $\gamma = 0.736, t=0.907, p=.365, ns$. The residual variability was still large, which indicates that there is a lot of unexplained variability in the model, as $\sigma^2 = 96.81$. The proportion of variance between schools (intraclass correlation coefficient) was 4.9%. Finally, the sample means appear to be reliable as indicators of the true school means, as reliability = 0.826.

3.3.2.3. Full Conditional model I for Aerobic Capacity (PACER)

The results for the conditional model including post test aerobic capacity as the outcome variable and the pre-test value of aerobic capacity and a variable indicating group membership as predictors specified at level1 are displayed in Table 17. The point estimate for aerobic capacity at post test controlling for pre-test is $M= 24.45$ laps (SE=1.12).

The baseline estimates for each school at post test ranged from a Mean of $M= 20.37$ for school 8 to $M= 27.71$ for school 3. Further, there was significant variation between schools in aerobic capacity (variance = 6.82 $\chi^2$ (df=4) = 28.07, $p=.000$). The 95% confidence interval for the mean intercept of aerobic capacity at post test ranged from 19.33 laps to 29.57 laps.

Only baseline value was a strong predictor of post test value, $\gamma =0.755, t= 21.76, p=.000$. SES was a significant predictor of the slope between pre-test aerobic capacity and post test aerobic capacity, $\gamma =0.0043, t= 3.32, p=.001$. In other words: an increase of one unit in SES (one additional percentage point of students who were considered socio-economically disadvantaged at the school), resulted in an increase of 0.04 number of laps, controlling for all other covariates.
in the model. The residual variability was still large, which indicates that there is a lot of
variability left to be explained, as $\sigma^2 = 88.40$. The intraclass correlation coefficient was 0.072,
which is the proportion of variance between schools (7.2%). Finally, the sample means appear to
be reliable as indicators of the true school means, as reliability = 0.864.

3.3.3 HLM Models Health Knowledge

3.3.3.1. Unconditional Model for Health Knowledge

The results for the fully unconditional model including health knowledge at post test as
the outcome variable and no predictors specified at level 1 or at level 2 are displayed in Table 18.
The point estimate for health knowledge at baseline was $M= 6.70$ (SE=0.306) correct answers
(out of 10).

Also displayed in Table 18, are the baseline estimates for each school in the main
intervention. The values range from a Mean of $M= 5.61$ for school 5 to $M= 7.79$ for school 7.
Further, there was significant variation between schools in post test health knowledge (variance
= 0.613, $\chi^2$ (df= 5) = 62.94, $p=.000$). The 95% confidence interval for the mean intercept ranged
from 5.62 correct answers to 7.78 correct answers. The intraclass correlation coefficient was
0.049, which is the proportion of variance between schools (4.9%). The sample means appear to
be reliable as indicators of the true school means, as reliability = 0.911.

The change model suggested that the variable ‘change in health knowledge’ was not
significantly different from zero for either the experimental or control group or for the groups
combined.

3.3.3.2. Conditional model I for Health Knowledge
The results for the conditional model including post test health knowledge as the outcome variable and the pre-test value of health knowledge and a variable indicating group membership as predictors specified at level 1 are displayed in Table 19. The point estimate for health knowledge at post test controlling for pre-test is $M = 6.72$ items correct (out of 10 items) (SE=0.282). The 95% confidence interval for the mean intercept of health knowledge at post test ranged from 5.56 items correct to 7.90 items correct.

Further, the baseline estimates for each school at post test ranged from a Mean of $M = 5.78$ for school 4 to $M = 7.39$ for school 8. Further, there was significant variation between schools in health knowledge (variance =.037, $\chi^2$ (df=5) = 32.14, $p = .000$).

Baseline value was a strong predictor of post test value, $\gamma = 0.471$, $t= 14.17$, $p = .000$. Being a member of the experimental group was associated with a 0.22 larger amount of correctly answered items at posttest. However, this value did not reach significance as group indicator variable was not a significant predictor of post test health knowledge, $\gamma = .220$, $t=0.931$, $p = .353$, ns. The residual variability was small, as $\sigma^2 = 4.87$. The intraclass correlation coefficient was 0.071 and the sample means appear to be reliable as indicators of the true school means, as reliability = 0.828.

3.3.3.3. Full Conditional model I for Health Knowledge

The results for the conditional model including post test health knowledge as the outcome variable and the pre-test value of health knowledge, age, gender and a variable indicating group membership as predictors specified at level 1 are displayed in Table 20. The point estimate for health knowledge at post test controlling for pre-test was $M = 6.59$ items correct (out of 10 items; SE=0.298).
Further, the baseline estimates for each school at post test ranged from a Mean of $M=5.37$ for school 4 to $M=7.66$ for school 8. Further, there was significant variation between schools in health knowledge (variance =0.291, $\chi^2$ (df=4) = 20.26, $p=.001$). The 95% confidence interval for the mean intercept of health knowledge at post test ranged from 5.56 items correct to 7.90 items correct.

Baseline value was a strong predictor of post test value, $\gamma =0.437$, $t= 7.99$, $p=.000$. As in Conditional model with just pre-test and experimental group membership as predictors, being a member of the experimental group was associated with a 0.22 larger amount of correctly answered items at posttest (but non-significant). There was a significant effect for participant sex, $\gamma =.507$, $t=2.091$, $p=.037$, where females (coded as 1) in the intervention showed higher post test health knowledge compared to males (coded as 0). Controlling for other covariates and pre-test, females scored 0.50 points higher (0.5 items more correct compared to males). The residual variability was small, as $\sigma^2 = 4.78$. The proportion of variance between schools was 5.7%. Finally, the sample means appear to be reliable as indicators of the true school means, as reliability = 0.767.

### 3.3.4. HLM Models Intentions to eat Healthy

#### 3.3.4.1. Unconditional model for Intentions to eat Healthy

The results for the fully unconditional model including intentions to eat healthy as the outcome variable and no predictors specified at level 1 or at level 2, are displayed in Table 21. The point estimate for intentions to eat healthy at baseline was $M=4.60$ (SE=0.146) correct answers (out of 8).

Also displayed in Table 21, are the baseline estimates for each school in the main intervention. The values ranged from a Mean of $M=4.05$ for school 4 to $M=5.11$ for school 7.
Further, there was significant variation between schools in intentions to eat healthy (variance = 0.081, \( \chi^2 (df=5) = 14.29, p=.014 \)). The 95% confidence interval for the mean intercept ranged from 4.04 correct answers to 5.16 correct answers. The intraclass correlation coefficient was 0.017, which is the proportion of variance between schools (1.7%). The sample means appear to be reasonably reliable (reliability=0.567).

The change model further indicated that for the experimental group, change in intentions to eat healthy significantly deviated from zero (significantly larger), \( \gamma = 0.442, t (df=5) = 2.294, p=.023 \), whereas the change for the control group did not deviate significantly from zero.

**3.3.4.2. Conditional model I for Intentions to eat Healthy**

The results for the conditional model including post test intentions to eat healthy as the outcome variable and the pre-test value of intentions to eat healthy and a variable indicating group membership as predictors specified at level1 are displayed in Table 22. The point estimate for health knowledge at post test controlling for pre-test was \( M = 4.47 \) number of healthier options chosen (‘number of items correct’; SE=0.126).

The baseline estimates for each school at post test range from a Mean of \( M= 4.11 \) for school 6 to \( M= 5.13 \) for school 8. Further, there was no significant variation between schools in intentions to eat healthy (variance =0.016, \( \chi^2 (df=5) = 7.96, p=.158 \)). The 95% confidence interval for the mean intercept of intentions to eat healthy at post test ranged from 4.22 to 4.72 out of eight healthier options chosen.

Baseline value was a strong predictor of post test value, \( \gamma = 0.51, t= 10.66, p=.000 \). The group indicator variable was a significant predictor of post test intentions to eat healthy, \( \gamma =0.40, t=2.00, p=0.45 \). Thus, being part of the experimental group resulted in a 0.4 unit higher reported
willingness to choose the healthier option over the unhealthier one. The residual variability was small, as $\sigma^2 = 3.63$. The proportion of variance between schools was very small (0.4%). Finally, the sample means appear to have lower reliability as indicators of the true school means (reliability = 0.236). The reliability estimates, however, are expected to be lower once the model more accurately predicts the data and less variability is left to explain. Raudenbush, Bryk, Cheong, Congdon and Du Toit argue low reliabilities do not invalidate HLM analyses.

In addition, they define low reliability as smaller than 0.100 (Raudenbush & Bryk, 2002 even define low reliability as smaller than 0.05), and for models with such small reliabilities, coefficients that random coefficients may be treated as fixed in subsequent analyses. Thus, the reliabilities reported for the models for the current projects are not considered low and are not considered to have adverse consequences on HLM analyses.

3.3.4.3. Full Conditional model I for Intentions to eat Healthy

The results for the conditional model including post test intentions to eat healthy as the outcome variable and the pre-test value of intentions to eat healthy and a variable indicating group membership as predictors specified at level1 are displayed in Table 23. The point estimate for health knowledge at post test controlling for pre-test is $M = 4.48$ number of healthier options chosen (‘number of items correct’) (SE=0.184).

The baseline estimates for each school at post test range from a Mean of $M= 4.05$ for school 6 to $M= 5.06$ for school 8. Further, there was no significant variation between schools in intentions to eat healthy (variance =0.037, $\chi^2$ (df=5) = 6.60, $p=.157$). The 95% confidence interval for the mean intercept of intentions to eat healthy at post test ranged from 4.10 to 4.86 out of eight healthier options chosen as calculated by: $4.48 \pm 1.96 (0.037)^{1/2} = (4.10, 4.86)$. 
Baseline value was a strong predictor of post test value, $\gamma = 0.51, t= 9.55, p=.000$. The group indicator variable was the only other significant predictor of post test intentions to eat healthy, $\gamma =0.46, t=2.05, p=0.41$. Thus, being part of the experimental group resulted in a 0.46 unit higher reported willingness to choose the healthier option over the unhealthier one.

The residual variability was very small, as $\sigma^2 = 3.61$. The intraclass correlation coefficient was: 0.010 and the sample means appear to have somewhat lower reliability as indicators of the true school means, as reliability = 0.373.

3.4. Additional Analyses

3.4.1. Three level model with classrooms

It can be argued that for the current project, randomization occurred on the level of classrooms, rather than schools. However, in every school in the intervention, physical education was not taught to individual classrooms, but to an entire grade level at once. Furthermore, due to the design of the measurements, those who were invited to the intervention, but did not join the after-school project, could still be control participants. Thus, participation in the intervention had to be treated as an individual level variable in any case.

To evaluate whether the results of the two-level model were different from the results of a three-level model taking into account classroom membership, the analyses were replicated with a third level (class section) added. This resulted in a model with 6 level three units (the schools), 85 level 2 units (the classrooms) and 931 participants (level 1). The results of the analyses were the same in terms of significance (or non-significance) of findings. An example of a fully conditional three-level model for post test aerobic capacity (PACER) score is displayed in Table 24. As in the two level model, experimental group participation was not a significant predictor of post test BMI, $\gamma_{100} = -0.016, \ t = -0.213, \ p=0.83$. There was, as was found in the two level model,
significant variation in the effect of experimental group participation to post test BMI based on school socio-economic status, $\gamma_{101}= 0.0058$, $t= 2.045$, $p=0.041$.

Further, it can be seen that, even though there was significant between classrooms in terms of post test BMI, accounting for between classroom variation, variance= 0.02847, $\chi^2 (df=62) = 86.135$, $p=.0023$, there is no significant variance remaining between schools, variance= 0.00069, $\chi^2 (df=4) = 5.97$, $p = 0.200$.

3.4.2. Missing data

Missing data due to non-responses to items is a frequently occurring problem in survey research, especially with young children as respondents. The reasons for non-responses can be at random, possibly due to fatigue, lack of knowledge, time constraints or accidentally missed items. The question is whether to leave cases with missing data out of analysis, or if a value should be imputed for the case and the blank replaced by the imputed value.

For the current project, large amounts of missing data were found on the composite scales of health knowledge (ten items) and intentions to eat healthy (eight items). The consequence was that if children missed one of the ten or eight items, they had no score on the entire scale, resulting in a missing value. The percentages of children with at least one missing item was very large at pre-test, 39.35 percent for intentions to eat healthy and 40.69 percent missing data for health knowledge. Missing data for the post test values presented a much better picture with 9.89 percent for health knowledge and 12.07 percent for intentions to eat healthy missing.

Multiple Imputation (MI) procedures assume that the missing data is missing at random. The current survey’s composite scales were asked at the end of the survey. This may be related to the large amount of missing data and may cause certain characteristics of participants to be
related to missing data (for example, those who read slower, those who are younger may be more likely to experience fatigue or be time pressured and miss items at the end of the survey).

Garson (2008) argued that an alternative to simply dropping the missing cases from the analyses (which is automatically done in HLM) or accept the data set with multiple imputations, is to run the analysis with dropped cases and then with the imputed values, in an effort to determine what difference the two methods may make. Thus, for the current project, the analyses were repeated with missing data imputed to determine if there were any differences in results between the original data analyses and data analyses with complete data. NORM statistical software was used (Schafer, 1997) to impute the missing data.

Results for the models including imputed data were very similar to the results obtained without the missing data. Minor changes were observed in coefficients, but no changes in significant coefficients occurred. The model with health had the largest percentage of missing data at baseline and posttest and as an illustration the conditional model for health knowledge, with an experimental group indicator and controlling for pre-test value with imputed data is displayed in Table 25. As can be seen, the same effects hold, even though the effects become larger due to smaller standard errors (a result of the more than doubled sample size).

3.4.3. At-Risk children

To test the hypothesis that the effect of the intervention may be different for children who were at-risk at baseline, the models were re-analyzed for this subgroup of students. The sample consisted of 306 students that, at baseline were either above the 85th or 95th percentile, according to CDC BMI standards (NCHS, 2003). Results of the analyses showed the same results as the 2 level conditional models, where no effects of experimental group participation on BMI, aerobic capacity or health knowledge were found (even though there were small changes in the positive
direction of the experimental group). As in the main analyses including the entire sample, for the at-risk group of students, experimental group participation was significantly associated with 0.89 units (healthier options chosen) increased intentions to eat healthy at posttest, \( t=2.833, p=.006 \).

The results for the full conditional model for the dependent variable intentions to eat healthy are summarized in Table 26.

3.5. Process Evaluation

To the authors’ knowledge, this is one of the largest studies of an after-school program aimed at underprivileged Hispanic elementary school children currently known, whereas it was conducted with a fairly small budget. Overall, the project was successful in recruitment of schools for the intervention (6 out of 9 approached schools agreed to participate), and unofficial reports indicate that all schools would be interested in repeating the program.

Aside from minor cuts and bruises, incidents were kept to a minimum. The teachers of the program consisted of student teachers and community health workers. They were successful in managing the intervention, and no classes had to be cancelled due to absences. The student teachers were flexible in filling in for each other in case of an absence and the approach to have three people for a maximum of 50 students seemed appropriate. Teacher turnover rates were low for the student teachers from the UTEP PETE program (0 percent). The research team felt that providing a stipend to the student teachers and the fact that the program was aimed directly at their job interests, strongly contributed to the lack of turnover. Further, the student teachers were enrolled in the University for the semester already, so it was felt that they were very likely to not experience major schedule changes or seek additional or other employment for the course of the semester.
Turnover rates were high for the community health workers (two out of three found other employment during the course of the program). A reason for turnover may have been the official job requirements that were placed on the job title assigned to the community health workers, which resulted in the hiring of individuals who were over-qualified for the job and who continued to seek additional employment (in which they were successful). Turnover rates reported by Kelder et al. (2005) for their after-school intervention program were much higher though, which was likely related to the fact that they relied on volunteers for implementation of the intervention and the fact that the intervention was conducted five days a week as compared to the current project, which implemented the intervention twice a week. In sum, while the study certain had its limitations, the little cost and great enthusiasm for after-school activities on part of the children, appear a step in the right direction toward implementation of structural, accessible and affordable after-school programs in an area in need.

CHAPTER 4: DISCUSSION

The present study aimed to extend previous research conducted among the Hispanic population (Treviño et al., 1998) in an after-school setting as previously tested by Kelder et al. (2005) and evaluate program effectiveness in terms of a combination of physical fitness (BMI, aerobic capacity, health knowledge, intentions to eat healthy) indicators and the self-reported dietary intake and health knowledge variables used by Kelder et al. (2005).

The study was successful in implementing an intervention program in two pilot intervention schools in the spring of 2008 and seven schools in the fall of 2008, of which six schools included both an intervention and a control group. Both the pilot and the main intervention were successful in participant recruitment, participant retention and implementation, experienced limited teacher turnover and almost no accidents. The pilot study resulted in a
reduction in Body Mass Index, increases in aerobic capacity (small effect sizes) and health knowledge (medium effect size), but not intentions to eat healthy (most likely due to small sample sizes, as the effect size was small to medium in size). The main intervention resulted in a marginal reduction in Body Mass Index for experimental group participants, and an increase in aerobic capacity for all participants. Also, consistent with a priori hypotheses, intervention participation was associated with an increase in intentions to eat healthy, but not with changes in health knowledge. Inconsistent with a priori hypotheses, the main intervention did not find differences between experimental and control group participants in terms of BMI, aerobic capacity and health knowledge.

The findings of the current study were largely in accordance with what has been found in previous literature regarding intervention programs: the findings in terms of significant BMI change have been limited, but there is evidence the intervention is successful in changing (mostly self reported) dietary intake or health knowledge or observed physical activity (e.g. Resnicow & Robinson, 1997; Lytle, Stone, Nichaman, Perry et al., 1996; McKenzie, Nader, Strikmiller et al., 1996). However, as mentioned in Stice et al. (2006), only one in five programs finds significant changes in terms of BMI reduction, and these may be programs focused on weight loss, rather than general health. However, while effects are small, findings may be meaningful nonetheless. For example, as children get older, their BMI is assumed to increase naturally, so the effects presenting a slight reduction may be valuable. For example, 6.3 percent of experimental group participants in the study successfully changed their at-risk status from obese to overweight or from overweight to healthy (where overweight was defined as over the 85th percentile in terms of BMI, and obese over the 95th percentile following standards by the Center for Disease Control and prevention (NCHS, 2003)) from pre test to post test. This
translates to 14 experimental group participants children who reduced their health risk, whereas
only 5 worsened their status. In other words: almost three times as many children reduced their
at-risk status than worsened their health status. For the control group, this ratio was 29 (reduced
their risk) to 19 (increased their risk).

This point can further be illustrated by a study by Coleman, Tiller, Sanchez et al., (2005),
where 473 third to fifth graders in El Paso, Texas (whose school was part of the CATCH trial)
were compared to 423 children who were in a school that did not take part in the CATCH trial.
They found that, in a sample of 93 percent Hispanic students from school low in socio economic
status, control schools increased their risk for overweight by 13 percent (girls) and 9 percent
(boys) from 3rd to 5th grade, whereas for CATCH schools, these percentages were 2 percent
(girls) and 1 percent (boys). Thus, even if a trial does not lead to significant reduction in BMI,
the delayed overweight and obesity development can be a substantial health benefit. In addition,
given the similarity of the population in the Coleman et al. (2005) study as compared to the
current study, it strengthens the notion that a slight reduction in BMI as was found in the current
study may be a valuable finding if we expect a substantial percentage of students to actually
increase their risk for overweight and obesity during the grade years our intervention targeted.

Several factors could have been influential regarding the success of the
intervention. For example, while the original study incorporated most recommendations from the
meta-analysis by Stice et al. (2006), such as having an interactive setting, conducting a relatively
brief intervention, focusing on at-risk youth, a number of recommendations were not
implemented due to various reasons. For example, Stice et al. (2006) indicate that interventions
aimed at a single health problem tended to be more effective compared to health programs aimed
at a wide variety of health behaviors. The current program aimed to change healthy eating habits
through health education and also implemented physical activity. During the health education components, a large number of modules were covered, and the simultaneous focus on both physical activity and nutrition may have limited the ability to change healthy behaviors. Also, no specific behavioral target was specified at the start of the study, such as weight loss or increase in physical fitness. Rather, the project was simply labeled as an after-school activity program and while the overall purpose was explained to be health promotion, no specific standards were used as aims. During the health education, however, active participation was occasionally rewarded by providing small incentives. Further, Stice et al. (2006) indicated that programs focused on females only have been shown to be more successful. The original study did not intend to focus on females only, especially because Hispanic boys ages 6-11 are the group that is at highest risk for development of obesity and type 2 diabetes (CDC, 2006).

Further, a surprising finding was that at baseline, health knowledge and intentions to eat healthy foods were associated with a higher BMI, in both the pilot study and the main intervention. While no clear explanation can be provided, it can be hypothesized that children with a higher BMI may be aware of their health status at a young age. Children from 3rd grade on have been previously exposed to the state required FitnessGram® tests, and receive a report card indicating whether their BMI and other physical fitness indicators were in the healthy range for their ages. Thus, children that were overweight may have been already more aware of their health status, or alternatively, more susceptible to acquiescence bias to researchers and PE teachers when asked to report their intentions to eat certain foods. Also, even if children’s intentions are to eat healthy, their actual ability to control their diet may be largely determined by their parents.
Further, an interesting finding was that, consistent with the meta-analysis of 64 randomized trials of obesity programs aimed at reducing BMI by Stice et al. (2006), the effects of the pilot study were somewhat larger than the effects found in the main intervention. Stice et al., (2006) indicated that reasons for larger effects found in pilot studies may be related to increased efforts and enthusiasm for new studies, and increased strength and dose of intervention for a smaller and easier to manage project.

In addition to the reasons mentioned by Stice et al. (2006), for the current study, larger effects found in the pilot study are hypothesized to be associated with several other factors related to study design and measurements. Survey measurements during the pilot study were taken during the after-school program. A disadvantage of this approach was a larger attrition rate as only students who were in attendance the final days completed the survey. However, the participants who weren’t motivated dropped out and thus post test survey measures only included those who remained part of the intervention until the very end. Second, unconscious bias may have influenced project staff and participants (acquiescence) when measurements were conducted in the after-school setting, as researchers know the participants were intervention group participants. In contrast, in the main intervention, all measurements were conducted during Physical Education sessions, where it was not known by the person obtaining the measurements who was in the intervention group and who was not. As such, the pilot effects may be conceptualized as effects ‘for those actively participating in the intervention’ whereas the results of the main intervention is the ‘average effect of those who signed up, regardless of attendance.’

While the advantage of the ‘blind’ measurement (not knowing which child is in the intervention) in the measurements of the main intervention likely reduced measurement bias, a potential disadvantage of completing the measurements during PE is that children in the control
group may interact with their peers who were in the intervention group. This is especially important regarding health knowledge and intentions to eat healthy as children may influence each other’s responses while completing the survey. While attempts were made to keep this interaction to a minimum, this was challenging at times, as a classroom was not available for such a large number of children. Thus, cross group (intervention and control) interactions may have influenced survey answers and biased treatment effects. Regardless, conducting the measurements during PE strongly reduced data attrition rates, which resulted in a measurement retention rate of 83.2 percent.

4.1. Study Limitations

Several limitations of the current study were found. For example, the follow-up period (about 4 months) was fairly short to see changes in clinical indicators such as Body Mass Index and data on individual demographics were limited. For example, the individual variable ethnicity was clearly not appropriate for the current sample, thus limiting our ability to include participant ethnicity as an individual level predictor. Further, given that the mean weighted effect size for BMI change found in previous studies is very small \( r = .04 \) (Stice et al., 2006), there may be a chance that the study has limited power to detect clinical differences. However, Stice et al. (2006) also indicate that among studies that did find a significant effect (about 21% of reviewed studies), the mean weighted effect size for BMI reduction was substantially larger. The power analysis for the original study was based on the effect size reported for studies that did find a significant effect. It was estimated that a sample size of \( n=480 \) would be sufficient to detect the effect similar to the effect sizes of successful studies, and the sample of the study actually reached \( n=931 \).
In addition, effect sizes reported by Kelder et al. (2005) of nutrition knowledge and intentions to eat healthy were larger than the effect sizes expected for clinical measures, which indicates that the current study should have had sufficient power to have detected effects on health knowledge in addition to the effects found for intentions to eat healthy. A reason for not finding the hypothesized effects on health knowledge may have been related to the use of a survey instrument (ASSQ, based on the CATCH program) that was not based on the chosen health education curriculum (Bienestar). The Bienestar curriculum was specifically chosen as it was tailored toward underprivileged Hispanic youth. It could be possible that the lessons taught in the Bienestar curriculum were not closely related to the questions asked on the survey instrument.

Further, given that there were changes found as in a slight reduction in BMI, an increase in aerobic capacity in both experimental group participants and control group participants, intervention diffusion may be a possible explanation for some of the effects found. The design was chosen to reduce the amount of between school variability, as to obtain a clearer effect of participation in the intervention. The after-school setting of an intervention program somewhat reduced the likelihood of the intervention effects ‘spilling over’ to control participants, as control participants were not present during the intervention after-school. However, control and experimental group participants were still in the same grade levels (and received PE simultaneously) and possibly within the same classroom as well (as invited children who did not join the program could still be a control participant). Their interactions with their peers who were part of the intervention program may have been related to the minor positive health changes found in the control group. Also, while all health education materials were in English and in Spanish, and all teachers spoke both English and Spanish, the language of choice for teaching
was often English. Thus, the monolingual Spanish speaking children may have had more difficulties understanding the materials and may have benefited less from the health education.

A major limitation was the intent-to-treat design. Only overall attendance rates were recorded, and were between 60 to 90 percent for each school. The attendance rates at the schools that had lower enrollment were slightly higher compared to schools that had a large amount of children enrolled in the program. However, individual attendance rates were not recorded, making assessment of a potentially more accurate ‘dose-effect’ relation impossible.

A final limitation may be related to the design of the study, where self selection in the intervention group may bias results. To account for this, participants of experimental and control groups were compared on demographic and baseline values, and analyses were controlled for differences found at baseline.

4.2. Future recommendations

Future recommendations include keeping attendance records and possibly use pedometers or accelerometers to estimate the intervention dose and intensity received. Longer follow-up times also recommended reducing possible bias caused by a naturally varying body changes. Also, as children in the experimental and control groups were part of the same schools, contamination of the intervention effect may have occurred. In future programs, the pros of having control and experimental group participants within the same schools (increased similarity) have to be weighed against potential bias of intervention contamination carefully before implementing the intervention. In terms of health education, validation of the Spanish version of the ASSQ would be appropriate. Possibly, the survey could be tailored toward Hispanic populations in the extent that this was not originally done. Also, health education
lessons could be taught in Spanish in some schools and in English in others and treatment effects
could be compared.

Further, socio economic status appears an influential variable, influencing several effects
associated with the outcome variables (including the non-significant effect of intervention group
participation on post test BMI) and deserves future exploration in its interaction with other
variables, and as both an individual and school level variable.

A very valuable avenue for future research, especially for the current population, involves
the association between academic achievement and academic performance. For example, Sallis,
Thomas, McKenzie et al. (1999) indicated that compared to the control condition, a 2-year
intervention program conducted in southern California that included twice as much time
allocated to physical activity did not adversely affect scores on an academic achievement test. In
fact, the scores on the achievement test of the participants in the intervention group were superior
to the control group. Future programs could look at the association between participation in an
after-school activity program and change in performance on the standardized TAKS
examinations.

Further, efforts are currently underway to assess the effects of continued exposure to
after-school physical activity programs. Future programs could further address the effects of
participation in summer programs in addition to programs conducted during the regular school
year, as recent evidence shows that children gain more weight during the summer months than
during the school year (Von Hippel, Powell, Downey & Rowland, 2007).

4.3. Conclusions

The current dissertation described the results of a study evaluating the effects of an after-
school health education and physical activity intervention conducted in elementary schools in El
Paso, Texas. The study was successful in implementing the program in all schools with a relatively small budget. While the findings in regards to physical indicators were modest, all findings were in the expected direction and there was some indication that the control participants slightly improved their health status as well. Given the high risk factors among the population and the limited financial needs and access to care, there is great need and enthusiasm on part of the children and schools to participate in projects that are accessible and address primary prevention of chronic diseases.
Figure 1: Original Study Design

E= Experimental C=Control group; EPISD= El Paso Independent School District
Table 1: Level 2 (School) characteristics

<table>
<thead>
<tr>
<th></th>
<th>Size (n)</th>
<th>SES (%)</th>
<th>Language (%)</th>
<th>Ethnicity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1 (pilot)</td>
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<td>87.5</td>
<td>99.3</td>
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<td>School 2 (pilot)</td>
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<td>34.8</td>
<td>78.0</td>
</tr>
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<td>648</td>
<td>89.8</td>
<td>55.2</td>
<td>98.0</td>
</tr>
<tr>
<td>School 4</td>
<td>561</td>
<td>96.3</td>
<td>80.6</td>
<td>99.6</td>
</tr>
<tr>
<td>School 5</td>
<td>679</td>
<td>82.0</td>
<td>27.4</td>
<td>74.5</td>
</tr>
<tr>
<td>School 6</td>
<td>666</td>
<td>93.2</td>
<td>66.4</td>
<td>98.5</td>
</tr>
<tr>
<td>School 7</td>
<td>709</td>
<td>23.3</td>
<td>22.3</td>
<td>62.2</td>
</tr>
<tr>
<td>School 8</td>
<td>595</td>
<td>49.1</td>
<td>26.4</td>
<td>75.3</td>
</tr>
</tbody>
</table>

(Source: EPISD campus profile, 2008)
### Table 2: Sample sizes across intervention schools

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Experimental</th>
<th>Control</th>
<th>Total</th>
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</thead>
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<tr>
<td>1</td>
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<td>131</td>
</tr>
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<td>School 2 (pilot)</td>
<td>41</td>
<td>0</td>
<td>41</td>
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<tr>
<td>3</td>
<td>School 3</td>
<td>54</td>
<td>152</td>
<td>206</td>
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<td>4</td>
<td>School 4</td>
<td>59</td>
<td>129</td>
<td>182</td>
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<td>5</td>
<td>School 5</td>
<td>56</td>
<td>112</td>
<td>164</td>
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<tr>
<td>6</td>
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<td>7</td>
<td>School 7</td>
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<td>90</td>
<td>122</td>
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<td>8</td>
<td>School 8</td>
<td>29</td>
<td>71</td>
<td>90</td>
</tr>
<tr>
<td>9</td>
<td>School 9</td>
<td>30</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>495</td>
<td>608</td>
<td>1103</td>
<td></td>
</tr>
</tbody>
</table>

Note: school 9 was an added experimental group school that did not have control group participants. Analyses including level 2 variables did not include school 9.
Figure 2: power analysis without covariates

- \( \alpha = 0.050 \)
- \( J = 12 \)
- \( \bar{\delta} = 0.30, \rho = 0.05 \)
- \( \bar{\delta} = 0.40, \rho = 0.05 \)
- \( \bar{\delta} = 0.50, \rho = 0.05 \)
Figure 3: Power analysis with a covariate explaining 50% of the variance
Figure 4: Power analysis with a covariate explaining 75% of the variance and an intraclass correlation of $\rho=.02$
Table 3: Demographic and physical baseline characteristics by Experimental group

<table>
<thead>
<tr>
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<th>Experimental (n=323)</th>
<th>Control (n=608)</th>
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</thead>
<tbody>
<tr>
<td>Sex (% females)</td>
<td>48.4 %</td>
<td>48.4 %</td>
</tr>
<tr>
<td>Age (mean, SD)</td>
<td>9.51 (± 0.96)*</td>
<td>9.68 (± 1.03)</td>
</tr>
<tr>
<td>% self reported ethnicity</td>
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<td></td>
</tr>
<tr>
<td>Hispanic or Mexican</td>
<td>26.9%</td>
<td>26.0%</td>
</tr>
<tr>
<td>White</td>
<td>12.5%</td>
<td>11.5%</td>
</tr>
<tr>
<td>African American</td>
<td>2.8%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Asian</td>
<td>0.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>30.0%</td>
<td>28.8%</td>
</tr>
<tr>
<td>Other</td>
<td>5.3%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Missing</td>
<td>23.5%</td>
<td>23.2%</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>19.58 (± 4.57)</td>
<td>18.51 (± 3.81)</td>
</tr>
<tr>
<td>4th</td>
<td>20.25 (±4.83)</td>
<td>20.43 (± 4.80)</td>
</tr>
<tr>
<td>5th</td>
<td>21.21 (± 3.46)</td>
<td>21.13 (± 5.25)</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>19.93 (± 4.21)</td>
<td>18.80 (± 3.96)</td>
</tr>
<tr>
<td>4th</td>
<td>20.67 (± 5.13)</td>
<td>19.41 (± 3.67)</td>
</tr>
<tr>
<td>5th</td>
<td>21.24 (± 4.80)</td>
<td>20.20 (± 3.75)</td>
</tr>
<tr>
<td>PACER (# of laps)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>17.13 (± 10.35)*</td>
<td>21.96 (± 11.16)</td>
</tr>
<tr>
<td>4th</td>
<td>27.15 (± 16.11)</td>
<td>23.74 (± 13.86)</td>
</tr>
<tr>
<td>5th</td>
<td>19.96 (±12.32)</td>
<td>24.83 (± 12.81)</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>17.00 (±7.04)</td>
<td>19.45 (±10.64)</td>
</tr>
<tr>
<td>4th</td>
<td>20.94 (±10.92)</td>
<td>19.56 (±7.88)</td>
</tr>
<tr>
<td>5th</td>
<td>21.23 (±13.50)</td>
<td>24.05 (±13.57)</td>
</tr>
<tr>
<td>Nutrition Knowledge (0-10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>5.42 (± 2.45)</td>
<td>5.51 (± 2.53)</td>
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<tr>
<td>4th</td>
<td>6.51 (± 2.34)</td>
<td>6.37 (± 2.43)</td>
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<tr>
<td>5th</td>
<td>7.88 (± 2.45)</td>
<td>7.07 (± 2.09)</td>
</tr>
<tr>
<td>Girls</td>
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<td></td>
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<tr>
<td>3rd (Mean, SD)</td>
<td>5.95 (± 2.50)</td>
<td>5.55 (± 2.16)</td>
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<tr>
<td>4th</td>
<td>6.85 (± 2.33)</td>
<td>6.58 (± 2.50)</td>
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<tr>
<td>5th</td>
<td>7.19 (± 2.48)</td>
<td>7.04 (± 2.18)</td>
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<td>Nutrition Intentions (0-9)</td>
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</tr>
<tr>
<td>Boys</td>
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<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>4.08 (± 1.76)</td>
<td>3.79 (± 1.61)</td>
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<tr>
<td>4th</td>
<td>4.50 (± 1.93)</td>
<td>4.17 (± 2.02)</td>
</tr>
<tr>
<td>5th</td>
<td>4.78 (± 1.80)</td>
<td>4.36 (± 1.75)</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd (Mean, SD)</td>
<td>4.63 (± 2.48)</td>
<td>4.09 (± 2.21)</td>
</tr>
<tr>
<td>4th</td>
<td>4.40 (± 1.95)</td>
<td>4.56 (± 2.19)</td>
</tr>
<tr>
<td>5th</td>
<td>4.81 (± 2.02)</td>
<td>4.37 (± 2.00)</td>
</tr>
</tbody>
</table>

* = significantly different on p<.05 from control group at baseline; ** = significantly different on p<.01 from control group at baseline, estimated with independent samples t-tests
Table 4: Power analyses summarized

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<tr>
<th>Graph</th>
<th>ρ</th>
<th>R² covariate</th>
<th>δ</th>
<th>n</th>
<th>Power</th>
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<td>.398</td>
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<td>.40</td>
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<td>.617</td>
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<tr>
<td>Figure 2</td>
<td>.05</td>
<td>0.0</td>
<td>.50</td>
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<td>.802</td>
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<td>Figure 3</td>
<td>.05</td>
<td>.50</td>
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<td>.05</td>
<td>.50</td>
<td>.40</td>
<td>40</td>
<td>.799</td>
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<td>.05</td>
<td>.50</td>
<td>.50</td>
<td>19</td>
<td>.801</td>
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<td>.75</td>
<td>.30</td>
<td>40</td>
<td>.769</td>
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<td>Figure 4</td>
<td>.02</td>
<td>.75</td>
<td>.40</td>
<td>23</td>
<td>.799</td>
</tr>
<tr>
<td>Figure 4</td>
<td>.02</td>
<td>.75</td>
<td>.50</td>
<td>14</td>
<td>.806</td>
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Table 5: Correlations Baseline values Pilot Study

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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<tbody>
<tr>
<td>BMI (kg/m²)</td>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>PACER aerobic capacity</td>
<td>-.634**</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>Nutrition Knowledge</td>
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<td>-.324</td>
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</tr>
<tr>
<td>Nutrition Intentions</td>
<td>.274*</td>
<td>-.351*</td>
<td>-.720**</td>
<td>1.00</td>
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</tr>
<tr>
<td>Sweets intake</td>
<td>-.267*</td>
<td>-.021</td>
<td>-.331**</td>
<td>-.390**</td>
<td>1.00</td>
<td></td>
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<tr>
<td>French Fries Intake</td>
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<td>1.00</td>
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<td>Vegetable Intake</td>
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<td>.012</td>
<td>.228</td>
<td>-.012</td>
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<td>.048</td>
<td>1.00</td>
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<tr>
<td>Fruit Juice consumption</td>
<td>-.049</td>
<td>.128</td>
<td>-.102</td>
<td>-.084</td>
<td>.244**</td>
<td>.171</td>
<td>.350**</td>
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<td>Fruit intake</td>
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<td>-.037</td>
<td>.095</td>
<td>-.027</td>
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<td>.085</td>
<td>.366**</td>
<td>.261**</td>
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<tr>
<td>TV viewing (week)</td>
<td>.054</td>
<td>.083</td>
<td>-.123</td>
<td>-.386**</td>
<td>.183*</td>
<td>.094</td>
<td>-.152</td>
<td>-.008</td>
<td>-.017</td>
<td>1.00</td>
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<td>.127</td>
<td>-.175</td>
<td>-.075</td>
<td>.160</td>
<td>.074</td>
<td>-.043</td>
<td>.015</td>
<td>-.056</td>
<td>.383**</td>
<td>1.00</td>
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</tr>
<tr>
<td>Video Games (week)</td>
<td>.078</td>
<td>-.035</td>
<td>.006</td>
<td>-.254*</td>
<td>.293**</td>
<td>.204*</td>
<td>.033</td>
<td>.142</td>
<td>.008</td>
<td>.346**</td>
<td>.183*</td>
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<td>Video Games (weekend)</td>
<td>.168</td>
<td>-.059</td>
<td>-.375**</td>
<td>-.487**</td>
<td>.297**</td>
<td>.081</td>
<td>-.073</td>
<td>.073</td>
<td>.227*</td>
<td>.281**</td>
<td>.227**</td>
<td>.536**</td>
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</table>

* = significant on p<.05; ** = significant on p<.01
Table 6: Pre-test and Post-test values for the pilot intervention

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<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td>23.20 ±5.33</td>
<td>23.01 ±5.30*</td>
</tr>
<tr>
<td>PACER aerobic capacity (# laps)</td>
<td>22.60 ±11.04</td>
<td>26.02 ±14.39**</td>
</tr>
<tr>
<td>Nutrition Knowledge (0-10)</td>
<td>5.74 ±2.62</td>
<td>7.16 ±2.81+</td>
</tr>
<tr>
<td>Nutrition Intentions (0-9)</td>
<td>4.78 ±2.21</td>
<td>5.48 ±1.83</td>
</tr>
<tr>
<td>Sweets intake</td>
<td>1.85 ±0.92</td>
<td>1.65 ±0.84</td>
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<td>1.88 ±0.83</td>
<td>1.45 ± 0.67*</td>
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<tr>
<td>Vegetable Intake</td>
<td>2.51 ±1.14</td>
<td>2.84 ±0.92</td>
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<tr>
<td>Fruit Juice consumption</td>
<td>2.63 ±0.99</td>
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* = significantly different on p<.05 from control group at baseline; ** = significantly different on p<.01 from control group at baseline, + = marginally significant p<.10, estimated with paired samples’ t-tests
Table 7: Regression analyses Pilot test on change variables

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* = significantly different on $p<.05$ from control group at baseline; ** = significantly different on $p<.01$ from control group at baseline, estimated with independent samples t-tests. All analyses control for age and gender.
Table 8: Correlations Main Intervention Baseline values

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<td>0.059</td>
<td>-0.153**</td>
<td>-0.209**</td>
<td>0.186**</td>
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<td>-0.034</td>
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<td>0.008</td>
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* = significant on p<.05; ** = significant on p<.01
Table 9: Baseline values by school for main intervention nutrition indicators by school

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<th>Health Knowledge</th>
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<td>4.45 ±1.9</td>
<td>6.38 ±2.4</td>
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<tr>
<td>School 4</td>
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<td>6.30 ±2.2</td>
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<tr>
<td>School 5</td>
<td>4.30 ±2.1</td>
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<td>School 6</td>
<td>4.55 ±1.9</td>
<td>6.53 ±2.4</td>
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<td>School 7</td>
<td>4.69 ±1.9</td>
<td>7.78 ±2.1</td>
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<td>School 8</td>
<td>4.05 ±1.9</td>
<td>6.41 ±2.5</td>
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Table 10: Descriptives: Pre and Post values for clinical indicators

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<th>School</th>
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<th>Pre-PACER</th>
<th>Post PACER</th>
<th>Pre-Curls</th>
<th>Post Curls</th>
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<tr>
<td>E</td>
<td>20.70 ±4.9</td>
<td>20.49 ±5.0+</td>
<td>29.8 ±16.0</td>
<td>35.9 ±21.7**</td>
<td>23.4 ±13.3</td>
<td>49.0 ±22.9**</td>
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<td>20.65 ±4.9</td>
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<td>22.4 ±18.6</td>
<td>39.8 ±27.1**</td>
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<td>24.9 ±14.1</td>
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<tr>
<td>E</td>
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<td>25.3 ±12.3</td>
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<td>26.0 ±9.3**</td>
<td>21.9 ±18.9</td>
<td>26.1 ±16.3</td>
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* = significantly different on p<.05 from baseline at posttest; ** = significantly different on p<.01 from baseline at posttest, estimated with independent samples t-tests
<table>
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<th>Control Pre</th>
<th>Control Post</th>
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<td>2.31 ±1.0</td>
<td>2.44 ±1.0*</td>
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<td>1.63 ±0.8</td>
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* = significantly different on p<.05 from baseline at posttest; ** = significantly different on p<.01 from baseline at posttest, estimated with paired samples t-tests
Table 12: Fully Unconditional Model post test BMI

Fixed Effects

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<td>4: -0.21393</td>
<td>5: -0.33134</td>
<td>6: -0.36005</td>
</tr>
<tr>
<td>Experimental</td>
<td>-0.161</td>
<td>.058</td>
<td>-2.787</td>
<td>.039*</td>
</tr>
<tr>
<td>Control</td>
<td>-0.118</td>
<td>.131</td>
<td>-0.899</td>
<td>.410</td>
</tr>
</tbody>
</table>

Random Effects post test model

<table>
<thead>
<tr>
<th>Variance</th>
<th>df</th>
<th>χ2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 BMI Variance</td>
<td>0.54271</td>
<td>5</td>
<td>22.696</td>
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<tr>
<td>Level 1 effect r_{ij}</td>
<td>17.56310</td>
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<td></td>
</tr>
</tbody>
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*=significant on p<.05, **=significant on p<.01
Table 13: Step 2: Conditional model Post-test BMI with Group Indicator variable and Pre-test value

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept:</td>
<td>19.699</td>
<td>0.1033</td>
<td>190.701</td>
<td>5</td>
<td>.000**</td>
</tr>
<tr>
<td>Group:</td>
<td>0.0064</td>
<td>0.0931</td>
<td>0.069</td>
<td>712</td>
<td>.946</td>
</tr>
<tr>
<td>Pre-BMI</td>
<td>0.9635</td>
<td>0.0137</td>
<td>70.533</td>
<td>712</td>
<td>.000**</td>
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</tbody>
</table>

Random Effects

<table>
<thead>
<tr>
<th>Variances</th>
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<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 BMI Intercept</td>
<td>0.0335</td>
<td>5</td>
<td>27.494</td>
<td>0.000**</td>
</tr>
<tr>
<td>Level 1 effect r_{ij}</td>
<td>0.700</td>
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<td></td>
<td></td>
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</tbody>
</table>

* = significant on \( p < .05 \), ** = significant on \( p < .01 \)
### Table 14: Full Conditional Model BMI

#### Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>19.662561</td>
<td>0.069128</td>
<td>284.439</td>
<td>4</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.009420</td>
<td>0.002574</td>
<td>-3.659</td>
<td>4</td>
<td>0.034</td>
</tr>
<tr>
<td>Group</td>
<td>-0.016713</td>
<td>0.072394</td>
<td>-0.231</td>
<td>613</td>
<td>0.818</td>
</tr>
<tr>
<td>SES</td>
<td>0.005416</td>
<td>0.002849</td>
<td>1.901</td>
<td>613</td>
<td>0.057</td>
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<tr>
<td>Sex</td>
<td>0.079308</td>
<td>0.067484</td>
<td>1.175</td>
<td>613</td>
<td>0.241</td>
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<td>SES</td>
<td>0.002457</td>
<td>0.002583</td>
<td>0.951</td>
<td>613</td>
<td>0.342</td>
</tr>
<tr>
<td>Pre BMI</td>
<td>0.964093</td>
<td>0.008545</td>
<td>112.828</td>
<td>613</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>0.000357</td>
<td>0.000366</td>
<td>0.978</td>
<td>613</td>
<td>0.329</td>
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<td>AGE</td>
<td>0.029166</td>
<td>0.035341</td>
<td>0.825</td>
<td>613</td>
<td>0.410</td>
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<td>-0.000400</td>
<td>0.001302</td>
<td>-0.307</td>
<td>613</td>
<td>0.758</td>
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#### Random Effects

<table>
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<th>df</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 BMI Intercept</td>
<td>0.01013</td>
<td>4</td>
<td>10.09706</td>
<td>0.038*</td>
</tr>
<tr>
<td>Level 1 effects r_{ij}</td>
<td>0.6745</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on p < .05, ** = significant on p < .01
Table 15: Fully Unconditional Model Post test Aerobic Capacity (PACER)

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept Post test PACER:</td>
<td>23.78</td>
<td>1.601</td>
<td>14.857</td>
<td>0.000**</td>
</tr>
<tr>
<td>School 3:</td>
<td>30.27749</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:</td>
<td>21.09150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:</td>
<td>23.01653</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:</td>
<td>19.80460</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:</td>
<td>25.56075</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:</td>
<td>22.38462</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Model</td>
<td>1.878</td>
<td>0.830</td>
<td>2.262</td>
<td>0.072</td>
</tr>
<tr>
<td>School 3:</td>
<td>4.00559</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:</td>
<td>2.26241</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:</td>
<td>2.07143</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:</td>
<td>1.65517</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:</td>
<td>3.22549</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:</td>
<td>-3.46154</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>2.448</td>
<td>0.979</td>
<td>2.500</td>
<td>0.053</td>
</tr>
<tr>
<td>Control</td>
<td>1.876</td>
<td>0.826</td>
<td>2.272</td>
<td>0.071</td>
</tr>
</tbody>
</table>

Random Effects post test model

<table>
<thead>
<tr>
<th>Variance</th>
<th>df</th>
<th>(\chi^2)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 PACER Variance</td>
<td>13.45</td>
<td>5</td>
<td>60.54</td>
</tr>
<tr>
<td>Level 1 effect (r_{ij})</td>
<td>182.14</td>
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</tr>
</tbody>
</table>

*=significant on p<.05, **=significant on p<.01
Table 16: Step 2: Conditional model Post-test Aerobic capacity (PACER) with Group

Indicator variable and Pre-test value

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept:</td>
<td>23.417</td>
<td>1.009</td>
<td>23.212</td>
<td>5</td>
<td>.000**</td>
</tr>
<tr>
<td>Group</td>
<td>0.736</td>
<td>0.812</td>
<td>0.907</td>
<td>657</td>
<td>.365</td>
</tr>
<tr>
<td>Pre test Pacer</td>
<td>0.800</td>
<td>0.032</td>
<td>25.357</td>
<td>657</td>
<td>.000**</td>
</tr>
</tbody>
</table>

Random Effects

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>Variance</th>
<th>df</th>
<th>χ2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 PACER Intercept</td>
<td>4.71887</td>
<td>5</td>
<td>31.435</td>
<td>0.000**</td>
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<tr>
<td>Level 1 effect r_{ij}</td>
<td>91.680</td>
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</tbody>
</table>

* = significant on p < .05, ** = significant on p < .01
**Table 17: Full Conditional Model PACER**

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>24.452099</td>
<td>1.118687</td>
<td>21.858</td>
<td>4</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>0.003699</td>
<td>0.041389</td>
<td>0.089</td>
<td>4</td>
<td>0.934</td>
</tr>
<tr>
<td>Group</td>
<td>0.126173</td>
<td>1.060960</td>
<td>0.119</td>
<td>4</td>
<td>0.912</td>
</tr>
<tr>
<td>SES</td>
<td>0.003508</td>
<td>0.040649</td>
<td>0.086</td>
<td>4</td>
<td>0.936</td>
</tr>
<tr>
<td>Sex</td>
<td>-1.180909</td>
<td>0.989962</td>
<td>-1.193</td>
<td>4</td>
<td>0.299</td>
</tr>
<tr>
<td>SES</td>
<td>0.018870</td>
<td>0.037077</td>
<td>0.509</td>
<td>4</td>
<td>0.637</td>
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<td>Pacer pre-test</td>
<td>0.754498</td>
<td>0.034680</td>
<td>21.75</td>
<td>557</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>0.004298</td>
<td>0.001296</td>
<td>3.317</td>
<td>557</td>
<td>0.001**</td>
</tr>
<tr>
<td>Age</td>
<td>0.172705</td>
<td>0.427816</td>
<td>0.404</td>
<td>557</td>
<td>0.686</td>
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<tr>
<td>SES</td>
<td>-0.017958</td>
<td>0.015662</td>
<td>-1.147</td>
<td>557</td>
<td>0.252</td>
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Random Effects

<table>
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<tr>
<th>Variable</th>
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<th>df</th>
<th>$\chi^2$</th>
<th>p</th>
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<tbody>
<tr>
<td>Level 1 PACER Intercept</td>
<td>6.81954</td>
<td>4</td>
<td>28.06817</td>
<td>0.000**</td>
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<td>Level 1 effects $r_{ij}$</td>
<td>88.40</td>
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</table>

* = significant on $p<.05$, ** = significant on $p<.01$
### Table 18: Fully Unconditional Models Post test Health Knowledge

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept post test knowledge</td>
<td>6.70</td>
<td>0.306</td>
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</tr>
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<td>School 3:</td>
<td>6.12805</td>
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<td>4:</td>
<td>5.61194</td>
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<tr>
<td>5:</td>
<td>7.29167</td>
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<td>6:</td>
<td>6.36458</td>
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<tr>
<td>7:</td>
<td>7.79070</td>
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<tr>
<td>8:</td>
<td>7.10169</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Change Model</td>
<td>0.253</td>
<td>0.255</td>
<td>0.994</td>
<td>0.366</td>
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<td>0.98750</td>
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<td>-0.07937</td>
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<td></td>
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<td>7:</td>
<td>0.02326</td>
<td></td>
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<tr>
<td>8:</td>
<td>1.07317</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>0.242</td>
<td>0.223</td>
<td>1.086</td>
<td>0.280</td>
</tr>
<tr>
<td>Control</td>
<td>0.209</td>
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Random Effects post test model

<table>
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<tr>
<th></th>
<th>Variance</th>
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<th>χ²</th>
<th>p</th>
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<tbody>
<tr>
<td>Level 1 Health Knowledge</td>
<td>0.613</td>
<td>5</td>
<td>62.94</td>
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</tr>
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<td>Level 1 effect r_{ij}</td>
<td>5.99478</td>
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</tr>
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</table>

*= significant on \( p < .05 \), **= significant on \( p < .01 \)
### Table 19: Step 2: Conditional model Post-test Health Knowledge with Group Indicator variable and Pre-test value

**Fixed Effects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.724527</td>
<td>0.281701</td>
<td>23.871</td>
<td>5</td>
<td>0.000**</td>
</tr>
<tr>
<td>Group</td>
<td>0.220425</td>
<td>0.233904</td>
<td>0.942</td>
<td>425</td>
<td>0.347</td>
</tr>
<tr>
<td>Health Knowledge</td>
<td>0.471196</td>
<td>0.044381</td>
<td>10.617</td>
<td>425</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

**Random Effects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variance</th>
<th>df</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Knowledge Intercept</td>
<td>0.367</td>
<td>5</td>
<td>32.41</td>
<td>0.000**</td>
</tr>
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<td>Level 1 effects $r_{ij}$</td>
<td>4.875</td>
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</tbody>
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* = significant on $p<.05$, ** = significant on $p<.01$
Table 20: Full Conditional Model Health Knowledge

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.594356</td>
<td>0.297477</td>
<td>22.168</td>
<td>4</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.023822</td>
<td>0.011735</td>
<td>-2.030</td>
<td>4</td>
<td>0.109</td>
</tr>
<tr>
<td>Group</td>
<td>0.220723</td>
<td>0.260445</td>
<td>0.847</td>
<td>358</td>
<td>0.398</td>
</tr>
<tr>
<td>SES</td>
<td>-0.009699</td>
<td>0.010408</td>
<td>-0.932</td>
<td>358</td>
<td>0.352</td>
</tr>
<tr>
<td>SEX</td>
<td>0.506879</td>
<td>0.242388</td>
<td>2.091</td>
<td>358</td>
<td>0.037</td>
</tr>
<tr>
<td>SES</td>
<td>0.019150</td>
<td>0.009959</td>
<td>1.923</td>
<td>358</td>
<td>0.055</td>
</tr>
<tr>
<td>AGE</td>
<td>0.005665</td>
<td>0.140184</td>
<td>0.040</td>
<td>358</td>
<td>0.968</td>
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<tr>
<td>SES</td>
<td>-0.004788</td>
<td>0.005867</td>
<td>-0.816</td>
<td>358</td>
<td>0.415</td>
</tr>
<tr>
<td>PRE-TEST Knowledge</td>
<td>0.436902</td>
<td>0.054667</td>
<td>7.992</td>
<td>358</td>
<td>0.000**</td>
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<tr>
<td>SES</td>
<td>0.002673</td>
<td>0.002432</td>
<td>1.099</td>
<td>358</td>
<td>0.273</td>
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</table>

Random Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variance</th>
<th>df</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRCPT1, U0j</td>
<td>0.29125</td>
<td>4</td>
<td>20.26114</td>
<td>0.001**</td>
</tr>
<tr>
<td>Level 1 effects r[ij]</td>
<td>4.78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on p<.05, ** = significant on p<.01
### Table 21: Fully Unconditional Models Post test Intentions to eat Healthy

#### Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept post test intentions</td>
<td>4.602</td>
<td>0.146</td>
<td>31.552</td>
<td>0.000**</td>
</tr>
<tr>
<td>School 3:</td>
<td>4.56627</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:</td>
<td>4.05344</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:</td>
<td>4.78814</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:</td>
<td>4.52222</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:</td>
<td>5.10843</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:</td>
<td>4.66667</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Model</td>
<td>0.296</td>
<td>0.104</td>
<td>2.846</td>
<td>0.005**</td>
</tr>
<tr>
<td>Experimental</td>
<td>0.442</td>
<td>0.006</td>
<td>2.294</td>
<td>0.023*</td>
</tr>
<tr>
<td>Control</td>
<td>0.243</td>
<td>0.148</td>
<td>1.647</td>
<td>0.160</td>
</tr>
</tbody>
</table>

#### Random Effects post test model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variance</th>
<th>df</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Health Intentions</td>
<td>0.081</td>
<td>5</td>
<td>14.29</td>
<td>0.014*</td>
</tr>
<tr>
<td>Level 1 effect rij</td>
<td>4.605</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on p<.05, ** = significant on p<.01

Note: the fully unconditional model with intercept that randomly varied across groups did not converge after 99 iterations. The model reported is the model with fixed random intercept.
Table 22: Step 2: Conditional model Post-test Health Intentions with Group Indicator variable and Pre-test value

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept:</td>
<td>4.465603</td>
<td>0.126474</td>
<td>35.309</td>
<td>5</td>
<td>0.000**</td>
</tr>
<tr>
<td>Group:</td>
<td>0.398321</td>
<td>0.198884</td>
<td>2.003</td>
<td>420</td>
<td>0.045*</td>
</tr>
<tr>
<td>Health Intentions</td>
<td>0.507178</td>
<td>0.047599</td>
<td>10.655</td>
<td>420</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

Random Effects

<table>
<thead>
<tr>
<th>Variance</th>
<th>df</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Intentions Intercept</td>
<td>0.01649</td>
<td>5</td>
<td>7.95674</td>
</tr>
<tr>
<td>Level 1 effects r_{ij}</td>
<td>3.630</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on $p<.05$, ** = significant on $p<.01$
Table 23: Full Conditional Model Intentions

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.476087</td>
<td>0.183771</td>
<td>24.357</td>
<td>4</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.006327</td>
<td>0.007217</td>
<td>-0.877</td>
<td>4</td>
<td>0.430</td>
</tr>
<tr>
<td>Group</td>
<td>0.463435</td>
<td>0.226645</td>
<td>2.045</td>
<td>359</td>
<td>0.041*</td>
</tr>
<tr>
<td>SES</td>
<td>-0.003985</td>
<td>0.009254</td>
<td>-0.431</td>
<td>359</td>
<td>0.667</td>
</tr>
<tr>
<td>SEX</td>
<td>0.121014</td>
<td>0.206261</td>
<td>0.587</td>
<td>359</td>
<td>0.557</td>
</tr>
<tr>
<td>SES</td>
<td>0.001972</td>
<td>0.008316</td>
<td>0.237</td>
<td>359</td>
<td>0.813</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.073792</td>
<td>0.116151</td>
<td>-0.635</td>
<td>359</td>
<td>0.525</td>
</tr>
<tr>
<td>SES</td>
<td>-0.000164</td>
<td>0.004774</td>
<td>-0.034</td>
<td>359</td>
<td>0.973</td>
</tr>
<tr>
<td>Pre-test Intentions</td>
<td>0.507095</td>
<td>0.053081</td>
<td>9.553</td>
<td>359</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.000274</td>
<td>0.002160</td>
<td>-0.127</td>
<td>359</td>
<td>0.899</td>
</tr>
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Random Effects

<table>
<thead>
<tr>
<th></th>
<th>Variance</th>
<th>df</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRCPT1, U_{0j}</td>
<td>0.03684</td>
<td>4</td>
<td>6.60281</td>
<td>0.157</td>
</tr>
<tr>
<td>Level 1 effects r_{ij}</td>
<td>3.609</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on \( p < .05 \), ** = significant on \( p < .01 \)
Table 24: Full conditional three-level model of Post test BMI

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>19.662</td>
<td>0.059</td>
<td>332.01</td>
<td>4</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.0093</td>
<td>0.0022</td>
<td>-4.211</td>
<td>4</td>
<td>0.019*</td>
</tr>
<tr>
<td>Group</td>
<td>-0.0157</td>
<td>0.0739</td>
<td>-0.213</td>
<td>613</td>
<td>0.831</td>
</tr>
<tr>
<td>Group SES</td>
<td>0.0058</td>
<td>0.0028</td>
<td>2.045</td>
<td>613</td>
<td>0.041*</td>
</tr>
<tr>
<td>Sex</td>
<td>0.0720</td>
<td>0.0665</td>
<td>1.083</td>
<td>613</td>
<td>0.280</td>
</tr>
<tr>
<td>Sex SES</td>
<td>0.0023</td>
<td>0.0025</td>
<td>0.910</td>
<td>613</td>
<td>0.364</td>
</tr>
<tr>
<td>Age</td>
<td>0.0291</td>
<td>0.0382</td>
<td>0.760</td>
<td>613</td>
<td>0.447</td>
</tr>
<tr>
<td>Age SES</td>
<td>-0.0004</td>
<td>0.0014</td>
<td>-0.278</td>
<td>613</td>
<td>0.781</td>
</tr>
<tr>
<td>BMI</td>
<td>0.964</td>
<td>0.0084</td>
<td>114.75</td>
<td>613</td>
<td>0.000</td>
</tr>
<tr>
<td>BMI SES</td>
<td>0.0004</td>
<td>0.0004</td>
<td>1.049</td>
<td>613</td>
<td>0.295</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 1 and 2 Random Effect</th>
<th>Variance</th>
<th>df</th>
<th>Chi-square</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept r_0jk</td>
<td>0.028</td>
<td>62</td>
<td>86.13</td>
<td>0.023*</td>
</tr>
<tr>
<td>Level 1 e_ijk</td>
<td>0.640</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 3 Random Effect</th>
<th>Variance</th>
<th>df</th>
<th>Chi-square</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Intercept u_{00k}</td>
<td>0.00069</td>
<td>4</td>
<td>5.969</td>
<td>0.200</td>
</tr>
</tbody>
</table>

* = significant on \( p < .05 \), ** = significant on \( p < .01 \)
### Table 25: Conditional Model Intentions for Health Knowledge with Imputed Data

**Fixed Effects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept:</td>
<td>6.724527</td>
<td>0.281701</td>
<td>23.871</td>
<td>5</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>IMPUTED:</strong> Intercept</td>
<td>6.622727</td>
<td>0.258918</td>
<td>25.578</td>
<td>5</td>
<td>0.000</td>
</tr>
<tr>
<td>Group:</td>
<td>0.220425</td>
<td>0.233904</td>
<td>0.942</td>
<td>425</td>
<td>0.347</td>
</tr>
<tr>
<td><strong>IMPUTED:</strong> Group:</td>
<td>0.084110</td>
<td>0.202205</td>
<td>0.416</td>
<td>898</td>
<td>0.677</td>
</tr>
<tr>
<td>Pre- Health Knowl.</td>
<td>0.471196</td>
<td>0.044381</td>
<td>10.617</td>
<td>425</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>IMPUTED:</strong> Pre Health kn.</td>
<td>0.497288</td>
<td>0.027356</td>
<td>18.178</td>
<td>898</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Random Effects**

<table>
<thead>
<tr>
<th></th>
<th>Variance</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Knowledge Interc.</td>
<td>0.367</td>
<td>5</td>
<td>32.41</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>IMPUTED</strong> level 1 intercept</td>
<td>0.324</td>
<td>5</td>
<td>56.90</td>
<td>0.000</td>
</tr>
<tr>
<td>Level 1 effects ( r_{ij} )</td>
<td>4.875</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IMPUTED:</strong> ( r_{ij} )</td>
<td>4.907</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on \( p<.05 \), ** = significant on \( p<.01 \)
Table 26: Full Conditional Model Intentions for At-risk Children (over 85\textsuperscript{th} percentile)

Fixed Effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.673985</td>
<td>0.271071</td>
<td>17.243</td>
<td>4</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.008319</td>
<td>0.011565</td>
<td>-0.719</td>
<td>4</td>
<td>0.512</td>
</tr>
<tr>
<td>Group</td>
<td>0.891704</td>
<td>0.314809</td>
<td>2.833</td>
<td>168</td>
<td>0.006**</td>
</tr>
<tr>
<td>SES</td>
<td>0.002943</td>
<td>0.013413</td>
<td>0.219</td>
<td>168</td>
<td>0.827</td>
</tr>
<tr>
<td>SEX</td>
<td>0.089378</td>
<td>0.295706</td>
<td>0.302</td>
<td>168</td>
<td>0.763</td>
</tr>
<tr>
<td>SES</td>
<td>-0.013435</td>
<td>0.012922</td>
<td>-1.040</td>
<td>168</td>
<td>0.300</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.073792</td>
<td>0.116151</td>
<td>-0.635</td>
<td>359</td>
<td>0.525</td>
</tr>
<tr>
<td>SES</td>
<td>-0.000164</td>
<td>0.004774</td>
<td>-0.034</td>
<td>359</td>
<td>0.973</td>
</tr>
<tr>
<td>Pre-test Intentions</td>
<td>0.5261</td>
<td>0.071686</td>
<td>7.339</td>
<td>168</td>
<td>0.000**</td>
</tr>
<tr>
<td>SES</td>
<td>-0.0009</td>
<td>0.003086</td>
<td>-0.286</td>
<td>168</td>
<td>0.775</td>
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</tbody>
</table>

Random Effects

<table>
<thead>
<tr>
<th></th>
<th>Variance</th>
<th>df</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRCPT1, U_{0j}</td>
<td>0.107</td>
<td>4</td>
<td>7.936</td>
<td>0.093</td>
</tr>
<tr>
<td>Level 1 effects r_{ij}</td>
<td>3.040</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant on p < .05, ** = significant on p < .01
LITERATURE CITED


McKenzie, T.L., Nader, P.R., Strikmiller, P.K., Yang, M., Stone, E.J., Perry, C.L., Taylor, W.C.,


Salmeron, J., Manson, J. E., Stampfer,M. J., Colditz, G. A.,Wing, A. L.,&Willett, W. C.


APPENDICES

APPENDIX 1

Project LEAN

AFTER-SCHOOL STUDENT QUESTIONNAIRE

The following questions ask about foods and meals you eat, and what you know about healthy eating and exercise. This is not a test! We want to learn about what kids your age eat and know about healthy eating and about exercise. Nobody will know the answers you give. No one will ever know what you say unless you tell them. Your name will never be used. Answering these questions is up to you. Your choice about answering or not answering the questions will not change the way you are treated in this program!

Please be as honest as you can (which means not lying):

Name or Number: ________________________________

1. What grade are you in? _________________

2. How old are you? _____ years old

3. Are you a boy or a girl?  Boy  Girl

4. How do you describe yourself?

   Hispanic or Mexican
   White
   Black
   Asian
   Don't Know
   Other

INSTRUCTIONS: Please CIRCLE your answer.

5. Yesterday, did you eat French fries or chips?

Chips are potato chips, tortilla chips, cheetos, corn chips, or other snack chips
   a. No, I didn’t eat any French fries or chips yesterday.
   b. Yes, I ate French fries or chips 1 time yesterday.
   c. Yes, I ate French fries or chips 2 times yesterday.
   d. Yes, I ate French fries or chips 3 or more times yesterday.
   e. Don’t know

6. Yesterday, did you eat any vegetables?

Vegetables are salads; boiled, baked and mashed (which means crushed into a soft mass) potatoes (but not fries or fried potatoes); and all cooked and uncooked ‘greens’ like carrots, broccoli, lettuce, tomatoes, onions, corn etc.
Do not count French fries or chips.
   a. No, I didn’t eat any vegetables yesterday.
   b. Yes, I ate vegetables 1 time yesterday.
   c. Yes, I ate vegetables 2 times yesterday.
   d. Yes, I ate vegetables 3 or more times yesterday.
   e. Don’t know

7. Yesterday, did you eat beans such as baked beans, or beans in a sauce (such as pinto beans, baked beans, kidney beans refried beans, or pork and beans)?

Do not count green beans.
   a. No, I didn’t eat any beans yesterday.
   b. Yes, I ate beans 1 time yesterday.
   c. Yes, I ate beans 2 times yesterday.
   d. Yes, I ate beans 3 or more times yesterday.
   e. Don’t know

8. Yesterday, did you eat fruit (like oranges, apples, bananas, grapes etc.)?

Do not count fruit juice.
   a. No, I didn’t eat any fruit yesterday.
   b. Yes, I ate fruit 1 time yesterday.
   c. Yes, I ate fruit 2 times yesterday.
   d. Yes, I ate fruit 3 or more times yesterday.
   e. Don’t know

9. Yesterday, did you drink fruit juice?

Fruit juice is a drink, like orange juice, apple juice, or grape juice.
Do not count sodas, fruit punch, kool-aid, sports drinks such as gatorade, and other drinks that taste like fruit, but are not really fruit?

a. No, I didn’t drink any fruit juice yesterday.
 b. Yes, I drank fruit juice 1 time yesterday.
 c. Yes, I drank fruit juice 2 times yesterday.
 d. Yes, I drank fruit juice 3 or more times yesterday.
 e. Don’t know

10. Yesterday, did you eat sweet rolls, doughnuts, cookies, brownies, pies, or cake?

a. No, I didn’t eat any of the foods listed above yesterday.
 b. Yes, I ate one of these foods 1 time yesterday.
 c. Yes, I ate one of these foods 2 times yesterday.
 d. Yes, I ate one of these foods 3 or more times yesterday.
 e. Don’t know

11. Yesterday, did you exercise or join in sports activities that made your heart beat fast and made you breathe hard for at least 20 minutes. (For example: playing catch or tag with your friends, playing basketball, running, skating, fast dancing, swimming laps, playing tennis, bicycling etc.)?

a. YES
 b. NO
 c. Don’t know

12. How many TV shows, DVD’s or videos do you watch during the week?

a. I didn’t watch TV, DVD or
 b. 1
 c. 2
 d. 3 or more
 e. Don’t know

13. How many TV shows, DVD’s or videos do you watch during the weekend?

a. I didn’t watch TV, DVD or
 b. 1
 c. 2
 d. 3 or more
 e. Don’t know

14. During the week, how many hours per day do you usually play video games like Nintendo, playstation, or use the computer to surf the Internet?

a. I don’t play video games or use the c
 b. Less than 1 hour a day
 c. 1-2 hours a day
 d. 3-4 hours a day
 e. More than 4 hours a day
 f. Don’t know
15. During the weekend, how many hours per day do you usually play video games like Nintendo, PlayStation, or use the computer to surf the Internet?
   a. I don’t play video games or use the computer
   b. Less than 1 hour a day
   c. 1-2 hours a day
   d. 3-4 hours a day
   e. More than 4 hours a day
   f. Don’t know

16. During the past 12 months, on how many sports teams did you play?
   Sports teams are teams like baseball teams, soccer teams, swim teams, basketball teams, dance teams, gymnastic teams, football teams or any other club teams where you exercise.
   a. 0 teams
   b. 1 team
   c. 2 teams
   d. 3 or more teams
   e. Don’t know

17. Do you ever read the labels on the back of food where it lists (show example) of what is in the food?
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know

18. Foods are split up in groups for foods that are a lot alike. From which food group should you eat the most servings each day? Choose only one group.
   a. bread, cereals, rice, pasta (like spaghetti or noodles)
   b. foods like milk, cheese, yoghurt
   c. fats, oils, sweets (like cookies and candy)
   d. fruits (bananas, apples, oranges etc.)
   e. meats (like steak, bacon, beef), fish (like tuna), chicken, beans, eggs, nuts
   f. vegetables (like carrots, avocados, green beans, green peppers, lettuce, salads)
   g. don’t know

19. From which food group should you eat the fewest servings (a serving is a portion that one person eats as part of a meal) each day? Choose only one group.
   a. bread, cereals, rice, pasta (like spaghetti or noodles)
   b. foods like milk, cheese, yoghurt
   c. fats, oils, sweets (like cookies and candy)
   d. fruits (bananas, apples, oranges etc.)
   e. meats (like steak, bacon, beef), fish (like tuna), chicken, beans, eggs, nuts
   f. vegetables (like carrots, avocados, green beans, green peppers, lettuce, salads)
   g. don’t know

20. How many total servings of fruits (bananas, apples, oranges etc.) and vegetables (salads, carrots, potatoes—but not fries—‘greens’) should you eat each day?
   a. At least 2
   b. At least 5
   c. At least 8
   d. At least 10
   e. I don’t know
21. What you eat can make a difference in your chances of getting ill or sick when you are grown up.
   a. YES
   b. NO
   c. I don’t know

22. The foods that I eat and drink now are healthy.
   a. Yes, all of the time
   b. Yes, sometimes
   c. No
   d. Don’t know

23. I like to try new foods.
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know

24. Do you ever eat cereal that has a lot of grains, such as raisin bran (a cereal that is darker, and most of the time not as sweet)?
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know

25. Do you ever eat whole wheat bread (whole wheat bread is darker in color, harder bread, sometimes with it comes with seeds; white bread is light, white and soft and most of the time does not have seeds)?
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know

26. Do you ever drink fruit juice (explain that Gatorade, fruit punch etc. are not fruit juice)?
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know

27. Do you ever eat fruit (bananas, apples, oranges, grapes etc.) for lunch?
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know

28. Do you ever eat vegetables (broccoli, onions, tomatoes, baked potatoes, green peppers etc.) for dinner?
   a. Almost always or always
   b. Sometimes
   c. Almost never or never
   d. Don’t know
INSTRUCTIONS: Please **CIRCLE** one of the two foods that you would pick if you had to choose just one.

29. If you were at the movies, which one would you pick?

a. popcorn with butter  
b. popcorn without butter

30. Which would you pick to drink?

a. regular milk  
b. low fat or skim milk (explain here)

31. Which food would you eat for a snack?

a. candy bar  
b. fresh fruit

32. Which would you do if you were going to eat a piece of chicken?

a. leave on the skin  
b. take off the skin and not eat the skin

33. Which food would you ask for?

a. frozen yogurt  
b. ice cream

34. Which would you choose to cook if you were going to help make dinner at home?

a. French fries  
b. baked potato
35. Which would you do if you were going to eat cooked vegetables?

- [ ] a. eat without butter
- [x] b. add butter

36. Which would you order if you were going to eat at a fast food restaurant?

- [ ] a. a regular hamburger
- [ ] b. a grilled chicken sandwich

INSTRUCTIONS: Please CIRCLE ONE of the two foods that you think is better for your health.

37.

- [ ] a. whole wheat bread
- [x] b. white bread

38.

- [ ] a. broiled beef
- [ ] b. broiled fish

39.

- [ ] a. cereal
- [x] b. eggs and bacon

40.

- [ ] a. beef
- [ ] b. beans
42. a. chicken  
    b. hamburger

43. a. whole milk  
    b. low fat or skim milk

44. a. frozen yogurt  
    b. ice cream

45. a. green salad  
    b. French fries

46. a. French fries  
    b. baked potato

46. a. 100% fruit juice  
    b. fruit punch
Hendrik ‘Dirk’ de Heer was born in Voorburg, the Netherlands as the youngest of four children of Ineke Valster and Frans de Heer. He came to El Paso in 2001 on a Track and Field scholarship. In 2004, he graduated cum laude with a B.A. in Psychology and Management. He was a 16 time all-conference selection, two-time Academic All-American and a member of two WAC conference championship teams, a member of the Student Athlete Advisory Committee, and the head of the community outreach subcommittee from 2002-2004. In 2004, he received the Golden Miner Award for the most well-rounded graduating student athlete regarding achievements in academics, athletics and community service. In August of 2005, he completed his M.S. at the Rijks Universiteit Groningen, the Netherlands in Industrial/ Organizational Psychology. The day after graduation, he returned to UTEP to start the PhD program in Health Psychology. In addition to pursuing the PhD, Hendrik has completed a Master’s of Public Health at the University of Texas at Houston Health Science Center in the spring of 2009. While pursuing his PhD, he worked as a teaching assistant and as a research associate for the department of Psychology and the College of Health Sciences mainly on projects aimed at cardiovascular disease prevention, physical activity and nutrition education.

As a UTEP graduate student, he received the Frank B Cotton Memorial Scholarship in 2007 and 2008, and the Outstanding Graduate Student Award for the department of Psychology 2008-2009. His dissertation project titled “Project Learning to Exercise through Academics in your Neighborhood” was funded ($74,542) by the Center for Border Health Research and supervised by Dr Osvaldo F Morera, associate professor in Psychology. For continuation of his dissertation project through the spring of 2009, he received a grant from the Hispanic Health Disparities Research Center. Dirk has presented his research at regional, national and international conferences such as the Society of Behavioral Medicine and the American Public
Health Association. He has authored or co-authored six peer-reviewed publications in journals such as *Personality and Individual Differences*, *Gait and Posture*, the *Journal of Sport Science and Medicine* and others and several more are under review.

Hendrik aims to continue to conduct research in either an academic or applied setting, and will continue his job search in Washington D.C. to join his newlywed wife Brooke, a fellow PhD student in Psychology.

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