TRANS-COMMUNITY APPROACHES TO CHILDHOOD OBESITY PREVENTION AND TREATMENT

by

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and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

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STATEMENT BY AUTHOR

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Dedication

For the Activa Y Sana families

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ABSTRACT

The Trans-community Approaches to Childhood Obesity Prevention and Treatment Study (Activa Y Sana) was a two-year (August 2006 to May 2008) intervention in one hundred and forty-one 3rd and 4th grade children and their parents from four schools in the Sunnyside School District in Tucson, Arizona. Activa was designed to expand upon schools as an intervention venue, and was the first to test the feasibility and impact of a multi-level, or "trans-community" approach (involving children, their parents or caregivers, schools, and community agencies) on the prevention of childhood weight gain in an at-risk Mexican-American population.

Families were assigned to one of three interventions, depending upon which school the child attended: Level 1, state-mandated nutrition- and physical activity-based health curricula; Level 2, Level 1 curricula plus an after-school program; or Level 3, Level 1 + Level 2 activities, plus a family intervention.

Primary endpoints of this study were changes in child BMI z-score, % fat, abdominal circumference, activity levels and food intake, psychosocial characteristics and correlates of these measures.

The three manuscripts contained herein represent the main findings of this pilot study. Identifying potential mediators and describing their influence on childhood overweight is essential to development of successful interventions. In Study #1, the findings for the examination of correlates of child BMI z-score and % fat are reported. Activa Y Sana was designed to test whether combining different levels of intervention would have a greater impact on child weight. In Study #2, the results of this trans-

community intervention on child weight status is discussed. The majority of evidence-based obesity prevention programs in use today were not designed with minorities in mind, and the continued scarcity of research in Latino populations has hindered the development of culturally-competent interventions that might reduce overweight prevalence. The challenges encountered while implementing Activa Y Sana, a population-specific intervention, are described in Study #3.

The results from this research may be used to help inform the design of future intervention programs with the goal of reducing the burden of obesity in Mexican-American children, currently the fastest-growing segment of the U.S. population.

CHAPTER I – BACKGROUND/SIGNIFICANCE

"Overweight and obesity may soon cause as much preventable disease and death as cigarette smoking. People tend to think of overweight and obesity as strictly a personal matter, but there is much that communities can and should do to address these problems."

-- Former Surgeon General Dr. David Satcher

INTRODUCTION

The Trans-community Approaches to Childhood Obesity Prevention and Treatment Study, henceforth referred to as "Activa Y Sana," was 2-year intervention with 3rd and 4th grade children and their parents/caregivers from four schools in the Sunnyside School District in Tucson, Arizona. The primary aim of this study was to test the impact of a "trans-community" approach (defined as a collaborative effort involving two or more community-based organizations with similar goals) on the prevention of childhood weight gain in a predominantly Mexican-American population.

Families were assigned to one of three intervention conditions, depending upon which school the child attended. Children in Level 1 received the state-mandated nutrition- and physical activity-based health curriculum; children in Level 2 received Level 1 curricula plus an after-school program; children in Level 3 received Level 1 + Level 2 activities, plus a family program. Primary endpoints of this study were changes in child BMI z-score, % fat, abdominal circumference, activity levels and food intake and correlates of these measures.

The three manuscripts contained herein represent the main findings of this pilot study, as well as a description and discussion of the challenges encountered with recruitment/retention and implementation of the intervention.

EXPLANATION OF THE PROBLEM, CONTEXT, AND SCOPE

At a time in which public health officials have described the increase in childhood obesity as an "epidemic" and the most critical public health threat facing children today," attempts at halting or even slowing this trend on a national level have been unsuccessful, and interventions limited in both their impact and reach.(Flegal 1999; Sokol 2000; Kohn and Booth 2003; Lobstein, Baur et al. 2004)

The shortage of proven strategies to prevent unhealthy weight gain in children may in part, be attributed to our limited understanding of the precise etiology of childhood obesity. Fundamentally, overweight is the consequence of an imbalance in energy intake relative to expenditure, which in children, is profoundly influenced by familial and environmental factors.(Davison and Birch 2001; Hill, Wyatt et al. 2003) Exactly which factors are responsible remains uncertain. Identifying potential mediators and describing their influence on childhood overweight is essential to development of sound and successful interventions. Herein, the findings for the examination of correlates of child BMI z-score and % fat are reported in Study #1 (Appendix A), including child behaviors (e.g. vegetable intake, physical activity habits) and child perception of parental influences (e.g. parental encouragement/support/modeling), with the aim of identifying possible risk factors for child overweight.

In addition to gaining an improved understanding of the factors related to the development of childhood overweight, there is a great need for cost-effective interventions that result in clinically significant health gains. Past preventive efforts have been largely unsuccessful because the majority of programs target children in a single

and limited environment - often a school. Although schools provide a means to reach a large audience of children, they are limited in their resources and ability to improve child nutrition and physical activity behavior. Treatment interventions also have failed to significantly impact child weight status, as they historically have not involved parents in the behavioral change process. Activa Y Sana was designed to expand upon schools as an intervention venue, and test whether combining different levels of intervention (one of which includes parents and caregivers) would have a greater impact on child weight. In Study #2 (Appendix B), the results of this trans-community intervention on child weight status is discussed. Comparisons across levels allowed us to assess the added impact of each level, or intervention dose, on child weight status compared to the more typical school-based program.

Evidence to date suggests a one-size-fits-all approach to treating childhood overweight is not effective, and interventions must be tailored to fit the target population. As obesity is a particular concern in minority populations who suffer from disproportionately high rates of weight-related diseases such as Type 2 diabetes and cardiovascular disease, Activa Y Sana was tested in a predominantly Hispanic population. (Perez-Escamilla and Putnik 2007), The majority of evidence-based obesity prevention programs in use today were not designed with minorities in mind, and the continued scarcity of research in Latino populations (Mexican-American as well as those born in other Latin countries) has hindered the development of culturally-competent interventions that might reduce overweight prevalence.(Yancey, McCarthy et al. 2004)

The challenges encountered while implementing Activa Y Sana, a population-specific intervention, are described in Study #3 (Appendix C).

The results from this research may be used to help inform the design of future intervention programs with the goal of reducing the burden of obesity in Hispanic children and parents, currently the fastest-growing segment of the U.S. population.(Bureau 2004)

STUDY AIMS

Activa Y Sana was designed to test the effectiveness of a trans-community intervention on child weight-related behaviors and weight gain. Child and parent psychosocial correlates of child weight were also examined.

The aims addressed in work reported herein include:

PRIMARY AIMS

Aim 1: To identify correlates of child BMI z-score and % fat among at-risk and overweight children.

Aim 2: To evaluate and compare the efficacy of three intervention levels in preventing unhealthy weight gain (BMI and body composition) among children at-risk or overweight.

Secondary Aims: To evaluate the acceptability and feasibility of the intervention for schools, community partners, children, and families to refine and develop the program and to develop program materials for future large-scale studies and community dissemination.

BACKGROUND/SIGNIFICANCE

Obesity Prevalence

Over the past three decades, obesity prevalence has increased dramatically, rising from 13% to 32% between 1960 and 2004. (Wang and Beydoun 2007) At this time, 66% of adults are estimated to be either overweight or obese. (Wang and Beydoun 2007) An increase in childhood obesity has been observed across all age groups, more than tripling in children and adolescents between the ages of 6 and 19 years since the 1970's.(Wang and Beydoun 2007) Current data suggest a childhood overweight prevalence of 17%, with an additional 35% children and adolescents at risk for overweight. (Ogden, Flegal et al. 2002; Hedley, Ogden et al. 2004; Ogden, Carroll et al. 2006; Wang and Beydoun 2007)

Defining Overweight and Obesity

Body mass index (weight (kg)/height $(m)^2$) is widely used to assess obesity in both children and adults because of its correlation with percent body fat and obesity-related health problems. (Kuczmarski 2000; W.H.O. 2003) Adult overweight and obesity is defined by BMI cutpoints of 25 and 30 kg/m^2, respectively, as recommended by the National Heart, Lung and Blood Institute's and North American Association for the Study of Obesity expert committee. (Obesity 2000) Similar recommendations regarding adult waist circumference (>35 inches for women, >40 inches for men) define excessive *central adiposity*, considered a better predictor of future obesity-related comorbidities than overall BMI. (Zhu, Heymsfield et al. 2005)

Childhood overweight is defined as a BMI greater than or equal to the sex- and age-specific 95th BMI percentile, while "at risk for overweight" is a BMI greater than or equal to the 85th but less than 95th percentiles.(Kuczmarski 2000) Developed by the Centers for Disease Control and Prevention and intended for assessment of children aged 2-19 years, these cutpoints are based on data collected from five national studies (NHES II and III and NHANES I, II, and III) conducted between the early 1960's and 1994. Although there exists no national recommendation regarding classification of central obesity in children and adolescents, it has been suggested that a child identified as very overweight (i.e. >99th percentile BMI-for-age) has a high probability of having excess body fat, adverse lipid and blood pressure levels, and an increased risk for adult obesity. (Freedman, Mei et al. 2007)

Health and Economic Costs of Obesity

Obesity has been defined as "the condition of excess body fat to the extent that health is impaired." (WHO 2000) A high body mass index during childhood is associated with undesirable lipid levels, insulin levels, and blood pressure (Freedman, Dietz et al. 1999) (Reilly, Methven et al. 2003) (Must and Strauss 1999) while the tendency for child BMI to track into adulthood (Guo, Roche et al. 1994) (Power, Lake et al. 1997; Must and Strauss 1999; Reilly, Methven et al. 2003) places obese children at increased risk for adult obesity and its related co-morbidities (e.g. type 2 diabetes and cardiovascular disease), (Berenson, Srinivasan et al. 1998), (Li, Li et al. 2004) as well as early mortality. (Freedman, Dietz et al. 1999) (Reilly, Methven et al. 2003) (Must and Strauss 1999) (Guo, Roche et al. 1994) (Power, Lake et al. 1997; Must and Strauss 1999; Reilly,

Methven et al. 2003) (Berenson, Srinivasan et al. 1998), (Li, Li et al. 2004) (Guo and Chumlea 1999; Engeland, Bjorge et al. 2004)(Guo and Chumlea 1999)

In addition to suffering adverse physical consequences, research suggests overweight children experience lower self-esteem as compared to their normal weight peers (Strauss, Smith et al. 1985; Braet, Merviele et al. 1997; Pierce and Wardle 1997; Strauss 2000), leading to increased rates of sadness, loneliness, nervousness, and higher rates of alcohol and tobacco use. (Strauss 2000)

Treating obesity and its associated health problems in children also presents a significant (and growing) fiscal challenge. Average estimated annual costs associated with obesity treatment in youth - based on 2001 constant U.S. dollar value - rose to 127 million dollars between 1997 and 1999.(Wang and Dietz 2002) As childhood obesity rates continue to climb unchecked, this economic burden is expected to increase substantially.

RISK FACTORS

The precise etiology of childhood overweight remains poorly understood. Fundamentally, overweight is a consequence of an imbalance in energy intake relative to expenditure – a condition in children that is profoundly influenced by familial and environmental factors.

Environmental Factors: Secular Trends in Nutrition, Activity, and Sedentary Behaviors

Trends in energy intake

Large portion sizes and ready availability of high-calorie food have been hypothesized as possible contributors to America's growing waistline.

Portion size of commonly consumed foods has increased over the past 30 years. (Nielsen and Popkin 2003) Food availability and food advertisement have also increased, with large quantities of palatable, high-calorie, low-cost foods aggressively marketed and available for purchase almost everywhere. At the same time, healthier, lower-energy foods (primarily fruits and vegetables) have increased in price, (Monsivias and Drewnowski 2007) making them less attractive to consumers when compared to cheaper and more convenient packaged goods.

Over 50% of the family food budget is now spent on foods outside of the home, primarily at restaurants. (Medicine 2005) A majority of restaurants -particularly fast food chains - have attracted and retained customers by offering "value" meals that provide double the food quantity for only a small increase in price. Limited prospective data suggest the consequences of eating more frequently away from home may be higher total energy intakes and poorer diet quality. (Bowman, Gortmaker et al. 2004; Taveras, Berkey et al. 2005)

It has been suggested that changes in the school food environment may also be promoting over-consumption of calories. Although USDA-funded school breakfast and lunch programs are required to adhere to the Dietary Guidelines for Americans, a 1998 School Nutrition Dietary Assessment Study reported that over 75% of schools provided meals exceeding the recommended guidelines for fat (and calorie) content. (Kids 2007) The increasing availability of competitive foods, or foods sold outside of the designated

school breakfast or lunch, has also been proposed as a possible obesogenic factor. In 2005, 94% of elementary schools reported selling competitive foods during school hours. (Parsad and Lewis 2006) Typically high in taste appeal to children, competitive foods displace healthier dietary options. Failure in school policy to discourage the ready availability and promotion of these foods has been correlated with increased child weight status (BMI) at the school level. (Kubik, Lytle et al. 2005)

While dietary patterns such as child-led snacking, frequent fast food consumption, and large portion sizes have been associated with both excessive fat and total calorie intake in cross-sectional studies of children (and longitudinal studies of adults), they have not been definitively shown to be significantly related to the development of obesity in children. (Huang, Howarth et al. 2004) (Moreno and Rodriguez 2007) The absence of a clear causal relationship between excess energy intake or diet composition and overweight onset in longitudinal studies may in part, be due to the challenges encountered when attempting to measure dietary intake. Food frequency questionnaires are the most practical choice for large-scale epidemiological investigations of diet and weight. However, there are very few questionnaires designed specifically for children. An alternative to this approach, the 24-hour recall, improves portion size estimation, but as children may not recall food they have consumed (or selectively recall food), resulting in significant measurement error. Parents provide an additional source of information, although this presents the additional issue of third person recall (as well as a potentially biased source of information).

Trends in energy expenditure – physical activity

Secular declines in the amount of youth physical activity are frequently cited as one of the primary contributors to the childhood obesity problem. However, the available data do not fully support existence of such a trend for children and adolescents, although it is possible that methodological difficulties inherent in measuring child physical activity have masked its true occurrence. (Eisenmann, Bartee et al. 2002) Limited data from the Youth Risk Behavior Survey (YRBS) support existence of a decline in physical activity among adolescents (grades 9-12) over the past decade, with the proportion of adolescents defined as inactive increasing from 10.9% (in 1993) to 14.7% (in 2003) in boys but not girls.(Brownson, Boehmer et al. 2005; Adams 2006)

Although data on temporal trends in physical activity are scarce, existing data from the 2003 Youth Risk Behavior Surveillance (YRBS) and 2002 Youth Media Campaign Longitudinal Study suggest that a majority of children and adolescents currently do not meet recommended physical activity levels (60 minutes per day, at least 30 of which are moderate-to-vigorous). (Duke, Huhman et al. 2003; Grunbaum, Kann et al. 2004) Twenty-three percent of children (age 9-12 yrs) in the YRBS 2003 Study had not engaged in any leisure-time physical activity (outside of school) in the previous 7 days, and 61.5% had not participated in any organized physical activities.

Similar trends have occurred within schools, as the recent emphasis on high stakes testing has diverted already-limited school resources away from subjects that are not tested on the exams (such as physical education). A 2000 School Health Policies and Programs Study found that fewer than one-half of elementary schools in the U.S. required physical education for grades 1 through 5. (Johnston, O'Malley et al. 2006) Active

transport to and from school (e.g. walking or cycling) also has declined over the past few decades. National survey data suggest the proportion of schoolchildren engaging in active transport has decreased from 50% in 1969 to 15% in 2003. (US Dept Transportation 1972; Agency 2003)

National surveys (as well as several smaller studies) have also captured age-related changes in physical activity as children move through middle childhood and into adolescence. (Saris, Elvers et al. 1986; Ross and Pate 1987; Sallis 1993) (Kimm, Glynn et al. 2002) The data suggest that participation in physical activity decreases with age - estimated rates of decline range from 1.8-2.7% per year in boys between the ages of 10 and 17 to 2.6-7.4% per year in girls (same age range). (Sallis 1993)

As difficult as child physical activity trends have been to quantify, establishing a causal relationship between physical activity and child weight status has been equally challenging. A smaller study found a relationship between inactivity and weight in preschool boys (but not girls) (Trost, Sirard et al. 2003) while a study of 47 boys and girls 5-10 years old that measured total energy expenditure using double-labeled water found body fat and BMI to be significantly inversely correlated with physical activity levels. (Abbott and Davies 2004) One of the largest studies (n=11,887) enrolling a nationally representative sample of boys and girls ages 10-15 years demonstrated an inverse association between physical activity and relative BMI in girls and overweight boys over one year. (Berkey, Rockett et al. 2003) Several other longitudinal observational studies (Gordon-Larsen, McMurray et al. 1999; Gordon-Larsen, Adair et al. 2002) and one cross-sectional study (Lohman, Ring et al. 2006) enrolling nationally representative samples of

children and adolescents have reported similar significant protective associations between physical activity and overweight; however, other national cross-sectional data do not agree with these findings, with data from two larger studies (YRBS, NHANES III) and several smaller studies (Obarzanek, Schreiber et al. 1994; Rowlands, Eston et al. 1999) finding both significant and non-significant relationships between physical activity and child overweight. (Crespo, Smit et al. 2001; Dowda, Ainsworth et al. 2001; Eisenmann, Bartee et al. 2002; Levin, Lowry et al. 2003)

Physical activity studies in children suffer from similar measurement challenges as dietary studies, which may be one of the limiting factors in establishing causal relationships between energy expenditure and overweight onset.

Trends in energy expenditure - sedentary behaviors

Second only to sleeping, television viewing takes up the greatest amount of children's leisure time, making it a frequently used index of sedentary behavior. (Dietz and Strasberger 1991) And unlike other sedentary activities, television viewing has the potential to impact both sides of the energy balance equation, through displacement of more physically active pursuits as well as the added influence of food advertisting. (Wiecha, Peterson et al. 2006)

Available data (primarily from cross-sectional studies) suggest that the majority of children and adolescents in the U.S. exceed the American Academy of Pediatrics television viewing recommendations ($\leq$2 hours per day), although these numbers have remained stable over the past few decades. (Biddle, Gorely et al. 2004) (Pediatrics 2001) Surveys estimate children and adolescents spend an average of 3 hours per day watching

television, with more than 5 hours daily of screen time if including video games and computer screen time. (Rideout, Roberts et al. 2005)

Several cross-sectional studies have suggested a dose-response relationship between hours of TV time and body fat percentage and risk of overweight.(Andersen, Crespo et al. 1998; Gortmaker, Must et al. 1999; Hancox and Poulton 2006) Possible causal mechanisms that have been suggested include television-induced decreases in resting energy expenditure, displacement of more active pursuits, advertising-driven increases in energy consumption, and mindless eating while viewing leading to greater energy intake. (Jordan and Robinson 2008)

Limited prospective studies have concluded that child TV viewing is a risk factor for subsequent development of overweight. (Dietz and Strasberger 1991; Hancox and Poulton 2006) and randomized controlled intervention trials have demonstrated decreased BMI, waist circumference, and triceps skinfold thickness in elementary school children who reduced their exposure to television and other screen media.(Epstein, Valoski et al. 1995; Robinson 1999; Epstein, Paluch et al. 2000)

Despite the above evidence suggesting a causal relationship between television and child weight, two recent meta-analyses (N=24 studies and 41 independent samples, and N=30 studies, respectively) separately concluded that TV viewing time has a non-significant effect on weight gain.(Biddle, Marshall et al. 2003; Marshall, Biddle et al. 2004)

Family and Individual-Level Risk Factors

Heritability of body weight

The heritability of body weight and fatness has been confirmed by numerous studies although its precise contribution is only a best estimate, explaining between 55% and 85% of the variance in adiposity in the adult population. (Maes, Neale et al. 1997) (Bulik, Sullivan et al. 2003; Schousboe, Willemsen et al. 2003; Romeis, Grant et al. 2004; Malis, Rasmussen et al. 2005) A recent study demonstrated the heritability of BMI and waist circumference in a large cohort (n=5,092 pairs) of preadolescent (age 8-11 yrs) twins.(Wardle, Carnell et al. 2008) Assessment of zygosity (via parental questionnaire regarding physical similarity to offspring and DNA testing) revealed substantial heritability for BMI and waist circumference founding this sample, explaining 77% of the variance in both, along with evidence for a modest (10%) shared environment effect.(Wardle, Carnell et al. 2008)

Ethnicity/Race

Minorities are disproportionately affected by obesity and its co-morbidities, with national data suggesting a higher prevalence (compared to whites) of almost 10 percentage points. (Wang and Beydoun 2007) Data from NHANES, BRFSS, and the Add Health study show large racial/ethnic differences in obesity for children as well as adults. Among children and adolescents 6-19 years of age, non-Hispanic Whites have the lowest combined prevalence of overweight and at risk for- overweight (28.2%) compared to non-Hispanic Black (35.4%) and Hispanic children and adolescents (39.9%). Hispanic boys (aged 6-11 years) had the highest combined prevalence of overweight and risk for overweight (43.9%) among young males, and non-Hispanic black girls (12-19 years) had the highest prevalence of combined overweight and risk for overweight at 41.9% among

young females.(Freedman, Khan et al. 2006; Wang and Zhang 2006) The disproportionate rise in obesity prevalence among ethnic minorities has been attributed to race/ethnic differences in lifestyle behaviors and economic disadvantages as well as genetic factors.(Cossrow and Falkner 2004)

Socioeconomic Status (SES)

Lower socioeconomic status (SES), a condition more prevalent among ethnic minorities in the United States, has been hypothesized as a predictor of obesity. Recent studies that included SES and ethnicity as predictors of BMI in their models concluded that while the association between SES and obesity does vary by ethnicity, ethnic differences in BMI cannot be fully explained by SES. (Zhang and Wang 2004; Ogden, Carroll et al. 2006; Wang and Zhang 2006) The prevalence of obesity has increased in all SES groups since the 1970's, and these trends are complex, with inconsistent patterns noted within age, gender, and racial/ethnic categories. Overall, persons with less education demonstrate higher obesity prevalence (27.4% for less than high school education compared to 15.7% for college and above), except Black women who inexplicably have the lowest prevalence within the least educated group. (Wang and Beydoun 2007) This inconsistency may be a result of the way SES is calculated. Education and income, the two most commonly used markers, do not appear to reflect SES equally across ethnic groups. (Zhang and Wang 2004; Wang and Zhang 2006)

Acculturation

Acculturation, defined as "the process by which immigrants adopt the attitudes, values, customs, beliefs, and behaviors of a new culture," is associated with significant

lifestyle change, often leading to increased risk for chronic disease.(Abraido-Lanza, White et al. 2004) Assimilation to mainstream U.S. culture has been shown to significantly impact obesity prevalence among foreign-born persons, with higher acculturation associated with less healthy food patterns, a more sedentary lifestyle, and increased risk for overweight.(Kaiser, Melgar-Quinonez et al. 2001; Gordon-Larsen, Harris et al. 2003) (Families 1998)

Family Environment

Parents influence their children in many ways: through the use of specific parenting practices, through modeling of behaviors and attitudes, and through interpersonal interactions within the family setting. Parents also help create the home environment that can promote or discourage certain behaviors, beliefs, and social norms. (Rhee 2008) Interactions between parents and children are complex, making it difficult to attribute specific adult and child characteristics and behaviors to development of overweight. To date, the focus has been primarily on child feeding practices, exposure to- and availability of foods, portion size as determined by parents, and modeling of health-related behaviors. Recently, investigators have begun to explore the more global concepts of parenting style and family functioning as they relate to child weight.

Parent Feeding Practices

Parental concerns about child weight lead to specific patterns of feeding that may contribute to the development of unhealthy eating practices and subsequently, overweight. Examples of this include limiting access to desired foods, reward contingency, and encouraging “clean plate” practices.

Encouraging children to "clean their plate" has been linked (although not consistently) with increased child weight and total time spent eating. (Klesges, Malott et al. 1986; Klesges, Stein et al. 1991) Parent BMI also appears to be a factor - children of obese parents are more compliant in cleaning their plate compared to children of non-obese mothers, and obese mothers use more prompting than non-obese mothers. (Lumeng and Burke 2006) Like adults, children override internal hunger cues when presented with larger portion sizes, eating more in quantity and in calories. (Rolls, Engell et al. 2000; Orlet Fisher, Rolls et al. 2003) It remains unclear whether larger portions are directly related to increased weight, or if children are able to compensate for larger portion sizes by decreasing the size of subsequent meals.

Use of external rewards to encourage eating (disregarding whether the child is full), may impair self-regulatory ability, possibly leading to greater calorie consumption over time.(Birch, McPhee et al. 1987) Use of rewards may also affect food preferences (a predictor of consumption) – e.g. "you may have dessert if you eat your vegetables." In this example, vegetables become a means to an end, which increases the value or liking of the dessert item and decreases preference for the vegetables, resulting in the opposite of the intended effect. (Birch, Zimmerman et al. 1980; Birch, Birch et al. 1982; Newman and Taylor 1992)

Restricting food intake has also been associated with a reduced awareness of internal hunger/satiety cues. In experimental studies, restricting food in preschool-age children resulted in a greater intake in food when restrictions were lifted, eating in the absence of hunger, and increased risk for overweight. (Fisher and Birch 1999; Fisher and

Birch 2000; Fisher, Mitchell et al. 2002) These findings differed by sex, being more commonly found among girls than boys. Food restriction is thought to increase risk for overweight because it teaches children to place a higher value on "forbidden" foods, making these foods more appealing and encouraging excess consumption when no longer restricted. However, since the majority of studies examining this topic have been cross-sectional (and in white populations), it is impossible to say whether this is a causal relationship, or one that would be significant in minority populations.

Limited research suggests that parenting practices differ by ethnicity. Focus groups (n=101 families) investigating feeding practices used by socio-economically diverse White, Hispanic, and African-American mothers of preschool children found the majority of mothers believed they should always determine the portion sizes for children, and that children should not be relied upon to decide when they are full.(Sherry, McDivitt et al. 2004) Hispanic mothers also reported pressuring their children to "eat enough" more frequently than their White and African-American counterparts, and less readily identified overweight children as actually being overweight.(Sherry, McDivitt et al. 2004) Focus groups in low-income Hispanic mothers of preschool children also found that mothers had difficulty identifying and acknowledging overweight in their children, and believed that child weight status was largely determined by genetics, rather than being a dynamic result of food and activity behaviors. (Crawford, Gosliner et al. 2004)

Exposure to- and availability of foods in the home

Children require repeated exposure to unfamiliar foods in order to develop a preference for them. (Wardle, Herrera et al. 2003) As food preference is a significant

predictor of consumption (Nicklas, Baranowski et al. 2001), frequent exposure to- and ready availability of healthy foods in the home are potentially important strategies in improving diet quality and preference for lower calorie foods.

Modeling of health-related behaviors

Parent modeling of healthy diet and physical activity behaviors appear to influence child health behavior. Consistent associations have been found between parent and child eating behaviors and attitudes.(Fisher, Mitchell et al. 2002; Brown and Ogden 2004) Limited studies have examined this topic longitudinally and found positive correlations between family and peer influences and fruit, juice, and vegetable consumption in younger (Gibson, Wardle et al. 1998; Cullen, Baranowski et al. 2001; Fisher, Mitchell et al. 2002) and older children. (Woodward, Boon et al. 1996) The positive effect of modeling appears to hold true across diverse social and ethnic groups – e.g. modeling of a low fat food pattern by African-American parents was associated with a similar pattern in their children(Baranowski, Klesges et al. 2004), and the acceptance of spicy foods by Mexican children was greater when older members of the family modeled consumption of these foods. (Rozin 1990)

Parental modeling, support, and encouragement of physical activity have also been shown to positively predict physical activity levels in children. In two comprehensive reviews of child physical activity correlates, parental support, direct help from parents, and opportunities to exercise were all found to be significantly associated with increases in recommended amounts of physical activity.(Sallis, Prochaska et al. 2000; van der Horst, Chin A. Paw et al. 2007)

Parenting style**,** a more global concept than parenting practices, provides the emotional backdrop for subsequent parent-child interactions. Research has suggested that parenting style (e.g. authoritative, authoritarian, permissive, or neglectful) modifies the relationship between parenting practices and child behavior, with more positive parenting styles (characterized by emotional warmth and involvement) associated with more positive child outcomes – e.g. higher school achievement, better self-regulatory ability, and fewer risk-taking behaviors.(Steinberg, Lamborn et al. 1992; Steinberg, Lamborn et al. 1994; Radziszewska, Richardson et al. 1996; Glasgow, Dornbusch et al. 1997; Aunola, Stattin et al. 2000) This appears to translate to weight outcomes as well. A positive parenting style (authoritative, or firm, but warm and accepting) has been associated with lower risk of child overweight, (Rhee, Lumeng et al. 2006), greater fruit and vegetable intake, and increased physical activity engagement (Schmitz, Lytle et al. 2002; Kremers, Brug et al. 2003), while a more authoritarian style (or strict disciplinarian approach) has been associated with 5-fold increased risk for overweight. (Rhee, Lumeng et al. 2006)

The global concept of family functioning may also be related to child weight. Dysfunction in its aspects – e.g. managing daily routines, accomplishing tasks, communicating with family members, and fulfilling parenting roles – may negatively impact child health status.(Jacobs and Fiese 2007) Family mealtime frequency is often used as a proxy for family functioning. Children and adolescents who eat meals with other family members have been found to consume healthier foods and meet the recommended dietary goals more often. (Stanek, Abbott et al. 1990; Neumark-Sztainer,

Hannan et al. 2003) e.g. family meal frequency has been inversely correlated with soft drink consumption and breakfast skipping in adolescents, and positively correlated with fruit & vegetable consumption, and dairy food consumption. (Videon and Manning 2003) Not only do family mealtimes present an ideal setting in which parents can model healthy behaviors, the act of coming together to eat suggests that families are able to function cohesively as a unit, and it is this improved functioning that is responsible for healthier eating and activity behaviors.

INTERVENTIONS TO PREVENT AND TREAT CHILD OVERWEIGHT

Although the phrase "intervention study" is used rather loosely in this review, it is important to distinguish between interventions specifically designed to reduce weight (treatment programs) and those designed to prevent overweight (prevention programs). Weight reduction or treatment studies are typically of shorter duration, involve fewer participants, and are characterized by direct (often intensive) contact between study staff and participants, while prevention studies typically target larger audiences with more general health recommendations and interventions.

A systematic review of 22 obesity prevention programs (conducted between 1990 and 2005) by the Cochrane Collaboration concluded that "the current evidence suggests that many diet and exercise interventions…in children are not effective in preventing weight gain, but can be effective in promoting a healthy diet and increased physical activity levels." (Summerbell, Waters et al. 2006) Of the 22 studies, 10 were long-term (more than 12 months in duration); only 6 of the long-term programs used a combined physical activity and nutrition intervention and of these 6, only one resulted in a

significant difference in the primary outcome (weight status). (Summerbell, Waters et al. 2006) Nineteen were school-based and only 2 were family-based, targeting non-obese children of overweight or obese parents. (Summerbell, Waters et al. 2006) One of the family interventions targeted a low-income audience. (Summerbell, Waters et al. 2006)

As previously discussed, the focus on high stakes testing has shifted the focus away from a well-rounded school curriculum (including health and physical education) to one focused solely on academics. This has left very few resources to support schools in carrying out successful interventions. School interventions require a number of committed people from different areas –e.g. district officials, school principals, staff and teachers, and parents or volunteers – as well as time and facilities.

Two multi-center school-based interventions in the U.S., CATCH (Coordinated Approach to Child Health) and Pathways, attempted to "bridge" between school and home by adding a family education component to promote lifestyle change beyond the school. These programs offered healthier food in schools, enhanced physical education and health education curriculum. While CATCH was successful in changing child eating and physical activity, this intervention did not impact child BMI. (Luepker, Perry et al. 1996) Pathways demonstrated small changes on some dietary aspects as well as knowledge and attitudes related to nutrition, but had no demonstrated impact on physical activity or BMI. (Caballero, Clay et al. 2003)

Despite some progress, there remains insufficient evidence supporting school-only programs for obesity prevention. (Story, Kaphingst et al. 2006)

FAMILY INVOLVEMENT IN CHILD WEIGHT MANAGEMENT

A review of family interventions funded by NIH concluded that programs targeting improvements within the home environment (through direct involvement of parents and caregivers) produce "significant, long-term results" on healthy eating and activity behaviors, but not weight. (Wadden, Brownell et al. 2004)

A 2006 survey of state chronic disease directors (CDDs) explored which obesity prevention and reduction strategies experts believed were most important – CDDs reserved the highest rating for "parents should role model for and teach healthy eating to their children, as well as stress the importance of physical activity." (Health 2006)

Other experts have come to similar conclusions. With regard to TV and child weight, the majority of the strategies recommended by health experts (e.g. eliminating TV from child bedroom, encouraging mindful viewing through monitoring of screen time, turning off the TV while eating) (Jordan and Robinson 2008) directly involve parents or caregivers.

While the number of publications reporting on childhood obesity prevention and treatment strategies and studies indicate a global recognition of this health crisis and movement toward a better understanding of the problem, the number of successful interventions (defined as weight normalization) involving parents or other family members remain limited in number.

Existing programs had sample sizes ranging between 30 and 60 children and with only a few exceptions recruited from primarily upper-SES white families, and employed a variety of intervention strategies including altering food intake and increasing physical activity/reducing sedentary behavior, and parent and child behavioral modification

training. (Appendix E contains a summary of these studies.) (Brownell, Kelman et al. 1983; Epstein, Koeske et al. 1984; Epstein, Wing et al. 1986; Graves, Meyers et al. 1988; Epstein, Valoski et al. 1990; Flodmark, Ohlsson et al. 1993; Epstein, McKenzie et al. 1994; Epstein, Valoski et al. 1995; Epstein, Paluch et al. 2000; Epstein, Paluch et al. 2004; Edwards, Nicholls et al. 2006; Dreimane, Safani et al. 2007) (Kirschenbaum, Harris et al. 1984; Israel, Stolmaker et al. 1985; Israel, Solotar et al. 1990; Golan, Fainaru et al. 1998; Golan and Crow 2004; Jiang, Xia et al. 2005; Sacher, Chadwick et al. 2005; Golley, Magarey et al. 2007; Kalavainen, Korppi et al. 2007; Nowicka, Pietrobelli et al. 2007; Rodearmel, Wyatt et al. 2007; Shelton, LeGros et al. 2007) Interventions were typically most intense during the first 8 and 16 weeks, involving group sessions lasting 45-90 minutes taught by clinical psychologists or interventionists with equivalent training. The majority of the programs were conducted out of obesity clinics or hospital outpatient settings (and by the same investigator here in the United States), which limits generalizability to other populations. (Summerbell, Ashton et al. 2006) Typical length of follow-up was 1 year, and losses to follow-up varied between 3-58% (median 15%). While overall, programs showed significantly greater effects on child weight with parental support than without (regardless the type of intervention), any changes in health behaviors and weight management attributed to the interventions appear to wane over time. Recent reviews have identified only two – by the same investigator recruiting upper-SES, white participants with intact families - that have demonstrated sustained behavior change past one year. (Epstein, Valoski et al. 1990; Epstein, Paluch et al. 2000)

Interventions have been even less successful in eliciting weight change in minority children, primarily due to a lack of participation of minorities in intervention and research programs. Reasons for recruitment and retention difficulties in minority populations are unclear – hypothesized reasons include competing challenges that many minorities (who are also limited resource audiences) face may interfere with attendance, and cultural differences (or a mismatch between what the investigators and participants perceive to be relevant information) result in a loss of interest or engagement. This may be particularly true in certain Mexican-American populations comprised of newly acculturated families who retain their homeland's cultural practices, attitudes, and beliefs and may not view child weight or health in the same way.

CONTRIBUTION OF PRESENT WORK TO LITERATURE

Although research to date has identified significant associations between child overweight and many of the factors listed above, causality cannot be determined from the available data. Moreover, the majority of findings are not readily generalizable, particularly to Mexican-American populations, as most studies have focused on whites (and to a limited extent, African-Americans). Until we recruit more diverse populations and use measures that precisely capture the many influences on child eating and activity behaviors (and child weight), we will continue to have minimal impact.

Activa Y Sana was the first study to test a multi-level weight reduction approach in a Mexican-American population involving children, their parents or caregivers, schools, and community agencies (YMCA and the University of Arizona Cooperative Extension).

The results of this study help to fill a critical research gap. Understanding how parents influence their children's health-related behaviors and finding new ways to sustain healthy behavior changes are vital next steps in the fight to reduce child obesity. Identifying key components of the intervention that show particular promise and could easily be implemented by non-university persons (e.g. school staff, YMCA staff) on a larger scale will help sustain the effects of the intervention long after the completion of the project.

Without more effective measures in place, childhood overweight prevalence will continue to climb, exceeding 30% by the year 2015, with school-aged children (6-11 years) demonstrating the most significant increases. (Wang and Beydoun 2007)

EXPLANATION OF DISSERTATION FORMAT

This dissertation was prepared using a manuscript format (three independent manuscripts found in Appendices A-C). Chapter 2 summarizes research methods including study design and description of the population, measurements, and the intervention. Chapter 3 summarizes the main findings of each of the three manuscripts and relevant conclusions. Chapter 4 integrates the findings and conclusions as they relate to the current literature. Appendix D contains a copy of the intervention materials. Appendix E is a review of published childhood obesity interventions that involve parents as agents of change.

CHAPTER II – METHODOLOGY

Activa Y Sana was a two-year study, designed to develop and evaluate a trans-community approach to prevent and treat childhood obesity. The overall objective was to slow excess weight gain in overweight or at risk children, and thereby allow height increases to naturally decrease BMI over time. The target population was children in 3rd and 4th grades with BMI at or above the 85th percentile for age and their parents or primary caregivers. Primary study outcomes were child weight change, BMI-for-age, percent body fat, correlates of child BMI z-score and % body fat, and child nutrition and physical activity behaviors. Secondary measurements included psychosocial outcomes such as self-esteem and self-efficacy.

The intervention was a cooperative effort between the investigators and staff at the University of Arizona Center for Physical Activity and Nutrition, teachers and administrators in Sunnyside School District, and the Tucson YMCA. Existing Cooperative Extension and Arizona Nutrition Network nutrition and activity curricula were used in this project, supplemented with new materials created specifically for the Activa population by the University of Arizona intervention team. Appendix D contains a description of intervention materials.

The study involved four Sunnyside District elementary schools. Three elementary schools were initially assigned to one of three intervention "levels": Level 1, school-based activities only; Level 2, school-based activities plus an after-school program; or, Level 3, school-based program, plus an after-school program, plus a family program. The interventions are described in detail below. A fourth school was added during Year 2

when recruiting Cohort 2 to replace the original control school (Level 1). Children in this school also received the Level 1 intervention.

THEORETICAL FRAMEWORK

Behavioral change has been hypothesized to occur in response to changes in variables that mediate behaviors.(Baranowski, Cullen et al. 2003) These variables originate from theories used to explain behavior.

The Activa Y Sana intervention was based on cognitive behavioral approaches (Beck 1967) that have been used extensively and effectively for the prevention and management of obesity for adults and children. (Wisotsky and Swencionis 2003) Within the cognitive behavioral framework, the Activa design also incorporated concepts from Social Learning Theory (Bandura 1977), the Theory of Planned Behavior (Ajzen 1985), and the Social Ecological Model. (McElroy, Bibeau et al. 1988) Key concepts from these theoretical models included self-efficacy, environmental influences, behavioral capability, expectancies, self-control and performance, observational learning, reinforcement, environmental context and social norms that when taken together, suggest that the Activa after-school and family-based programs would have a greater impact on motivating and sustaining changes in health-related behaviors. Additionally, work by Epstein (Epstein, Valoski et al. 1990) has previously demonstrated the long-term effectiveness of family intervention versus child-only intervention, and thus a family approach was adopted as the central aspect of the intervention protocol for Level 3.

RESEARCH METHODS

Population

The school district from which participants were recruited was selected due to its predominantly Mexican-American population, a group who suffers disproportionately from child overweight and its co-morbidities. (Perez-Escamilla and Putnik 2007) The target age group (8- to 10-year-olds) was chosen due to an increased risk for overweight that occurs between preschool and late childhood years, suggesting that the middle childhood years may be an optimal time to intervene. (Ogden, Carroll et al. 2006) Equal numbers of boys and girls were recruited to participate.

Design

Three schools within the Tucson Sunnyside School District were assigned to one of three interventions levels: Level 1, a school intervention based on state curriculum standards for nutrition and physical activity; Level 2, Level 1 + an after-school nutrition and physical activity program co-sponsored by the YMCA; and Level 3, Level 1 + Level 2 combined with a family intervention. Each intervention level was designed to build upon the previous one, i.e. Level 2 included the Level 1 intervention, and Level 3 included Levels 1 and 2. Level 1 served as the comparison condition because it represented the minimal requirement, or "standard of care," for schools in the state of Arizona. A fourth school was added during Year 2 to replace the original control school (Level 1) when recruiting for Cohort 2.

The purpose of the multi-level design was to assess whether addition of the components in Levels 2 and 3 provided added benefit in terms of improved outcomes

beyond those produced by a standard school curriculum, and whether the addition of the family component improves outcomes compared to those produced by the after-school program.

Description of Schools/District

Sunnyside School District is the third largest district in Pima County. The District includes fourteen elementary schools, with a student body that is eighty-seven percent Hispanic, and four percent Native American. Eighty-five percent of students qualify for the federal Free and Reduced Meals Program. Given that children of low income minority families have increased risk for excess adiposity and disease risk factors, Sunnyside School District demographics reflect an at-risk population for obesity and diabetes.

Selection of schools as the intervention unit (versus the participants) was to reduce potential threats to internal validity associated with participants' awareness of the other interventions that might be viewed as more attractive, e.g. resentful demoralization and compensatory rivalry. (Shadish, Cook et al. 2002) If children within the same school were randomly assigned to interventions, these threats would be more likely to occur. Because the schools were homogeneous with respect to demographics known to be related to obesity (e.g., ethnicity, SES, identical PE and nutrition programs), it was expected that the four study sites would be similar at baseline regarding these variables thereby decreasing the likelihood that changes in outcome measures over time would be due to site differences.

Recruitment of Participants

All 3rd and 4th grade children attending the participating schools were invited to join the study. Recruitment activities were timed with the advent of school in order to gain access to parents and children at "Back to School" and "Meet Your Teacher" nights. These venues provided an opportunity to interact with parents and children in a non-threatening setting, and allowed university staff to become familiar with school grounds and meet key school staff members and administrators.

Parents or caregivers of children who expressed an interest in participating were asked to provide contact information and fill out an eligibility screening form. Parent-reported child height and weight data were used to estimate BMI. The intent was to recruit primarily at-risk for overweight or overweight ($\geq$85th percentile weight for age and gender) children in order evaluate the effect of the intervention on this outcome measure. Children meeting eligibility criteria (as determined by Principal Investigator based on criteria below) were invited to participate in the study at the time of screening or through a follow-up phone call and mailed consent packet. Written child assent and parental consent were obtained prior to participation.

Exclusionary criteria included:

- Child not in grades 3 and 4 at baseline
- Child/parent not willing to participate for full follow-up period
- Presence of any significant medical condition contraindicating full participation in a physical activity and nutrition intervention, based on American Academy of Pediatrics Guidelines (Pediatrics 2001)
- Parent/primary caregiver unable or unwilling to participate in assessments (all levels) and intervention (Level 3 only)
- Parent or child unable to participate in the exercise and/or nutrition program due to a serious cognitive limitation

Parents at the two schools receiving Levels 2 and 3 of the intervention were informed of the limited number of slots available in the after-school and family program, and that the purpose of the study was to develop a successful program that could be utilized in the future by the school district in other elementary schools if there was interest.

Cohort 1

Cohort 1 was recruited during the summer of 2006. Total children and parents consented at baseline were 96 and 80, respectively. (16 families had 2 children enrolled). Participant pool and number of participants by school and condition are given in Table C.6. in Appendix C, pp 152.

Cohort 2

Cohort 2 was recruited in summer of 2007. An additional school (School D) was added at this time replacing the original control school, yielding 15 new families assigned to the Level 1 condition. (The original school, School A, was not included in recruitment activities during summer of 2007 due to lack of support by school administration, making a university presence difficult.) Cohort 2 recruitment efforts at Schools B (n = additional 15 families consenting to participate in Level 2) and C also occurred at this time (n = additional 15 families consenting to participate in Level 3). (Table C.6., Appendix C)

ACTIVA Y SANA INTERVENTION

Each level of intervention is described in detail below. The study timeline, including timing of the intervention delivery, is shown in Figure C.1., Appendix C., pp 146.

Level 1: School-based program

Level 1 was considered the "standard of care," or control condition, as all four schools received it. Thus, the two Activa schools (A and D) receiving only Level 1 served as the comparison group for the other interventions.

The Level 1 intervention consisted of an enhanced nutrition and physical activity curricula developed within the Sunnyside School District by University of Arizona faculty and staff working in partnership with school district officials, and designed to meet the Arizona Comprehensive Health and Physical Activity Standards.

Curricula development was funded through a three-year Federal Department of Education grant serving all fourteen elementary schools within the Sunnyside District (including the four Activa schools), enrolling a total of 8,500 children from low SES, minority families. Schools received physical activity equipment and teachers received eight in-service workshops each year, providing them with innovative physical education curricula aimed at increasing developmentally appropriate physical activity during the school day and enhanced nutrition education that was incorporated into the school health curriculum delivered in the classroom setting.

Implemented in the fall of 2006, Level 1 used a combination of Great Body Shop (Nutrition Education) and CATCH P.E. curricula. See Appendix D for a detailed description of curricula and lessons.

Levels 2 & 3

Intervention Levels 2 (after-school program) and Level 3 (after-school plus family intervention) reflected a cognitive behavioral approach to making health behavior changes, which focuses on three basic steps: (1) changing behaviors, (2) challenging

maladaptive thought patterns that hinder the desired behavioral changes, and (3) developing strategies for long-term maintenance of desired behavioral change. In this study, the desired behavioral changes included increased physical activity, decreased inactivity (e.g. TV viewing, video games, Internet), decreased consumption of sugared beverage and fast food, increased consumption of fruits, vegetables, and low fat milk and control of portion sizes.

Level 2: School-based plus after-school intervention

Level 2 of the intervention began in October of 2006 at Schools B and C. Level 2 included the school-based program (Level 1) plus an onsite YMCA after-school program held two days per week and every other Friday for a minimum of ten days per month. Sessions began immediately after school and lasted for two hours, focusing largely on physical activity and individualized physical activity goals, with a short nutrition lesson combined with a healthy snack. Nutrition and physical activities built on behavioral skills and content learned in the Level 1 program.

The physical activity component was based on "Pyramid Power," developed by the Activa intervention team for a previous project and adapted for delivery in the after-school program. The Pyramid Power Program is based on the Physical Activity Pyramid model developed by Corbin and Pangrazi (1998) (Corbin and Pangrazi 1998) for the American College of Sports Medicine. The model is similar to the Food Guide Pyramid developed by the USDA to guide dietary choices. Like the food pyramid, activities towards the base are recommended as a foundation (lifestyle activity). The second and third levels of the pyramid include aerobic and sport activity and strength and flexibility,

respectively. These activities provide health benefits as well as enjoyment, challenge, social benefits. Activa Pyramid Power Lessons were divided into four parts: (1) team time warm-up, (2) nutrition activity,(3) group theme activity based on the activity pyramid, and (4) student choice.

Past research suggests that sport game-based physical activity instruction does not provide the necessary mediating factors to increase cardiovascular fitness and physical activity. Therefore, all activities within the Level 2 intervention were structured to be student-centered (versus teacher-centered) and physical activity-based (versus game- or sport-based). This was intended to increase child enjoyment of physical activity, develop physical and behavioral skills necessary to increase cardiovascular fitness, social acceptance, and support to be active (through educational instruction, role model projection, and parental and other influential adult involvement), as well as assist children in developing their own programs. The focus on motivation through experiential activities (intrapersonal) and adult influences (interpersonal), problem-solving skills (intrapersonal), and provision of social and physical environments that support the students' physical activity opportunities are congruent with the social-ecological model.

The YMCA concepts of Respect, Responsibility, Caring, and Honesty were also integrated into the Level 2 lessons to create an environment conducive to the physical activity motivators of fun, success and social reinforcement. Team building, problem-solving, cooperative and trust-building activities were used to enhance personal and social responsibility. The YMCA also donated a cargo van (dubbed "The Moving Van") to house and bring physical activity equipment (e.g. rollerblades, bicycles and other

active play equipment) and active video games (e.g. Dance Dance Revolution) for use during the sessions.

Both of the Level 2 schools participated in the Team Nutrition Healthy Snacks program, which provided children with a portion-controlled snack and fruit serving to eat during the nutrition lesson.

All nutrition and physical activity programs used in Level 2 were designed to meet the Arizona State Standards for Comprehensive Health and Physical Activity.A complete list of lesson topics used in the after-school program are given in Appendix D.

Level 3: School-based plus after-school plus family intervention

Family interventions have been shown to be successful by creating supportive environments in addition to disseminating information so that participants may apply what they have learned. (Komro and Stigler 2000) The family component integrated and reinforced the basic nutrition and physical activity information students received at school (Level 1) and during the after-school program (Level 2), and provided family members with strategies to work together to plan healthy menus, read food labels, and support each other in making healthy decisions about food consumption and physical activities. Parents of students who participated in the after-school program at School C were invited to attend a series of nutrition education and physical activity classes (referred to as "Family Fun Nights") held at their school during the fall semesters of 2006 (Cohort 1) and 2007 (Cohort 2).

The family intervention consisted of twelve, two-hour sessions taking place on Thursday evenings between 5:30pm and 7:30pm. All sessions were taught in English

with Spanish translation assistance and bilingual materials. Children and adults began each Family Fun Night together by participating in a group physical activity demonstration. This demonstration allowed adults and children the opportunity to be active together, and provided a fun way to instruct families on a new piece of physical activity equipment. Prior to each family night, children were introduced to the physical activity equipment that would be used in that week's family intervention during the after-school program. This allowed them to become familiar with equipment ahead of time, so that they could assist Activa staff in instructing their parents. (At the conclusion of each family night, each family was given the equipment to keep and use at home together.) Each physical activity demonstration was followed by a "light meal" (which doubled as a food demonstration) where families were given the opportunity to try a "5-A-Day" recipe (utilizing seasonal fruits and vegetables) prepared by study staff. Recipes and basic food preparation tips were provided during each session by a registered dietitian and Extension Nutrition Educator who circulated among the families as parents and children ate. Children and parents were then separated for the remainder of the evening (approximately one hour), spending the remaining time engaged in nutrition-themed physical activities (children) or discussion/nutrition activities (adults). (A copy of the family intervention session schedule and lesson topics may be found in Appendix D).

All family intervention sessions were team-taught by university staff and Cooperative Extension Nutrition Educators with assistance from guest speakers (e.g. Family Practice MD, YMCA staff) and school physical education staff. Lesson content was adapted from research-based nutrition and physical activity curricula (e.g. Expanded

Food and Nutrition Program, University of Arizona's Cooperative Extension Service in Pima County; Eating Right is Basic—Enhanced, Michigan State University Extension, 2001; Healthy Weight 4 Life, University of Arizona Center for Nutrition and Physical Activity) and families participated in hands-on activities designed to help them apply nutrition and activity skills in a way that fit their available resources.

Parent topics on food, nutrition and health included "making the most of your food dollars"; quick and easy meals; keeping food safe; healthy eating without dieting; healthy food choices away from home; MyPyramid; the importance of breakfast; and food and nutrition for children and adolescents. Parents were encouraged to set weekly goals with their child (related to what the child learned in that week's lesson), as well as setting a personal goal guided by topics discussed at the family night intervention meeting.

Child nutrition topics included making healthy food choices using "Whoa, Slow, Go" food categories, appropriate portion sizes, healthy beverages (focusing on water for thirst), making good choices when eating out, and the importance of eating fruits and vegetables. Nutrition education was delivered in the context of physical activity (e.g. "Salad Bar Hoopla," "Fast Food Scramble"), which allowed the children to remain physically active and engaged during the entire session.

The physical activity component of the family intervention was based on the CHOICES Project (Reeves 2008), designed to introduce children and parents to the health benefits of physical activity, providing the motivational grounding for choosing a physically active life over a sedentary one – a first step in the goal-setting process.

Physical activity was incorporated into each class using videos, interactive video gaming systems (e.g. Dance Dance Revolution; Nintendo Wii). Children received activity backpacks that during the first week of the intervention which provided a place to store equipment received during the program (e.g. Frisbee, Nerf ball) and contained ideas for family activities. Families also participated in physical activity self-assessments (e.g. pedometer logging), designed to address barriers to physical activity, encourage social support within the family, and develop action plans/goals to increase opportunities for family physical activity.

MEASUREMENTS

Timing

Baseline measurements took place during late summer/fall of 2006 (Cohort 1) and late summer/fall of 2007 (Cohort 2). (Figure 1) Follow-up measurements occurred during February and March of 2007 (Cohort 1), July/Aug of 2007 (Cohort 1) and December 2007 (Cohorts 1 and 2). Number measured can be seen in Table 1.

Outcome Measures

The primary outcome measures were BMI, % body fat, waist circumference, physical activity and food intake. Secondary measures included selected psychosocial variables related to physical activity and eating (e.g., self esteem, self efficacy). All assessments were completed by trained staff at the schools during scheduled measurement sessions. Total time required to complete assessments was approximately 1.5 hours for children, and 2 hours for parents. Measures were collected by staff not

directly involved in the intervention to minimize demand characteristics around responses.

Main outcomes assessment points were baseline and 6, and 12 months of the study. Each child and one parent/primary caregiver were assessed. Analyses focused on between-groups comparisons at different measurement occasions, as well as within-groups change over time (i.e. change trajectories) to evaluate response variance and to assess whether intervention adjustment had improved outcomes. (Figure 1, Timing of Measurement)

Body weight and composition were assessed using the standard, validated techniques as described in the *Anthropometric Standardization Manual* (Lohman 1988) (Lohman, Roche et al. 1988) and *Applied Body Composition Assessment* (Heyward 2004). (Heyward and Wagner 2004)

Body Mass Index (BMI) was calculated from weight in kilograms (kg) divided by height in meters (m) squared. Standing height was measured in duplicate (nearest millimeter) using the Shorr measuring board. Body weight was measured in duplicate (nearest 0.1 kg) using the Seca Model 770 scale calibrated with a standard weight. Abdominal circumference was measured in duplicate (nearest mm) via a standard anthropometric tape measure.

Estimates of fat-free mass and fat mass provide a means for interpreting the changes in body mass. Bioelectrical Impedance Analysis (resistance and reactance) is functionally related to FFM (because of its water content) and thus provides a direct estimate of FFM. Determinations of resistance (R) and reactance (Xc) were made using a

single frequency (800 μA at 50 Khz) impedance analyzer (RJL Systems' Quantum II), and FFM was estimated from resistance index (Ht^2/R using the following, previously validated, age- and gender-specific equations.

Children (Houtkooper, Going et al. 1992):

Fat free mass (FFM) = 0.61*((height*height/resistance) + .25* (weight) + 1.31

Adults (Heyward and Wagner 2004):

Men

Fat free mass (FFM) = ((.00066360*(height*height) - .02117*resistance + .62854*weight - 0.1238*age + 9.33285) + (.0008858*(height*height) - .02999*resistance + .42688*weight - .07002*age + 14.524350))/2

Women

FFM = ((.00064602*(ht*ht) - .01397*resistance + .42087*(wt) + 10.43485) + (.00091186*(ht*ht) -.01466*(resistance) + .2999*(wt) - 0.07012*(age) + 9.37938))/2

Body fat and % body fat were then derived from FFM and body weight.

Adjustment for Child Growth – BMI z-score

Child BMI changes with age, making measures of BMI alone inappropriate for comparisons of overweight amongst groups of children. Unlike adult BMI values which may be compared directly, child BMI (used as a surrogate measure of adiposity) must be adjusted for age and gender. Hence, age- and gender-specific BMI z-scores provide a

continuous, standardized variable that may be used in place of BMI for estimating changes in adiposity over time.

Child BMI was adjusted for age and sex using Epi Info™ 3.4.3 software (Division of Integrated Surveillance Systems and Services at the Centers for Disease Control and Prevention). Epi Info™ provides a BMI z-score and precise BMI centile when child sex, height, weight, and age is entered, by comparing each child's demographic and anthropometric data with data from NHES and NHANES (the reference populations). (Kuczmarski 2000) Following current guidelines, children above the 95th percentile were considered overweight, while those between the 85th and 95th percentile were classified as "at risk for overweight." (Kuczmarski 2000)

Physical activity

The Children's Physical Activity Correlates questionnaire (CPAC) was used to assess child physical activity. The CPAC was a self-administered 24-hour recall asking children to choose from 31 activities (e.g. "What did you do YESTERDAY after school?" and "What did you do TODAY after school?") and report their participation in those activities as "None," "A little," or "A lot" adapted from a similar questionnaire developed for the Pathways Study. (Stevens, Cornell et al. 1999)This questionnaire provided estimates of moderate-to-vigorous physical activity, METS, and activity type. Additional questions assessed active mode of transport to school, and whether the child participated in an organized club or team sport.

In adults, physical activity was assessed using the Arizona Activity Frequency Questionnaire (AAFQ), previously validated against doubly-labeled water in adults.

(Staten, Taren et al. 2001) The AAFQ provided estimates of adult moderate-to-vigorous physical activity, METS, activity type, and frequency over the previous 28 days. Both occupational (hours per week spent at work and intensity of activity while at work) and non-occupational (frequency, intensity, and duration of leisure, personal care, recreational, household activities) activities are assessed. This questionnaire is available in both English and Spanish.

Food intake

Dietary intake was assessed in adults using the Arizona Food Frequency Questionnaire (AFFQ), a 113-item, semi-quantitative scannable food frequency questionnaire designed to assess usual eating habits over the previous 3 months (up to the previous year). Frequency of consumption is grouped into 7 categories ranging from rarely/never to more than 3 times per day. Participants are also asked to report usual portion size (small, medium or large) and answer open-ended questions identifying specific types and brands of food and vitamins along with fruits and vegetables not listed. This is a validated questionnaire (against food recalls and dietary records) in populations living in the Southwest and is available in English and Spanish. (Martinez, Marshall et al. 1999)

Dietary intake behavior was monitored in children using the Child Diet Assessment Questionnaire (CDAQ) and The Children's Habits Questionnaire (CHQ) developed for the Choices study. (Ritenbaugh 2007)

The CDAQ was designed to capture the eating habits of children thought to have the greatest impact on health, notably consumption of processed and convenience foods, the

number of meals eating away from home, milk and soft drink consumption, and the intake of fruits and vegetables. The CDAQ consists of several subscales, the first of which consists of 11 questions asking children to recall what they ate YESTERDAY (e.g. "Yesterday, did you eat any vegetables?"). Additional subscales ask children to characterize their food-related habits (8 questions, e.g. "Do you ever read nutrition labels on food packages"), answer questions testing their nutrition knowledge (4 questions, asking children "Which is healthier?" choosing between 2 items), and disclose food preferences (9 questions, e.g. Which would you order at a fast food restaurant?" choosing between 2 items). The Children's Habits Questionnaire (CHQ) also provided estimates of breakfast frequency and beverage preference and frequency of consumption.

Sedentary Behavior

Child sedentary behavior was assessed with 2 questions from the Children's Habits Questionnaire: "How many hours of video games (like Game Boy, X-Box, Play Station) and computer games do you play every day?" and "How many hours of television do you watch every day?" Children's responses to these two questions were combined to estimate "screen time."

Psychosocial factors

Adult psychosocial factors were evaluated using the following three questionnaires:

Self-Efficacy and Exercise Habits Scale measured beliefs that one can "stick with" an exercise program under varying circumstances. This questionnaire has two constructs – "resisting relapse" and "making time" - with 5 items each. (Sallis, Pinski et al. 1988)

Exercise Intrinsic Motivation Inventory measured level of motivation for exercise and physical activity within the constructs of enjoyment/interest (e.g. "I enjoy getting involved in physical activities very much", perceived competence (e.g. "I think I do pretty well at physical activities compared to others"), effort/importance ("e.g. It is important for me to do well at physical activities") and pressure/tension (e.g. "I am usually anxious when I engage in physical activities"). Each of these constructs had 4 questions. (McAuley, Duncan et al. 1989) Weight Management Self-Efficacy Scale measured self-efficacy related to body weight within the constructs of emotions, availability, social pressure, physical discomfort, and positive situations. This questionnaire had 5 possible of 5 subs-scores (20 questions total, each assessed on a 10-point scale, 1= Not Confident, 10 = Very Confident) with higher scores indicating higher weight management self-efficacy. (Clark, Abrams et al. 1991)

Child psychosocial measures were assessed using the Children's Physical Activity Correlates (CPAC) instrument and the Children's Health Habits (CHQ) Questionnaire. The CPAC includes 44 items that together measure 10 constructs potentially related to physical activity in children. The instrument is a combination of a number of validated scales including 15 items from the Children's Attraction to Physical Activity (CAPA) scale (Brustad 1993), 5 items from Harter's perceived competence scale (Harter 1982), 6 items from Rosenberg's self-esteem scale and 18 items from a parent socialization scale developed by Welk and colleagues.(Welk, Wood et al. 2003) The reliability and validity of the CPAC has been previously tested. (Schaben, Joens-Matre et al. 2004) The CPAC measures 10 constructs related to liking of games, sports, and exercise, fun of physical

exertion, perceived importance of exercise, peer acceptance, competence at PA, parent as a role model, parental support, parental encouragement, and child self-esteem.

The CHQ also included 11 questions that evaluated child nutrition and physical activity self-efficacy – "How Sure Are You?" – e.g. "I can eat a fruit every day." Responses were framed as a 4-point Likert scale, ranging from "I know I can" to "I know I can't." The CDAQ similarly evaluated dietary self-efficacy with 8 questions that asked children "How Sure Are You?" when given a choice between 2 foods – e.g. "How sure are you, that you can drink low fat or skim milk instead of whole milk?"

Training, quality control, and quality assurance

All staff participated in training and certification, and standard protocols were developed and rehearsed for intervention and measurement activities. Data collection staff was certified against experts, including group practice of interview techniques for child questionnaires. Although there was additional training for interventionists in relation to intervention delivery, joint training assured that all staff was fully informed regarding how intervention and measurement fit together. Data collection staff was re-certified before each assessment period. Bilingual (Spanish/English) data collectors and intervention staff were hired to work with Spanish-speaking parents/caregivers. All completed forms were reviewed for completeness with children and parents. Intervention staff met after each family session to debrief on successes and challenges of each lesson. There were also monthly combined meetings of all after-school (Level 2) and family (Level 3) program staff to ensure coordination of activities across sites. School teachers

who delivered PA and health curricula (Levels 1, 2, and 3) received quarterly professional development workshops taught by university intervention experts.

Process evaluation

Process evaluation activities were designed to: 1) describe the actual activities implemented compared to activities planned (fidelity and dose); 2) determine the extent of exposure to the target audience (exposure); 3) provide for quality assurance and adherence to decisions, plans and protocols (fidelity); 4) identify, count and describe participants (reach); 5) clarify interactions, processes and dynamics both internally and externally (context); and 6) evaluate the acceptability and feasibility of the intervention for children and families.

Dose was documented by recording the activity conducted including the context (e.g. nutrition classes, physical activity); format and content; length (number of minutes, days); and the interventionist (teacher, YMCA staff, university staff) as well as recording which participants attended intervention activities. Reach was documented by recording attendance at all program activities. An estimate of exposure (percentage of the target audience that has actually received the intervention components) was extracted from attendance data. Fidelity to protocols (according to training) was measured by direct observation on a random selection basis. The evaluator used a checklist to verify that all major components of a presentation were covered. The checklist was developed based on the content used in training. Acceptability and feasibility were assessed using surveys and semi-structured interviews in children, parents, and interventionists (Nutrition Educators,

University research staff). Process evaluation materials (e.g., fidelity checklists, interviews) were developed in the 3 months prior to the intervention.

Statistical Considerations

Statistical power calculations and sample size

Because the proposed study was developmental, significance testing was not the main priority; rather, the objective was the development of an effective, sustainable program for the prevention and reduction of childhood obesity. The smaller number of participants in the study allowed carefully monitoring of the interventions and theoretically would reduce the likelihood of missing data and the drop out rate. The use of statistical models in this project was primarily for the analysis of change in order to estimate change parameters as well as effect sizes for a larger, more controlled (R01) experimental study in which program effectiveness can be assessed.

Despite the focus on parameter and effect size estimation, a power analysis to assess ability to detect between-group differences in BMI was conducted using the number consented from each intervention level (Level 1 control group, n=37 and Level 2 and Level 3 intervention groups, n= 54 and 50, respectively). Mean BMI for all consented children in the study at baseline was 22.3 kg/m^2 (SD, 5.2 kg/m^2). Estimated power for a two-sample comparison of means was conducted using Intercooled Stata 9.2 (StataCorp, College Station, TX). Type 1 error was set at .05 and the test was 2-sided. Based on these parameters, power to detect a large (3.0 kg/m^2 effect size was calculated to be 0.85 and the power to detect a medium (2.0 kg/m^2) effect size was 0.51.

Adjusting for child growth – BMI z-score

Age- and gender-specific BMI z-scores were used in place of BMI for estimating changes in adiposity over time. Child BMI was adjusted for age and sex using Epi Info™ 3.4.3 software (Division of Integrated Surveillance Systems and Services at the Centers for Disease Control and Prevention). Epi Info™ provides a BMI z-score and precise BMI centile based on child sex, height, weight, and age using data from NHES and NHANES as the reference populations. (Kuczmarski 2000) Children above the 95th percentile were considered overweight, while those between the 85th and 95th percentile were classified as "at risk for overweight." (Kuczmarski 2000)

Imputation of missing data

To obtain an accurate estimate of the intervention effect on outcome measures in children lost to follow-up, imputation of missing data was carried out using Multiple Imputation Chained Equations (WinMICE software, TNO Quality of Life, Leiden, the Netherlands, 2005). The WinMICE software generates multiple imputed data sets (typically five) by picking data values at random from the distributions of observed or predicted data for each of the imputed variables (e.g. BMI z-score and % fat). To fill in missing baseline data (n=3) the WinMICE program chose an observed % fat value at random from the baseline data to fill in for each missing value at baseline. To fill in missing data at the 6-month follow-up (n=19) WinMICE was directed to select, at random, values derived from the distribution associated with the regression of 6-month BMI z-score or % fat regressed on baseline BMI z-score or % fat, respectively. Each of the data sets were then analyzed using standard statistical tests. No significant differences were found between models using imputed data and those that used observed values only.

Data Analyses

Statistical analyses were completed using the Statistical Package for the Social Sciences (SPSS, version 15.0). Analyses were conducted with data from Cohort 1 (who had completed baseline and two follow-up measures at the time of this writing) and also for the entire baseline sample (which included Cohort 2 children and parents, as well as Cohort 1 participants who were subsequently lost to follow-up).

Measures of central tendency and distribution were examined at baseline and for follow-up measurements, as well as tests for normality and homoscedasticity.

Differences in baseline variables between boys and girls and parents with higher or lower levels of acculturation were explored using independent samples t-tests.

Pearson coefficients were calculated to quantify associations between child and adult dietary, physical activity, and psychosocial variables and child BMI z-score and % body fat at baseline in order to select covariates to test in the multivariate models.

Multiple linear regression analysis was performed to determine the amount of variance in outcome measures that could be predicted using different computations of independent variables. Covariates were selected for model testing relative to statistical significance in bivariate correlations.

Baseline differences between children who returned for measurements and those who did not were compared using independent t-tests.

Analysis of variance was used to identify significant differences child anthropometric variables, and dietary, physical activity, and psychosocial variables

among intervention levels at baseline and 6 months, as well as assess differences in changes in these variables between baseline and 6 months.

Within each intervention level and intervention dose, paired t-tests were used to assess significant changes between baseline and 6 months.

Independent t-tests were used to evaluate the effect of the Level 2 and Level 3 intervention "dose" on child anthropometric, nutrition/activity, and psychosocial factors between baseline and 6 months, by comparing children who attended at least 50% of all after-school or after-school plus family sessions to those that attended fewer than 50% of sessions.

As comparative data identifying optimal frequency of intervention dose needed to elicit specific behavior changes do not currently exist, 50% was chosen as the minimum dose necessary for children to be exposed to key concepts of the intervention program. Predictors of BMI z-score and % fat change were evaluated using multiple regression models with contrast variables, testing the effects of Level 2 and Level 3 versus the control condition (Level 1) and Level 2 intervention versus Level 3 intervention on BMI z-score and % body fat changes between baseline and 6 months. Models using imputed data were compared with those using observed values only.

CHAPTER III – SUMMARY OF FINDINGS

The studies in this dissertation were designed to:

1. Determine correlates of child BMI and % body fat in a baseline sample of children and parents through selection and testing of potential mediators based on the Social Cognitive Theory framework (SCT)
2. Test whether combining different levels of intervention would have a greater impact on child weight
3. Assess the feasibility of implementing a multi-level weight reduction approach in a population of at-risk and overweight children and parents and explore the challenges surrounding participant recruitment and retention to-, and participation in a community-based intervention study

The following are the most significant findings that emerged from all results presented herein.

Study #1:

Hypothesized correlates of child BMI and % fat in this study were child and parent dietary habits (e.g. vegetable intake, sweetened beverage consumption), child and parent physical activity (e.g. minutes spent in moderate-to-vigorous physical activity, screen time), child psychosocial factors (e.g. self-esteem, perceptions of parental modeling, support, and encouragement), adult psychosocial factors (e.g. self-efficacy), and parent BMI and % fat. Parental acculturation and child gender were also considered as potential moderators of child behavior and were explored in subgroup analyses.

Major Findings:

Adult BMI and % body fat were the most significant predictors of child BMI and % body fat, respectively. Overall, less acculturated parents (estimated from parental language preference on consent forms and questionnaires) and their children had lower BMI, % fat, and waist circumferences compared to more acculturated families, although differences were only significant for children. Significant relationships were found between hypothesized correlates of BMI z-score and % fat, although there were no consistent predictors of BMI z-score and % body fat across all subgroups.

Exploratory analyses of subgroups – gender and acculturation – showed that girls had significantly higher body fat percentages than boys. Although not an a priori measure, acculturation was tested as a potential moderator of behavior. Significant subgroup differences were noted between children and parents from more and less acculturated families, including higher levels of fruit, vegetable, and juice intake and physical activity in less acculturated adults, and lower waist circumference and BMI in their children.

Child BMI z-score was found to be a significant predictor of self-esteem, but only in the overall sample, and in boys. Child self-esteem appeared to be bi-directionally related to child adiposity – i.e. low self-esteem predicted high % fat, and a high BMI z-score was a predictor of self-esteem. Parental encouragement was a consistent predictor of self-esteem overall and across all subgroups (significant in bivariate and multivariate models), suggesting that this parenting practice influences child self-esteem in this population.

Parent BMI and % fat were the strongest consistent predictors of both BMI and % fat in children.

Study #2:

The primary aim of Activa Y Sana was to test whether combining different levels of intervention (school, school + after-school, and school + after-school + family program) would have a greater impact on child weight. We hypothesized that the after-school program and family program would result in larger changes in BMI z-score and helps sustain changes compared to the school-only program.

Major Findings:

Overall, there were no significant differences in primary outcome measures (BMI, % body fat) among intervention levels at baseline or 6 months, or in changes from baseline to 6 months.

As expected, height and weight significantly increased from baseline within each intervention level ($p<.01$ for both measures), indicating child growth.

Children participating in the after-school program (Level 2) and those participating in the after-school + family intervention (Level 3) reported significant increases in physical activity between baseline and 6 months ($p<.05$ for both).

Children participating in the after-school + family intervention also reported significant increases in perception of parental support, parental encouragement, and parent as a healthy role model between baseline and 6 months (these changes were significantly different from the changes that occurred in Levels 1 and 2, $p<.05$).

Analyses by Level 2 intervention dose (after-school program only) suggested significant differences at 6 months between groups based on attendance. Children who attended fewer than 50% of after-school sessions reported significantly decreased self-efficacy between baseline and 6 months ($p<.05$) while those attending more than 50% of sessions reported an increase in self-efficacy (although not significant). Children who attended 50% or more of sessions significantly reduced % body fat and sweetened beverage consumption, ($p<.05$ for both) while those who attended fewer than 50% of sessions did not change % body fat, and reported increased sweetened beverage consumption (although not significant). Children who attended more than 50% of after-school sessions reported significantly decreased perceived fun of physical exertion from baseline to 6 months. ($p<.05$)

Analyses by Level 3 intervention dose (after-school + family program) did not demonstrate any significant differences between groups based on attendance. Both groups (those who attended more than 50% of intervention sessions and those who attended fewer than 50%) reported significant increases in physical activity and in perception of parental support between baseline and 6 months. ($p<.05$ for both) Those who attended more than 50% of sessions also reported significantly increased perceptions of self-efficacy and parental encouragement. ($p<.05$ for both)

An important limitation of the study was the high rate of attrition (62% of study sample did not return at 6 months) and therefore we were underpowered to detect anything less than a large (BMI - 3.0 kg/m^2) intervention effect.

Although mean BMI z-score in children enrolled in the Activa intervention did not significantly decrease between baseline and follow-up (6 month) measures, neither did they increase. Activa was able to demonstrate a collaborative approach to child weight through involvement of a community agency (partnering with school) and the participation of families in an evening program.

Study #3:

This descriptive study framed a discussion of recruitment and retention challenges to a community-based research program in minority populations within the context of a case study – a trans-community obesity prevention study in low-income Hispanic children and their parents and caregivers. The strategies used to encourage recruitment and retention of participants to the Activa Y Sana study was compared to current best evidence practices (as suggested by Yancey and colleagues) (Yancey, Ortega et al. 2006) to determine whether the use of existing evidence-based guidelines for recruitment and retention of minority participants would optimize recruitment and retention rates.

Major Findings:

Despite using "best-practice" recruitment and retention strategies recommended by experts and adjusting strategies between our first and second cohorts based on process evaluation data, we did not attain our recruitment goals (n=40 per intervention level) in the Level 1 (control condition) and attrition from this condition exceeded 20%. Although we met initial sample size goals in the other two intervention levels with the addition of the second cohort, significant numbers of children failed to return for follow-up

measures, resulting in a study that was insufficiently powered to detect changes in the primary outcome (BMI).

Participation in intervention activities was adequate but not high (mean attendance in the Level 2 intervention was 57%, while mean attendance in the family program was 54%).

Overall, there was negligible improvement in intervention program participation between Cohorts 1 and 2 for the Level 2 intervention program. It is unclear whether the larger difference found between cohorts in Level 3 participation was due to changes made in retention strategies or to the smaller sample size (resulting in more individual attention).

Comments provided by the families at the exit interviews provided some insight as to why intervention program retention rates remained in the moderate range despite best efforts. Parent comments suggested that those who regularly attended the sessions appreciated the information provided and benefited from the sessions; however, time was cited as a major barrier to attendance. Future intervention programs may experience improved recruitment and retention rates if they are sensitive to this perception by shortening the required number of sessions or reducing the duration of sessions (1 hour seems to be the maximum). Key teaching points could be conveyed in 1 hour through the use of activities that engage parents and children in a hands-on manner that teaches them a skill that they may then apply immediately upon their return home. It is also noteworthy, however, that time was thought to be a major factor in adherence to study

recommendations, and it may be that the issue of time management should be more explicitly addressed within the intervention materials themselves.

Involvement of family members and children from other grades in the Activa program was another recurring theme in the exit interview. Involving the entire family including siblings and grandparents to the extent possible may be important in promoting sustainable change. Parents reported that some of the biggest barriers to healthy behavior change were engaging the entire family in this effort and getting children to try new and healthy foods. One child and one parent may have difficulty advocating change to the entire family. Moreover, many families have more than one child in school and may have trouble finding child care which would prevent them from attending the intervention.

Although at first glance, recruitment and retention rates for Activa appear low, we suggest that these data are not uniquely so, but instead is part of a trend in behavioral research – one which emphasizes the general difficulty inherent in attempting to change behavior (a common issue with intervention studies) and the specific challenges in recruiting and retaining families to group-based intervention studies that cannot tailor time and location to individual family needs. Limited resource audiences such as those recruited to Activa may have different priorities and challenges than more affluent counterparts and may not have the same time and energy to devote to improvement of dietary or activity behaviors.

CHAPTER IV - DISCUSSION AND RECOMMENDATIONS

The Trans-community Approaches to Childhood Obesity Prevention and Treatment Study was two-year controlled intervention in one hundred and forty-one 3rd and 4th grade children and their parents/caregivers from four schools in the Sunnyside School District in Tucson, Arizona. The primary aim of this study was to test the feasibility and impact of a multi-level, or "trans-community," approach on the prevention of childhood weight gain in an at-risk Hispanic population of children and their parents. While the data do not show a significant intervention effect on child BMI or % fat, several findings are noteworthy.

Study #1 identified several correlates of child BMI and % body fat that were significant predictors in multivariate models. Child self-esteem, a predictor of % body fat, appeared to be bi-directionally related to child adiposity – i.e. low self-esteem predicted high % fat, and a high BMI z-score in turn was a predictor of self-esteem. Our findings agree with previous research suggesting child adiposity is a predictor of lower self-esteem, and that this relationship appears to be mediated by sex and age, with the lowest self-esteem observed in boys prior to age 13, and in girls after 13. (Stradmeijer, Bosch et al. 2000) This is reasonable given that high body weight could lead to a low self-concept, and/or low self-concept might lead children to engage in compensatory behaviors (e.g. emotional eating or isolation) which would further exacerbate overweight.

Also of interest was the finding that parental encouragement was significantly associated with child self-esteem in the overall sample and across all subgroups as well as showing up as a significant predictor of self-esteem in the multivariate model. Thus, self-

esteem represents an important intervention target and emphasizes the importance of parental influence and involvement in child health and behavior.

Exploratory analyses of gender- and acculturation subgroups revealed several interesting differences. Girls had significantly higher body fat percentages than boys, possibly indicating that Hispanic girls may be at increased risk for overweight at an earlier age in our population.

Although not specified as a measure *a priori*, acculturation (estimated from parental language preference on consent forms and questionnaires) was tested as a potential moderator of child and parent weight status and behavior. Less-acculturated parents and their children both reported consuming higher levels of fruit, vegetable, and juice intake and physical activity than their more acculturated counterparts, and had lower waist circumferences and BMI (although only significantly lower in children). This finding, although based only on an estimate of acculturation, adds to numerous existing data which suggest that the process of acculturation is related to unhealthy lifestyle changes, accelerating unhealthy weight gain in both adults and their children. (Families 1998; Kaiser, Melgar-Quinonez et al. 2001; Gordon-Larsen, Harris et al. 2003)
Parent BMI and % fat consistently predicted child BMI and % fat in English-preference families, which agree with previous studies that established the heritability of body weight and fatness. (Maes, Neale et al. 1997) (Bulik, Sullivan et al. 2003; Schousboe, Willemsen et al. 2003; Romeis, Grant et al. 2004; Malis, Rasmussen et al. 2005) This highlights the continued need to focus obesity prevention efforts on younger children in which early intervention may moderate genetic susceptibility to overweight.

Study #2 reflected the primary aim of this project, which was to test the impact of a multi-level "trans-community" intervention on child weight status.
Although no significant intervention effect was detected, trends in child psychosocial characteristics (e.g. increased perception of parental support, encouragement, role modeling in children participating in family intervention) suggest that parental involvement is of fundamental importance in childhood obesity prevention and treatment efforts.

A secondary aim of Activa was to assess the feasibility of implementing a community-based behavioral intervention in this population. In this regard, Activa was successful in creating a collaborative model program, bringing together four elementary schools, a community agency (YMCA), University of Arizona Cooperative Extension, and children and families with the common goal of improving family and child health. Children participating in both the after-school and family interventions reported significant increases in physical activity levels compared to the control condition, and as a result, principals at the two intervention schools (School B and School C) have pledged to continue to support a YMCA-PE teacher-led after-school program at least one day per week.

Study # 3 highlighted challenges encountered when recruiting participants to community-based interventions – particularly in a limited resource minority audience. The inability to meet recruitment and retention goals in the Activa Y Sana study should not be dismissed as a failure on the part of the investigators or a lack of motivation or interest on the part of the participants.

Although at first glance, recruitment and retention rates for Activa appear low, arguably these data are not uniquely so, but instead emphasize the general difficulty inherent in attempting to change behavior (a common issue with intervention studies) and the specific challenges in recruiting and retaining families to group-based intervention studies that cannot tailor time and location to individual family needs. Limited resource audiences such as those recruited to Activa may have different priorities and challenges than more affluent counterparts and may not have the same time and energy to devote to improvement of dietary or activity behaviors.

Limitations

There were several limitations to this study. One of the aims of the grant was to identify effect sizes produced by the interventions for the primary outcomes to determine plausible sample sizes for future large-scale (R01) controlled experimental studies.

Uneven attrition between groups (27% in Level 1, 18% in Level 2, and 6% in Level 3) threatened comparability between groups, and the small sample size led to a study that was underpowered to detect anything less than a "large" (-3.0 kg/m2) decrease in BMI. In general, we recommend a sample size of 54 (versus 40) per group to achieve an 80% power in future studies (assuming 27% attrition).

Activa did not have a true control group, as children enrolled in the Level 1 condition (comparison group) were exposed to the same enhanced health curriculum implemented in the other two levels. It is possible that the information provided to students in school may have influenced children in Level 1 to make behavioral changes that in turn, impacted their weight status, possibly enough to reduce any initial

differences in weight caused by the Level 2 and Level 3 interventions. Additionally, the low sample size in the Level 1 condition following the intervention may have led to a biased estimate of the control condition.

We did not randomize the schools to the intervention assignment, instead working with school administrators and staff to get a "feel for" which schools would be amenable to hosting the after-school and family night interventions. While this approach may introduce significant bias, as this was a pilot study, we believed that it was important to test the intervention in schools that were cooperative so that administrators, teachers and staff supported and promoted the program.

Except for anthropometric data, our measures were collected via self-report. The simplified version of a food frequency questionnaire and activity questionnaire that we used with the children asked only what they ate "yesterday" may not represent typical patterns of consumption or activity and these instruments lack sensitivity to measure nutrient intake, calories and energy expenditure, and instead are better at describing general patterns of consumption and activity. Moreover, they do not describe the full breadth of the diet or full range of possible activities and do not allow for "fill in the blank" answers – therefore, foods or activities that may be contributory to overweight may not have been included.

The intervention success may have been limited by inherent limitations of behavioral theories underlying the intervention. The chosen behavioral theories to some extent dictated which variables we chose to focus our intervention efforts on, and if theories have limited ability to explain behavior (because they do not include the right

variables), then it follows that an intervention based on these theories would be less than effective. Baranowski and colleagues have suggested the effectiveness of interventions is not only limited by the ability of mediating variables to predict behavior, but also the ability of interventions to elicit change in these variables. (Baranowski, Lin et al. 1997) Thus, behavioral intervention studies that do not demonstrate an effect are not necessarily poorly designed or executed, but merely unable to effect change in mediating variables (Baranowski, Anderson et al. 1998) It is possible that our study did not target the variables that effect behavior change in children. Further, behavioral theories are based on assumptions that may not hold true for diverse audiences from different cultural backgrounds. Choosing theories that do not consider diverging values, beliefs, and attitudes would automatically preclude targeting the right mediators. Our population may require a modified version of traditional behavior theory models.

Lastly, our design primarily targeted children, not adults. Even in the Level 3 intervention, parents were engaged as more of a social support than key players in child behavior change, and may not have been motivated to make changes or perceived the program as something that required immediate action on their part.

Strengths

With very few exceptions, existing data on the efficacy of family interventions to reduce child weight have come from studies recruiting primarily upper-SES white, intact families.(Brownell, Kelman et al. 1983; Epstein, Koeske et al. 1984; Epstein, Wing et al. 1986; Graves, Meyers et al. 1988; Epstein, Valoski et al. 1990; Flodmark, Ohlsson et al. 1993; Epstein, McKenzie et al. 1994; Epstein, Valoski et al. 1995; Epstein, Paluch et al.

2000; Epstein, Paluch et al. 2004; Edwards, Nicholls et al. 2006; Dreimane, Safani et al. 2007) (Kirschenbaum, Harris et al. 1984; Israel, Stolmaker et al. 1985; Israel, Solotar et al. 1990; Golan, Fainaru et al. 1998; Golan and Crow 2004; Jiang, Xia et al. 2005; Sacher, Chadwick et al. 2005; Golley, Magarey et al. 2007; Kalavainen, Korppi et al. 2007; Nowicka, Pietrobelli et al. 2007; Rodearmel, Wyatt et al. 2007; Shelton, LeGros et al. 2007) The majority of these programs were conducted out of obesity clinics or hospital outpatient settings, which limited generalizability to other populations.

Activa Y Sana was one of the first obesity prevention and treatment interventions to test the impact of a community-based multi-level intervention in a limited-resource minority population that targeted not just children, but also parents. While not following the typical RCT design, generalizability of the Activa intervention is high.. If the reality of this population is single parents, parents with large extended families, households with two working parents, English as a second language, and financial challenges, then for intervention programs to truly make a difference means that they must be designed to be flexible and responsive to these circumstances.

Arguably, the trans-community model represents one of the best possible options to promote and sustain lifestyle changes, as it allows for linkage of organizations with similar missions, and provides families with accessible means to meet others in their community, creating a social network which in turn may promote enhancement in community health. Strengthening community ties by linking families to resources may be the way to provide the critical capacity required for communities to support, rather than obstruct, optimal health.

Future Research

We need to reframe the way we think about interventions. While the randomized controlled trial (RCT) is considered the gold standard study design, potential pitfalls of such a design in a community setting such as this one need to be addressed. The RCT design may not be the best choice to evaluate child weight management interventions implemented in community settings, as there is a great deal of pressure to adhere closely to study protocols and intervention scripts when carrying out studies within this design. While structure (whether it is a theoretical framework or a measurement protocol) is necessary in order to be able to evaluate whether there is in fact an intervention effect and so others may duplicate the protocol, scripted approaches do not always work and in fact, they may be a barrier to successful implementation and outcomes. This rigidity (or the researcher agenda) when working with human subjects – whether they are children or adults – must be tempered if studies are to recruit and retain an adequate number of participants to determine whether or not a program has had a meaningful effect in real-world settings.

Moreover, stringently adhering to study protocols does not allow one to "see the forest for the trees" when working in behavioral change models, and reduces the ability of investigators to adjust and modify recruitment or intervention approaches to fit the population, thus optimizing recruitment/retention and subsequently, study efficacy.

Resnicow and colleagues have described two dimensions to models for understanding and creating culturally-sensitive community weight interventions: 1) surface sensitivity, where the intervention themes incorporate normal cues and symbols

that reflect the target groups' culture and 2) deep structure sensitivity in which the intervention reflects an understanding the dominant beliefs and values of a culture, and interventionists tailor materials to incorporate and resonate with these values. (Resnicow, Baranowski et al. 1999)

The beliefs and values that constitute this "deep structure" have yet to be elucidated. It is possible that our intervention, while succeeding at the surface sensitivity, failed to adequately address beliefs and values constituting the deeper structure. Our participants, although sharing the same ethnic/racial background, were obviously from two very distinct cultural backgrounds and the extent to which each groups "deep structure" beliefs overlapped is unclear.

As mentioned in the first chapter of this dissertation, the shortage of proven strategies to prevent unhealthy weight gain in children may in part, be attributed to our limited understanding of the precise etiology of childhood obesity. Identifying potential mediators and describing their influence on childhood overweight is essential to development of sound and successful interventions. This suggests a need to return to basic nutrition and physical activity behavioral research to determine the underlying values, beliefs, attitudes that dictate behavior. Since young children rely on parents to provide them with opportunities to engage in healthy eating and regular physical activity, understanding parental values, beliefs and attitudes related to child health and weight represents an important and unexplored area of research.

There currently remains a very limited evidence base guiding interventions that target underserved and minority populations. Future research should also include

qualitative methods to better understand the perceived barriers to healthy lifestyle change, and should focus on identifying behavior change models that are applicable to diverse populations. We must consider redefining program success in minority populations that often have different priorities and resources.

Given that time is an oft-cited concern of parents and that involvement of other children was suggested as a possible barrier to recruitment, future studies should invite entire families to participate and programming should strive to be flexible – both in terms of the intervention protocol and the duration/timing of the intervention delivery – for example, two-hour blocks each week may not be a feasible option for working parents with other young children at home.

Transparent reporting of ethnicity, initial sample size, attrition rate, along with frank discussion of challenges encountered in behavioral interventions is a necessary, not optional, step in reporting results of any intervention trial. These data will provide researchers with crucial data that will hopefully lead to the development of more effective programs.

Application to Community Health Settings

Programs will continue to be ineffective if they cannot reach participants and are not well-attended. Solving these issues should be a top research priority.

Our obesogenic environment may be overwhelming any attempts by intervention program at improving child and family health. A concerted and coordinated effort should be undertaken to improve community infrastructure to support healthy behaviors. This can be accomplished through modifications of the built environment, creating a

community with adequate sidewalks and safe places to play, community meeting places where families have access to health information and free or low-cost opportunities to be physically active, and grocery stores that offer healthy foods within walking distance.

It has become very clear that parents are key players in determining child health. Future childhood obesity prevention and treatment studies should be designed to involve parents and foster parenting skills (e.g. time management, child feeding practices) that will support healthy living and will have a positive impact on weight.

Research without a plan for sustainability should not be supported – sustainable models should not be the eventual goal, but the initial goal of every program.Although the intervention was initially delivered by UA faculty and staff, part of the effort to sustain this program involved training YMCA staff and Cooperative Extension nutrition educators to deliver the program in community settings. YMCA staff have already received training in physical activity programming and delivery (emphasizing lifestyle activities rather than competitive sports) and nutrition education. These activities are infused into YMCA facilities in Tucson providing opportunities to reinforce activities conducted at the schools. These efforts are and continue to be supported through engaging University of Arizona undergraduate and graduate students to assist the YMCA and Cooperative Extension in program delivery, at the same time providing these students with training and internship opportunities.

University of Arizona faculty and staff have also worked with all of the Sunnyside schools to help them conduct school wellness self-assessments (e.g., CDC School Health Index) and develop tailored wellness plans. As a result of these efforts,

Sunnyside schools have written CDC grants requesting support of the wellness plans (two of which have been funded).

The following are some general thoughts on how to continue to expand on the trans-community model demonstrated by the current efforts within the Sunnyside School district (which include the Activa study) to create self-sustaining partnerships within the community – schools + community agencies + clinics – with university support:

1. Schools represent centralized, easily accessible, familiar locales that have access to children which would allow for initial health screenings (e.g. BMI).
2. After-school programs jointly sponsored by the school and a local community agency or agencies (e.g. YMCA, Cooperative Extension) and assisted by high school students trained as mentors could serve a dual purpose: supervised child care combined with physical activity and nutrition education opportunities.
3. Family programs hosted by schools or community agencies and taught by community-based paraprofessionals (e.g. EFNEP Nutrition Educators or other Extension agents) provide opportunities for families to come together and learn about various health-related topics and hook into local resources (e.g. Food Bank, farmer's market, free health clinics), at the same time creating social networks that sustain healthy lifestyle changes.

We must consider a multi-faceted approach that will engage community members. Interventionists must be prepared to deliver interventions and resources to highly mobile, resource-challenged families who may not recognize child weight as an issue or consider health in the same way.

Approaching the issue of childhood overweight as a trans-community effort is both the challenge and the solution.

APPENDIX A

CORRELATES OF WEIGHT STATUS AND BODY COMPOSITION IN 8-10-YEAR-OLD HISPANIC CHILDREN

INTRODUCTION

Childhood obesity is a major public health problem in the United States, affecting approximately 16% of all children, with an additional 34% estimated to be "at risk," (Wang and Beydoun 2007). A high body mass index during childhood is associated with undesirable levels of lipids, insulin, and blood pressure (Freedman, Dietz et al. 1999) (Reilly, Methven et al. 2003) (Must and Strauss 1999), and its tendency to track into adulthood (Guo, Roche et al. 1994) (Power, Lake et al. 1997; Must and Strauss 1999; Reilly, Methven et al. 2003) places obese children at increased risk for adult obesity, its co-morbidities, (Berenson, Srinivasan et al. 1998), (Li, Li et al. 2004) and early mortality. (Engeland, Bjorge et al. 2004) Overweight children also experience lower self-esteem compared to their normal weight peers, a condition with significant (Strauss, Smith et al. 1985; Braet, Merviele et al. 1997; Pierce and Wardle 1997; Strauss 2000) emotional and social consequences, including increased rates of sadness, loneliness, nervousness, and higher rates of alcohol and tobacco use. (Strauss 2000)

Although the obesity epidemic affects children from all ethnic and social backgrounds, overweight and its co-morbidities are disproportionately prevalent among minorities.(Flegal, Ogden et al. 2004; Freedman, Khan et al. 2006) Hispanics are at particularly high risk, with data from national health surveys (NHANES, BRFSS, and the Add Health Study) suggesting that rates of overweight in Hispanic children and adolescents exceed the national average by almost 10 percentage points, with Hispanic boys ages 6-11 experiencing the highest prevalence of extreme BMI (BMI $\geq 99^{th}$ percentile). (Freedman, Khan et al. 2006; Wang and Zhang 2006)

Despite increasing recognition of the risks of childhood obesity, there remains a shortage of proven strategies to prevent unhealthy weight gain in children. In part, this may be attributed to our limited understanding of the precise etiology of childhood obesity. Although fundamentally overweight is the consequence of an imbalance in energy intake relative to expenditure (Hill, Wyatt et al. 2003), exactly *which* factors are responsible remains uncertain. Increased availability of energy dense foods, secular declines in physical activity, and a simultaneous increase in sedentary behavior in the United States are widely considered as primary causes of weight gain - behaviors which, in children, are profoundly shaped by familial and environmental factors. (Davison and Birch 2001)

While unhealthy eating and activity behaviors undoubtedly contribute to the incidence of childhood overweight, they are arguably only mediators within the causal pathway leading to childhood obesity, and it is the "upstream" factors, e.g. parent and child psychosocial characteristics and parent modeling that represent the major roadblocks on the path to a healthy weight. Interventions targeting these factors may be more successful in eliciting sustained weight change than any attempts to alter diet and activity behavior alone.

The idea of parents as key players in child weight control is not new, as Epstein demonstrated the effect of family functioning, parental support and the home environment on child weight as early as the 1970's. Subsequent interventions based on this premise have demonstrated that overweight children have greater success in normalizing body weight with parental support than without it. (Brownell, Kelman et al.

1983; Epstein, Koeske et al. 1984; Epstein, Wing et al. 1986; Graves, Meyers et al. 1988; Epstein, Valoski et al. 1990; Flodmark, Ohlsson et al. 1993; Epstein, McKenzie et al. 1994; Epstein, Valoski et al. 1995; Epstein, Paluch et al. 2000; Epstein, Paluch et al. 2004; Edwards, Nicholls et al. 2006) (Kirschenbaum, Harris et al. 1984; Israel, Stolmaker et al. 1985; Israel, Solotar et al. 1990; Golan, Fainaru et al. 1998; Golan and Crow 2004; Jiang, Xia et al. 2005; Sacher, Chadwick et al. 2005; Golley, Magarey et al. 2007; Kalavainen, Korppi et al. 2007; Nowicka, Pietrobelli et al. 2007; Rodearmel, Wyatt et al. 2007; Shelton, LeGros et al. 2007) Nevertheless, family interventions remain limited in number and like other approaches, lose initial effectiveness over time, as shown in recent reviews which identified only two interventions that have been successful in demonstrating long term effects on child weight status. (Epstein, Valoski et al. 1990; Epstein, Paluch et al. 2000).

Family-based interventions have been even less successful in eliciting weight change in minority children. The majority of evidence-based obesity prevention programs in use today were not designed for minorities, and the continued scarcity of research in Latino populations (Mexican-American as well as those born in other Latin countries) has hindered the development of culturally-competent interventions that might reduce overweight prevalence.(Yancey, McCarthy et al. 2004)

As it remains unclear exactly how parents influence child weight, assessing both parent and child psychosocial correlates of weight, in addition to nutrition and physical activity behaviors, is a necessary step in designing effective programs. Culture has been cited as a primary determinant of lifestyle and health outcomes. (Yancey, Ory et al. 2006) As communities increasingly consist of newly emigrated families whose cultural norms, values, and traditions may differ significantly from families who grow up in the United States, understanding how acculturation modifies lifestyle and health choices is an important consideration when designing interventions intended for minority populations.

Using baseline data from Activa Y Sana, we sought to determine correlates of child BMI and % body fat in Mexican-American children through selection and testing of potential mediators based on the Social Cognitive Theory framework (SCT). The SCT explains child health behavior as a function of personal skills, self-efficacy, and outcome expectancies interacting with the environmental variables of parental modeling and resource availability. (Baranowski, Perry et al. 2002)

Hypothesized correlates of child BMI and % fat in this study were child and parent dietary habits (e.g. fruit and vegetable intake, sweetened beverage consumption), child and parent physical activity (e.g. minutes spent in moderate-to-vigorous physical activity, screen time), child psychosocial factors (e.g. self-esteem, perceptions of parental modeling, support, and encouragement), adult psychosocial factors (e.g. self-efficacy), and parent BMI and % fat. Parental acculturation and child gender were considered as potential moderators of child behavior and were explored in subgroup analyses.

METHODS

Participants

Activa Y Sana was a trans-community childhood obesity prevention and treatment trial in a lower socioeconomic status, predominantly Mexican-American

community. One hundred forty-one children in the 3rd and 4th grades at four elementary schools and their parents or caregivers volunteered to participate in the 18-month study. Complete anthropometric data were collected from 96 children and 86 parent/caregivers (10 parents had 2 children enrolled in study). To reduce potential confounding from use of duplicate parent data, one child from each of the ten families was chosen at random to be removed from baseline analyses, leaving 86 adult/child dyads for the analyses presented herein.

The final sample (>80% Mexican-American) was closely representative of the schools and community from which we recruited (88% Mexican-American, 5% White, 4% Native American, 2% African American, and 1% Asian, with over 90% participation in subsidized lunch programs). Although children with a wide range of weight for height were enrolled, heavier children were oversampled since the main aim of the project was to slow weight gain in at-risk and overweight children. The University of Arizona Human Subjects Protection Program Committee approved the study and written parental informed consent and child assent were obtained.

Measurements

Anthropometry

Anthropometric measures were obtained following the standard, validated techniques outlined in the Anthropometric Standardization Manual. (Lohman, Roche et al. 1988) Body weight was measured to the nearest 0.1 kg using a SECA Model 770 scale. Standing height was measured to the nearest mm using a Shorr measuring board. Abdominal circumference was measured to the nearest mm using a standard anthropometric tape measure. Two measures of each variable were obtained and the averages were used as the criterion measures.

Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters squared.

Body composition was estimated from Bioelectrical Impedance Analysis (BIA). Resistance (R) and reactance (Xc) were measured twice using the RJL Systems Quantum II single frequency impedance analyzer, and the averages used to estimate body composition. Fat free mass (FFM) was estimated from resistance index (Ht^2/R) using the following validated age- and gender-specific equations:

> Child fat free mass =.61*((height*height/resistance) + .25* (weight) + 1.31 (Houtkooper, Going et al. 1992)

For adult men, the following equation was used:

> Fat free mass = ((.00066360*(height*height) - .02117*resistance +.62854*weight - .1238*age + 9.33285) + (.0008858*(height*height) - .02999*resistance + .42688*weight - .07002*age + 14.524350))/2 (Heyward and Wagner 2004)

For adult women, the following equation was used:

Fat free mass = ((.00064602*(height*height) - .01397*resistance + .42087*(weight) + 10.43485) + (.00091186*(height*height) -.01466*(resistance) + .2999*(weight) - 0.07012*(age) + 9.37938))/2 (Heyward and Wagner 2004)

Body fat and % body fat were then derived from FFM and body weight.

Questionnaires

Child and parent demographic information (e.g. birthdate, gender, race/ethnicity), behaviors (diet and physical activity), and psychosocial correlates of behavior were assessed by questionnaires. Children completed questionnaires in English, and parents had an option of English or Spanish. Parent acculturation was estimated based on consent and questionnaire language preference.

The Children's Physical Activity Correlates questionnaire (CPAC) was used to assess child physical activity. The CPAC was a self-administered physical activity recall asking children to report level of participation ("none," "a little," "a lot") in 31 activities during the after-school period (e.g. "What did you do YESTERDAY after school?"), that was adapted from a similar questionnaire developed for the Pathways Study. (Stevens, Cornell et al. 1999) CPAC provided estimates of moderate-to-vigorous physical activity, METS, and activity type. Additional questions assessed active mode of transport to school, and whether the child participated in an organized club or team sport.

In adults, physical activity was assessed using the Arizona Activity Frequency Questionnaire (AAFQ), which was previously validated against doubly-labeled water in adults. (Staten, Taren et al. 2001)The AAFQ provided estimates of adult moderate-to-vigorous physical activity, METS, activity type, and frequency over the previous 28 days. Both occupational (hours per week spent at work and intensity of activity while at work) and non-occupational (frequency, intensity, and duration of leisure, personal care, recreational, household activities) activities are assessed. This questionnaire is available in either English or Spanish.

Dietary intake was assessed in adults using the Arizona Food Frequency Questionnaire (AFFQ), a 113-item, semi-quantitative scannable food frequency questionnaire designed to assess usual eating habits over the previous 3 months. Frequency of consumption is grouped into 7 categories ranging from rarely/never to more than 3 times per day. Participants are also asked to report usual portion size (small, medium or large) and answer open-ended questions identifying specific types and brands of food and vitamins along with fruits and vegetables not listed. The AFFQ has been validated (against food recalls and dietary records) in populations living in the Southwest and is available in English and Spanish. (Martinez, Marshall et al. 1999)

Dietary intake behavior was monitored in children using the Child Diet Assessment Questionnaire (CDAQ) and The Children's Habits Questionnaire (CHQ) developed for the Choices study. (Ritenbaugh 2007) The CDAQ was designed to capture the eating habits of children thought to have the greatest impact on health, notably consumption of processed and convenience foods, the number of meals eating away from home, milk and soft drink consumption, and the intake of fruits and vegetables. The

CDAQ consists of several subscales, the first of which consists of 11 questions asking children to recall what they ate the previous day (e.g. “Yesterday, did you eat any vegetables?”). Additional subscales ask children to characterize their food-related habits (8 questions, e.g. “Do you ever read nutrition labels on food packages”), answer questions testing their nutrition knowledge (4 questions, asking children “Which is healthier?” choosing between 2 items), and disclose food preferences (9 questions, e.g. Which would you order at a fast food restaurant?” choosing between 2 items). Estimates of breakfast frequency and beverage preference and frequency of consumption were obtained for the Children’s Habits Questionnaire.

Child sedentary behavior was assessed with 2 questions from the Children’s Habits Questionnaire: “How many hours of video games (like Game Boy, X-Box, Play Station) and computer games do you play every day?” and “How many hours of television do you watch every day?”

Adult psychosocial factors were evaluated using three questionnaires. The Self-Efficacy and Exercise Habits Scale measured beliefs that one can “stick with” an exercise program under varying circumstances. This questionnaire has two constructs – “resisting relapse” and “making time” - with five items each. (Sallis, Pinski et al. 1988) The Exercise Intrinsic Motivation Inventory measured level of motivation for exercise and physical activity within the constructs of enjoyment/interest (e.g. “I enjoy getting involved in physical activities very much”, perceived competence (e.g. “I think I do pretty well at physical activities compared to others”), effort/importance (“e.g. It is important for me to do well at physical activities”) and pressure/tension (e.g. “I am usually anxious when I engage in physical activities”). Each of these constructs had four questions. (McAuley, Duncan et al. 1989) The Weight Management Self-Efficacy Scale measured self-efficacy related to body weight within the constructs of emotions, availability, social pressure, physical discomfort, and positive situations. This questionnaire had five subs-scores (20 questions total, each assessed on a 10-point scale, 1= Not Confident, 10 = Very Confident) with higher scores indicating higher weight management self-efficacy. (Clark, Abrams et al. 1991)

Child psychosocial measures were assessed using the Children’s Physical Activity Correlates (CPAC) instrument and the Children’s Health Habits (CHQ) Questionnaire. The CPAC includes 44 items that together measure 10 constructs potentially related to physical activity in children. The instrument is a combination of a number of validated scales including fifteen items from the Children’s Attraction to Physical Activity (CAPA) scale (Brustad 1993), five items from Harter’s perceived competence scale (Harter 1982), six items from Rosenberg’s self-esteem scale and 18 items from a parent socialization scale developed by Welk and colleagues.(Welk, Wood et al. 2003) The reliability and validity of the CPAC has been previously reported.(Schaben, Joens-Matre et al. 2004) The CPAC measures ten constructs related to liking of games, sports, and exercise, fun of physical exertion, perceived importance of exercise, peer acceptance, competence at physical activity, parent as a role model, parental support, parental encouragement, and child self-esteem.

The CHQ also included eleven questions that evaluated child nutrition and physical activity self-efficacy – "How Sure Are You?" – e.g. "I can eat a fruit every day." Responses were framed as a 4-point Likert scale, ranging from "I know I can" to "I know I can't." The CDAQ similarly evaluated dietary self-efficacy with eight questions that asked children "How Sure Are You?" when given a choice between two foods – e.g. "How sure are you, that you can drink low fat or skim milk instead of whole milk?"

Data Analyses

Child BMI changes with age, making BMI an inappropriate measure when making comparisons of overweight between groups of children. Age- and gender-specific BMI z-scores were used in place of BMI for estimating changes in adiposity over time.

Child BMI was adjusted for age and sex using Epi Info™ 3.4.3 software (Division of Integrated Surveillance Systems and Services at the Centers for Disease Control and Prevention). Epi Info™ provides a BMI z-score and precise BMI centile based on child sex, height, weight, and age using reference data from the National Health and Examination Survey (NHES) and National Health and Nutrition Examination Survey (NHANES). (Kuczmarski 2000) Children above the 95th percentile were considered overweight, while those between the 85th and 95th percentile were classified as "at risk for overweight." (Kuczmarski 2000)

Adult BMI cutoffs for overweight (BMI 25-29.9 kg/m^2) and obesity (BMI 30+ kg/m^2) from World Health Organization were used to determine weight status of adults. (WHO 2000)

Statistical analyses were completed using the Statistical Package for the Social Sciences (SPSS, version 15.0). Measures of central tendency and distribution were examined, as well as tests for normality and homoscedasticity. Independent t-tests were used to compare subject characteristics (e.g. anthropometry) between males and females and between children with more and Spanish-speaking parents. Pearson correlation coefficients were calculated to examine associations between child and adult dietary, physical activity, and psychosocial variables and child BMI z-score and % body fat and to select covariates to test in the multivariate models. Multiple linear regression was used to examine relationships between dependent variables of weight status and body composition (BMI z-score, % body fat) and hypothesized predictor variables. Covariates were selected for model testing relative to their location in our model (Figure A.1.) and their statistical significance in bivariate correlations. Standardized beta coefficients were evaluated to determine the magnitude and direction of the associations between each of the predictor variables and BMI z-score and % body fat.

Additional analyses were conducted with self-esteem and self-efficacy as dependent variables and BMI z-score or % body fat as predictors along with other psychosocial measures, as well as stratified analyses by sex and parental acculturation to explore possible differences in patterns of correlates between males and females, and children from English- versus Spanish-speaking homes. For correlation and regression analyses, a significance threshold $p<=.10$ was set to decrease type II error because of the smaller sample size.

RESULTS

Eighty-three percent of children reported their ethnicity as Hispanic. Children were 54% female, 9.1 ± 0.6 years of age, and had an average BMI of 22.2 ± 5.4 kg/m^2. Fifty-two percent of children fell above the 95th BMI-for-age percentile, placing them in the overweight category. An additional ten percent were between the 85th and 95th percentiles, placing them at risk for overweight. Body composition data for children indicated the mean body fat was above 25% for boys and 30% for girls. (Table A.1.) While height, weight, BMI, BMI z-score, and waist circumference did not differ significantly between boys and girls, percent body fat was significantly higher in girls (32.3 ±7.2%) compared to boys (26.9 ±8.6%), $p<.05$. Child BMI and waist circumference, but not % fat, were significantly lower in children whose parents preferred to read and write in Spanish.

Children from Spanish-speaking families reported higher consumption of candy and candy bars ($p<.05$) and more frequent snacking while watching television ($p<.10$) than children from English-speaking families. (Table A.2.) Children of Spanish-speaking families were more physically active compared to children of English-speaking parents. ($p<.05$) Children from English-speaking families reported more frequent eating out occasions or getting food "to go." ($p<.10$) Boys reported spending more time engaged in television viewing and video game playing than girls. ($p<.05$)

Participating adults were 81% female, 34.9±7.3 years old, with a mean BMI of 31.7± 6.4 kg/m^2. (Table A.3.) Ninety percent of the adults were overweight or obese according to WHO guidelines. (WHO 2000) Thirty-eight percent preferred to read and write in Spanish, and sixty-one percent reported working outside the home on a full-time basis. Men were significantly taller than women, with nearly identical weight and significantly lower BMI and percent body fat. Although Spanish-speaking parents had lower average weight, waist circumference, BMI, and % body fat than English-speaking, the differences were not significant.

English-speaking parents reported greater weight instability in the previous year (i.e. gained or lost more than 5 lbs) ($p<.10$) and higher energy expenditure exerted in leisure time activities than parents who preferred Spanish. ($p<.05$) (Table A.4.) Parents who preferred reading and writing in Spanish reported greater energy expenditure through recreational activities ($p<.10$) and household activities ($p<.10$) as well as greater moderate physical activity overall ($p<.10$) compared to those who preferred to read and write in English. Parents who preferred Spanish also reported significantly higher consumption of fruits, vegetables, and juice. ($p<.05$) Men reported significantly higher consumption of milk ($p<.05$), energy expended through recreational activities ($p<.05$), and moderate-to-vigorous physical activity ($p<.05$) than women.

Bivariate correlations between demographic variables, psychosocial, nutrition and physical activity variables and child weight status (child BMI z-score, body composition) can be found in Tables A.5. - A.12. Variables with significant relationships ($p<0.10$) were entered into the first step of the regressions of the multivariate models.

Overall, parent BMI was significantly correlated with child BMI and child BMI z-score (Table A.5., $r = 0.40$, $p<.05$; $r = 0.40$, $p<.05$), although this relationship was not significant in children from Spanish-speaking families. (Figure A.2.) Child % body fat

was significantly correlated with parent % body fat in children from English speaking families ($r= 0.34$, $p<.05$), but not among gender subgroups or children from Spanish speaking families ($r=0.07$). (Table A.5.) Waist circumference in the overall sample (and particularly in girls) was significantly inversely correlated with screen time and daily physical activity (estimated metabolic equivalents). (Tables A.6., A.7.) In girls, % body fat was also positively associated with screen time. (Tables A.7.)

There were no significant behavioral correlates of child BMI z-score. Child intake of fruit was marginally significant for children from English-speaking families. ($p<.10$) (Table A.8.)

In the overall sample, child BMI, BMI z-score, and % body fat were all inversely associated with self-esteem. ($r = -0.25$, $p<.05$; $r = - 0.18$, $p<.10$; $r = -0.26$, $p< .05$) (Table A.9.) Subgroup analyses showed the significant inverse relationship between self-esteem and anthropometric measures was strongest for boys and children from English speaking families. Self-esteem was positively correlated with enjoyment of physical activity and perceived acceptance by peers in the overall sample, and with fun of physical exertion in children from Spanish speaking families. (Table A.9.)

Self-efficacy (related to healthy eating and activity) was positively correlated with child nutrition knowledge in the overall sample, as well as all subgroups. (Table A.10.) Self-efficacy was also positively associated with child perception of parental encouragement in the overall sample, and in boys and girls. Boys', but not girls', perception of parental role modeling (of healthy behavior) and parental support were also positively related to self-efficacy.

Child enjoyment of physical activity and perceived acceptance by peers was positively correlated with perception of parental support and encouragement in the overall sample and subgroups. (Table A.11.) Subgroup analyses showed a positive correlation between perceived parental modeling and encouragement and fun of physical exertion for girls only.

Vegetable intake was positively correlated with nutrition knowledge in the overall sample and all subgroups. (Table A.12.) Among boys, there was also a positive relationship between fruit and milk consumption and nutrition knowledge. An inverse relationship between ice cream and candy intake knowledge and nutrition knowledge was shown among children whose parents spoke only Spanish.

Selection of variables for regression models was based on the significant relationships between dependent variables and predictors in the bivariate analyses. Standardized beta coefficients for significant predictors are given in Tables A.13., A.14., and A.15.

Child BMI z-score was regressed on child self-esteem, child screen time, child physical activity, and child fruit and vegetable intake, and parent BMI. Parent BMI was the only significant predictor in the model ($p<.001$), which explained 14.5% of the variance in BMI z-score. (Table A.13.)Subgroup analyses revealed a significant cultural divergence, with the model explaining 24.9% of the variance in children from English-speaking families and 5.8% in the children of Spanish-speaking families.

Child % body fat was regressed on child self-esteem, screen time, physical activity, and vegetable and fruit intake. Adult % fat and child self-esteem were significant predictors in the overall model, explaining 6.8% of the variance in child % fat. (Table A.14.) Subgroup analyses showed self-esteem predicted % body fat in boys and in children from English-speaking families, but not in girls or children from Spanish-speaking households. The only significant predictor of girls' % body fat was screen time. This model failed to explain a significant proportion of the variance in % body fat in children from Spanish-speaking families.

Child self-esteem was regressed on child BMI z-score, child perception of peer acceptance, fun of physical exertion, and child perception of parental support, encouragement, and healthy role modeling. Child perception of parental encouragement was a significant predictor of child self-esteem across the entire sample. (Table A.15.) Child BMI z-score was also a significant predictor of self-esteem in the overall sample (explaining 34.4% of the variance in self-esteem along with parental encouragement) and in boys. Peer acceptance was a significant predictor of self-esteem in children from Spanish-speaking families.

DISCUSSION

This study examined correlates of child BMI z-score and % fat – specifically parent and child diet and physical activity behaviors, psychosocial factors, and demographics - in a predominantly Mexican-American sample chosen for high BMI. In our study, Spanish-speaking parents and their children had lower BMI, % fat, and waist circumferences compared to English-speaking families, although differences were only significant for children. This finding is supported by numerous data suggesting that the process of acculturation in the United States is related to unhealthy lifestyle changes, leading to overweight in both adults and their children. (Families 1998; Kaiser, Melgar-Quinonez et al. 2001; Gordon-Larsen, Harris et al. 2003) Girls had significantly higher body fat percentages than boys, possibly indicating that Mexican-American girls may be at increased risk for overweight at an earlier age in our population.

Although we found significant relationships between hypothesized correlates of BMI z-score and % fat, there were no consistent predictors of BMI z-score and % body fat across all subgroups. Exploratory analyses of subgroups (sex and acculturation) indicate that our overall models may not apply to children from Spanish-speaking households.

In our self-esteem prediction model, perception of parental encouragement was a significant predictor of child self-esteem across the overall sample and all subgroups. Child BMI z-score was also a significant predictor of self-esteem, but only in the overall sample, and in boys. Child self-esteem was a significant predictor of child % fat. This finding suggests a reciprocal relationship between self-esteem and adiposity, in that an overweight child is more likely to have low self-esteem, low self-esteem may at the same time prompt children to engage in coping behaviors (e.g. emotional eating, increased sedentary behavior) that may lead to a higher BMI. This confirms previous research suggesting child adiposity is a predictor of lower self-esteem, and that this relationship

appears to be mediated by sex and age, with the lowest self-esteem observed in boys prior to age 13, and in girls after 13. (Stradmeijer, Bosch et al. 2000)

Parental encouragement was a consistent predictor of self-esteem across all subgroups, suggesting that this parenting practice impacts child self-esteem, and in turn, may also indirectly affect child weight status. If these findings are validated by future research, intervention programs should focus on ways in which parents may support and encourage their children in physical activity and healthy eating endeavors.

In our English-speaking sub-sample, parent BMI and % fat consistently predicted child BMI and % fat, supporting numerous existing studies establishing the heritability of body weight and fatness. (Maes, Neale et al. 1997) (Bulik, Sullivan et al. 2003; Schousboe, Willemsen et al. 2003; Romeis, Grant et al. 2004; Malis, Rasmussen et al. 2005) As this appeared to be the strongest, consistent predictor of both BMI and % fat in our study population, this highlights the continued need to focus obesity prevention efforts on younger children in which early intervention may moderate genetic susceptibility to accelerated weight gain.

There were several limitations in our study. This study was designed to test a trans-community obesity prevention and treatment program in low socioeconomic status 3rd and 4th grade Mexican-American children and their parents living in the Southwest. Our findings are specific to this population of school-aged children, and may not represent children of other ethnicities or body sizes. Correlational and regression analyses of our primary outcome measures (BMI z-score and % fat) were unable to explain a substantial portion of the variance in BMI z-score or % fat. While this may be, in part, related to our somewhat truncated distribution of child BMIs (overweight or at-risk children were oversampled, comprising 62% of the sample), this finding is not unexpected given the complexity of childhood overweight and difficulty in assessing mediators of body composition and obesity. There is a great need to pursue larger-scale studies investigating hypothesized correlates of behavior and weight within different ethnicities, SES and acculturation levels.

Other factors potentially influencing child adiposity (e.g. parent SES, food availability/accessibility in the home) were not measured. Acculturation was estimated from parent language preference rather than a validated questionnaire.

Our chosen theoretical framework (SCT) may not accurately predict behavior in this population. Baranowski and colleagues cite the inability of current theoretical models to predict behavior as one of the possible reasons for null findings in interventions. (Baranowski, Anderson et al. 1998)

While our study participants appeared to come from similar ethnic and socioeconomic backgrounds, our findings highlight subtle differences between subgroups of our participants (English-speaking, Spanish-speaking, male, and female) in behaviors, body composition, and psychosocial characteristics.

While this apparent heterogeneity within our sample may be viewed as a disadvantage, it serves to reinforce the apparent differences (even within the same ethnic groups) in culture, indicating that a one-size-fits-all intervention approach is unlikely to be effective in eliciting behavior or weight changes.

CONCLUSIONS

Parent BMI was a significant predictor of child BMI z-score in English-speaking families, but not in Spanish-speaking families. Parental encouragement was a significant predictor of child self-esteem, which in turn was a strong predictor of child % body fat in boys and English-speaking families. Our study has further supported a growing body of research suggesting parents influence their child's weight through different mechanisms and that culture may act as a moderator of these relationships.

Interventions tailored to fit a target population that focus on improving family functioning and providing parents with the skills to encourage their children and support them in healthy lifestyle choices may be helpful in helping children achieve and maintain a healthy body composition and weight.

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FIGURES

Figure A.1. – Hypothesized Relationships Among Parent and Child Variables

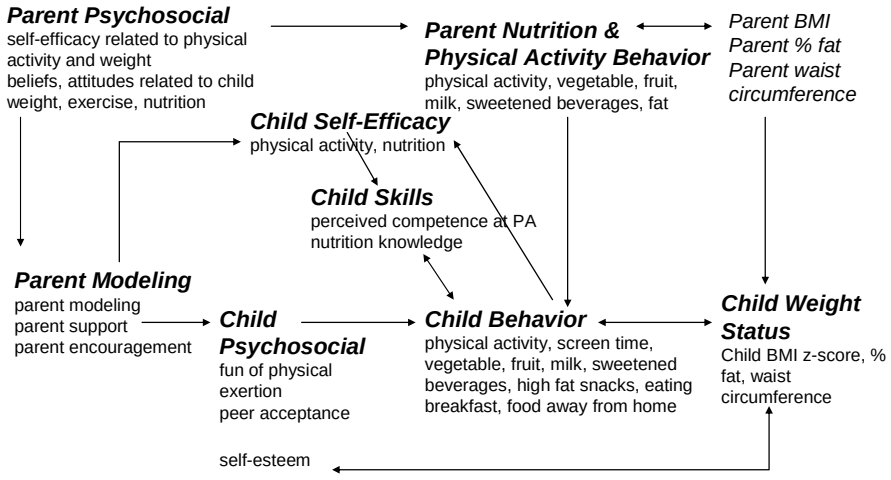
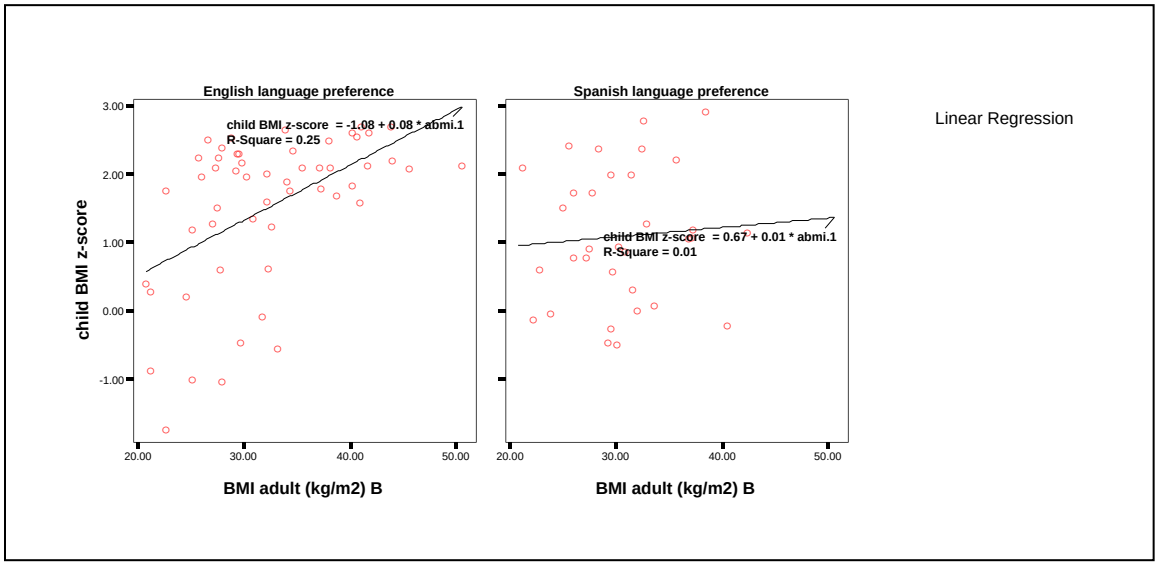


Figure A.2. – Child BMI z-score versus adult BMI by parent language preference



TABLES

A.1. - Child Characteristics (mean ±SD)

	Total Sample [d] n=86	Boys n=40	Girls n=46	English[a] n=53	Spanish[a] n=33
Age (yrs)	9.1 ± 0.6	9.0 ± 0.6	9.2 ± 0.6	9.1± 0.59	9.2 ± 0.73
Height (cm)	136.8 ± 7.0	136.2 ± 7.3	137.3 ± 6.8	136.7± 7.6	136.9± 6.2
Weight (kg)	42.1 ± 13.0	39.6 ± 11.5	44.3 ± 14.0	43.8± 13.4	39.3± 12.1
Waist cir.(cm)	73.9 ± 16.6	72.2 ± 13.4	75.4 ± 19.1	77.2[c] ± 15.8	68.7[c]±17.0
Body fat (%)	29.8 ± 8.3	26.9[b] ± 8.6	32.3[b] ± 7.2	30.9±7.9	28.0±8.7
BMI (kg/m^2)	22.2 ± 5.4	21.1 ± 4.8	23.1 ± 5.8	23.1[c]±5.3	20.8[c]±5.4
BMI z-score	1.35 ±1.1	1.3 ±1.0	1.4 ±1.1	1.5± 1.1	1.1± 0.98

[a]parent language preference for reading and writing;[b]significantly different from one another by gender, p<.05; [c]significantly different from one another by acculturation, p<.05;[d]ethnicity 83.7% Hispanic

Table A.2. – Differences in behaviors, psychosocial characteristics between subgroups, children; mean ±SD
Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d; psychosocial variables on 4-point scales (1 = low, 4 = high)

	Total Sample n=86	Boys n=40	Girls n=46	English[a] n=53	Spanish[a] n=33
Vegetables	1.19 ±0.98	1.2 ±0.99	1.17± 0.97	1.15 ±1.0	1.24 ±0.93
Fruits	1.44 ±1.00	1.45 ±0.99	1.43 ±1.02	1.38 ±0.95	1.55 ±1.1
Milk	1.14 ±0.92	1.12 ±0.88	1.15 ±0.96	1.13 ±0.98	1.15 ±0.83
Sweets, pastries	0.45 ±0.70	0.38 ±0.59	0.51 ±0.79	0.40 ±0.63	0.53 ±0.80
Ice cream	0.34 ±0.52	0.33 ±0.47	0.36 ±0.57	0.36 ±0.56	0.31 ±0.47
Candy, candy	0.41±0.71	0.43 ±0.59	0.39 ±0.80	0.26 [b] ±0.59	0.63 [b] ±0.82
Food away from home	0.22 ±0.41	0.3 ±0.46	0.15 ±0.36	0.28 [c] ±0.45	0.12 [c] ±0.33
Breakfast	5.45 ±2.3	5.26 ±2.49	5.6 ±2.12	5.25 ±2.41	5.76 ±2.17
TV viewing	3.01 [d] ±1.13	2.9 [d] ±1.1	3.1 ±1.17	3.0 ±1.15	3.0 ±1.1
Snacking while viewing TV	0.61 ±0.49	0.67 ±0.47	0.56 ±0.50	0.53 [c] ±0.50	0.74 [c] ±0.44
Video game playing	2.02 [d] ±1.08	2.55 [d] ±1.23	1.56 ±0.65	2.01 ±1.06	2.03 ±1.13
Physical activity	121.8 ±88.0	121.4 ±86.1	122.2 ±90.6	105.7 [b] ±77.8	147.69 [b] ±98.1
Sweetened beverages	2.08 ±0.57	2.03 ±0.54	2.13 ±0.61	2.04 ±0.56	2.14 ±0.61
Self-efficacy	3.15 ±0.55	3.21±0.52	3.1 ±0.57	3.2 ±0.53	3.1 ±0.57
Fun of physical exertion	2.91 ±0.71	3.00 ±0.64	2.92 ±0.76	2.90 ±0.66	2.92 ±0.78
Perception of peer acceptance	2.80 ±0.71	2.83 ±0.59	2.77 ±0.79	2.79 ±0.67	2.80 ±0.77
Perceived competence at physical activity	2.93 ±0.60	2.97 ±0.57	2.90 ±0.62	2.96 ±0.56	2.98 ±0.66
Self-esteem	3.17 ±0.65	2.36 ±0.64	3.10 ±0.66	3.19 ±0.66	3.17 ±0.67
Perceptions of parent as a role model	2.97± 0.56	3.03 ±0.49	2.93 ±0.62	2.93 ±0.54	3.04 ±0.59
Perceptions of parental support	3.05 ±0.55	3.13 ±0.52	2.99 ±0.57	3.03 ±0.53	3.09 ±0.58
Perceptions of parental encouragement	3.19 ±0.59	3.13 ±0.65	3.25 ±0.55	3.19 ±0.63	3.21 ±0.54

[a]parent language preference for reading and writing;[b]significantly different from one another by acculturation, p<.05;[c]significantly different from one another by acculturation, p<.10;[d]signficantly different from one another by gender, p<.05

Table A.3. – Parent/Caregiver Characteristics (mean ±SD)

	Total Sample[c] n=86	Men n=16	Women n=70	English[a] n=53	Spanish[a] n=33
Age (yrs)	34.9 ± 7.3	39.1 ± 10.5	33.9 ± 6.0	34.3± 7.4	35.8± 7.2
Height (cm)	161.6 ± 8.2	170.1[b]± 8.3	159.7[b] ± 6.9	161.8± 8.5	161.3±7.8
Weight (kg)	82.9 ± 18.7	82.8 ± 15.5	82.9 ± 19.5	85.1± 20.1	79.6± 16.0
Waist cir(cm)	99.7 ± 18.2	98.6 ± 13.8	99.9 ± 19.2	102.2±18.3	95.7±17.7
Body fat (%)	39.2 ± 7.7	28.4[b] ± 8.3	41.8[b] ± 5.6	40.0± 7.9	37.9±7.3
BMI (kg/m^2)	31.7 ± 6.4	28.8[b] ± 6.1	32.4[b] ± 6.4	32.4± 7.0	30.5 ± 5.2

[a]parent language preference for reading and writing; [b]significantly different from one another by gender, p<.05;
[c]ethnicity 80.2% Hispanic

Table A.4. – Differences in behaviors, psychosocial characteristics between subgroups, adults; mean±SD

	Total Sample n=86	Men n=16	Women n=70	English[a] n=53	Spanish[a] n=33
Vegetables	232.9± 267.4	299.57± 432.3	222.19± 234.1	166.25[a] ± 193.1	350.9[a] ± 336.5
Fruits	261.6± 430.9	304.7± 433.6	254.4± 433.8	170.9[a] ± 198.1	414.8[a] ± 637.4
Milk	364.9± 339.3	668.1[c] ± 496.4	322.3[c] ± 292.8	340.9 ± 275.8	405.8 ± 430.4
juice	197.4 ± 292.6	232.9± 191.4	301.6± 293.2	135.4[a] ± 155.6	300.1[a] ± 417.8
Sweetened bev	554.1± 692.0	514.4± 561.3	521.8± 722.5	646.3 ± 776.6	387.3 ± 477.0
Wt management self-efficacy	7.0 ± 1.9	7.17± 1.5	7.0 ±1.9	6.94 ± 1.8	7.18 ± 2.1
Exercise self-efficacy	3.96± 0.93	4.18± 0.65	3.92± 0.97	4.02 ±0.88	3.87 ± 1.0
Days/week worked	3.17 ± 2.6	2.8± 3.0	3.23± 2.6	3.47 ± 2.6	2.64± 2.7
Hrs/day worked	4.44 ± 4.4	4.9 ±5.2	4.37± 4.3	4.95 ± 4.2	3.55± 4.7
<u>Occupational activity</u>					
Teens	1.98 ±0.79	2.30±0.82	1.93±0.78	2.19[a] ± 0.73	2.22[a] ±0.56
20's	2.13 ±0.56	2.40±0.51	2.08±0.56	2.22± 0.56	1.96 ±0.54
30's	1.96± 0.68	2.33[d] ±0.50	1.89[d] ± 0.69	1.91 ±0.68	2.05 ± 0.69
<u>Non-occupational activity</u>					
Teens	2.15 ±0.82	2.50± 0.85	2.09±0.80	2.36 ± 0.73	1.78 ±0.85
20's	2.16± 0.64	2.40± 0.52	2.12±0.65	2.21 ±0.60	2.08 ±0.70
30's	1.87 ±0.65	2.22[d] ± 0.44	1.80[d] ± 0.66	1.76 ±0.61	2.05 ±0.69
Leisure activity energy expend/d (kJ)	1605.6 ± 1154.9	1685.2± 1364.9	1593.2± 1130.6	1154.6[a] ± 168.4	956.1[a] ± 183.9
Recreational activity energy expenditure (kJ)	990.4± 1589.2	1915.7[c] ± 2924.7	845.9[c] ± 1243.9	739.3[a] ± 1101.4	1427.7[a] ± 2152.2
Household activity energy expenditure (kJ)	4207.7 ± 2790.1	2681.2[d] ±2054.7	4446.2[d] ± 2825.5	3787.7[b] ± 2390.7	4938.7[b] ± 3297.0
METS Level 1 activities (kJ)	5423.4 ± 2720.7	3752.9[c] ±2898.3	5684.5[c] ± 2620.1	5260.0 ± 2521.9	5707.9 ± 3065.6
METS Level 2 activities (kJ)	1295.8 ± 1768.1	1967.2± 2607.0	1190.9± 1602.7	1017.7 ± 1206.5[b]	1780.0 ± 2412.2[b]
METS Level 3 activities (kJ)	376.1 ± 1164.3	1176.4[c] ± 2509.9	251.0[c] ± 743.9	217.7± 531.7	651.7 ± 1783.8
Total daily energy expenditure (kJ)	11781.9 ± 3988.3	12640.1± 8620.5	11645.7± 2747.3	11389.8 ± 2987.1	12449.9 ± 5279.3

[a]significantly different BY ACCULTURATION p<.05;[b]significantly different BY ACCULTURATION p<.10;
[c]significantly different BY GENDER p<.05;[d]significantly different by GENDER p<.10

Table A.5. – Correlates of child BMI z-score, % fat, waist circumference

	Total Sample (n=86 pairs)	Boys n=40	Girls n=46	English n=53	Spanish n=33
Child BMI z-score					
Parent BMI	.40**	.46**	.35**	.51**	.07
Child % fat					
Parent % fat	.21*	.20	.21	.34**	-.07
Child waist					
Parent waist	.28**	.12	.38**	.27*	.22

*p<.10, **p<.05

Table A.6.- Correlates of child % body fat

	Total Sample n=86	Boys n=40	Girls n=46	English n=53	Spanish n=33
Child % body fat					
Vegetables	0.05	0.08	0.02	0.14	-0.09
Fruits	-0.01	0.12	-0.14	0.17	-0.21
Milk	-0.01	-0.08	0.04	0.06	-0.11
Sweets, pastries	-0.07	-0.17	-0.07	-0.01	-0.13
Sweetened beverage	-0.11	-0.25	-0.05	-0.12	-0.06
Eating out	-0.06	0.02	-0.03	-0.05	-0.19
Screen time	0.09	0.11	0.28*	0.14	0.02
Physical activity	-0.09	-0.12	-0.05	-0.07	-0.03

*significant, p<.10

Table A.7. - Correlates of child waist circumference

	Total Sample n=86	Boys n=40	Girls n=46	English[a] n=53	Spanish[a] n=33
Child waist circ.					
Vegetables	0.04	0.07	0.03	0.11	-0.04
Fruits	0.03	0.04	0.02	0.13	-0.05
Milk	0.02	-0.13	0.11	0.08	-0.06
Sweets, pastries	0.02	-0.08	0.06	0.03	0.07
Sweetened beverage	-0.08	-0.15	0.06	-0.02	-0.13
Eating out	0.02	0.01	0.07	0.01	-0.10
Screen time	0.13	0.02	0.29**	0.14	0.12
Physical activity	-0.22**	-0.11	-0.29**	-0.13	-0.22

**significant, p<.05

Table A.8. – Correlates of child BMI z-score

	Total Sample (n=86 pairs)	Boys n=40	Girls n=46	English n=53	Spanish n=33
Child BMI z-score					
Vegetables	.05	.10	.01	.21	-.23
Fruits	.05	.17	-.05	.25*	-.24
Milk	.02	-.03	.06	.09	-.11
Sweets, pastries	-.10	-.06	-.14	-.04	-.15
Sweetened beverage	.04	-.12	.14	.002	.14
Eating out	.06	.13	.02	.06	-.09
Screen time	.14	.10	.24	.10	.14
Physical activity	-.02	-.11	0.6	.08	.21

*p<.10

Table A.9. - Correlates of child self-esteem

	Total Sample (n=86 pairs)	Boys n=40	Girls n=46	English n=53	Spanish n=33
Child self-esteem					
Child BMI z-score	-.18*	-.27*	-.09	-.15	-.26
Child BMI	-.25**	-.35**	-.16	-.27	-.25
Child % body fat	-.26**	-.37**	-.10	-.33**	-.18
Child waist cir	-.24	-.30*	-.19	-.29**	-.20
fun physical exertion	.21*	.22	.19	.14	.32*
Perception of peer acceptance	.47**	.54**	.41**	.29**	.73**
Perception of parental encouragement	.55**	.54**	.60**	.64**	.51**
Perceptions of parental support	.46**	.49**	.43**	.53**	.42**
Perceptions of parent role model	.31**	.21	.36*	.25	.36**

*p<.10, **p<.05

Table A.10. – Correlates of child self-efficacy

	Total Sample (n=86 pairs)	Boys n=40	Girls n=46	English n=53	Spanish n=33
Child self-efficacy					
Parent modeling	.17	.40**	.02	.32**	.01
Parent encourage	.42**	.48**	.40**	.36**	.41**
Parent support	.33**	.47**	.22	.36**	.32*
Parent self-efficacy	.07	-.10	.26	-.04	-.04
Child nutrition knowledge	.32**	.32**	.36**	.25*	.50**
Child vegetable	.32**	.37**	.28*	.22	.51**
Child fruit	.24*	.22	.26*	.13	.42**
Child milk	.12	.14	.11	.09	.19
Child pastries, sweets	-.02	-.01	-.01	-.05	.04
Child sweetened bev	-.10	.02	-.17	-.24*	.12
Child eating out	.02	.01	-.01	-.05	.08
Child screen time	-.19*	-.35**	-.10	-.10	-.31*
Child physical activity	.02	-.08	.10	.13	-.05

*p<.10, **p<.05

Table A.11. – Correlates of child psychosocial characteristics

	Total Sample (n=86 pairs)	Boys n=40	Girls n=46	English n=53	Spanish n=33
Fun physical exertion					
Percept parent role modeling	.17	.05	.23	.10	.25
Percept parent support	.22**	.05	.31**	.18	.26
Percept parent encourage	.15	.03	.28*	.14	.17
Perceived peer accept					
Percept parent role modeling	.27**	.26	.27*	.17	.42**
Percept parent support	.39**	.36**	.40**	.40**	.38**
Percept parent encourage	.39**	.35**	.47**	.34**	.49**

*p<.10, **p<.05

Table A.12. – Correlates of child nutrition and activity behaviors

	Total Sample (n=86 pairs)	Boys n=40	Girls n=46	English n=53	Spanish n=33
Child vegetable					
Child nutrition knowledge	.39**	.42**	.37**	.37**	.44**
Child self efficacy	.32**	.37**	.28*	.22	.51**
Parent vegetable	.15	.19	.09	.05	.30
Child fruit					
Child nutrition knowledge	.16	.27*	.06	.15	.21
Child self-efficacy	.24*	.22	.26*	.13	.42**
Parent fruit	-.04	-.11	.11	.10	-.15
Child juice					
Child nutrition knowledge	.10	.11	.11	.02	.29*
Child self-efficacy	.26**	.39**	.16	.16	.44**
Parent juice	.004	.02	-.02	-.02	-.02
Child milk					
Child nutrition knowledge	.13	.31**	-.07	.14	.09
Child self-efficacy	.12	.14	.11	.09	.19
Parent milk	-.02	-.07	.04	-.05	.12
Child pastries & desserts					
Child nutrition knowledge	-.07	-.15	-.02	-.20	.17
Child self-efficacy	-.02	-.01	-.01	-.05	.04
Child sweetened beverage					
Child nutrition knowledge	-.18	-.14	-.25	-.24*	-.43*
Child self-efficacy	-.10	.02	-.17	-.24*	.12
Parent sweet beverages	.013	-.13	.08	.03	-.02
Child candy, candy bars					
Child nutrition knowledge	-.14	-.03	-.24	-.50	-.32*
Child self-efficacy	-.02	-.02	-.03	.08	-.06
Child eating out					
Child nutrition knowledge	-.02	.02	-.04	-.03	.00
Child self-efficacy	.02	.01	-.01	-.05	.08
Child screen time					
Perceived peer acceptance	-.08	-.02	-.22	.06	-.25
Fun of physical exertion	.09	.20	-.07	.20	-.05
Perceived competence at physical activity	-.10	-.28*	.06	-.02	-.02
Parent energy expenditure	-.10	.09	.09	.05	-.10
Parent leisure time energy expend	.12	-.01	.25	.11	-.30
Child physical activity					
Perceived peer acceptance	.008	-.18	.15	.11	-.08
Fun physical exertion	-.09	-.14	-.06	-.13	-.06
Perceived competence at physical activity	.13	.06	.17	.12	.22
Parent energy expenditure	.03	-.03	.09	.14	-.10

*p<.10, **p<.05

Table A.13. – Multiple regression analysis to predict child BMI z-score

	Total Sample n=86		**Boys n=40**		**Girls n=46**		**English[a] n=53**		**Spanish[a] n=33**	
Predictors	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**
Adult BMI	.40	.000	.43	.008	.40	.009	.51	.000	-.06	.801
Self-esteem	-.10	.362	-.24	.196	-.06	.689	-.10	.429	-.13	.625
Screen time	.16	.131	-.04	.805	.34	.029	.12	.360	.20	.360
Physical activity	-.04	.690	-.15	.329	.06	.731	-.07	.633	-.15	.468
Vegetables	.06	.608	.07	.712	.08	.673	.08	.591	-.02	.925
Fruits	.04	.765	.16	.398	-.24	.809	.16	.276	-.25	.297
	Adj R^2 = .145		Adj R^2 = .179		Adj R^2 = .112		Adj R^2 = .249		Adj R^2 = .00	

Table A.14. – Multiple regression analysis to predict child % body fat

	Total Sample n=86		**Boys n=40**		**Girls n=46**		**English[a] n=53**		**Spanish[a] n=33**	
Predictors	**Stand.β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**
Adult % fat	.2	.039	.21	.190	.38	.021	.40	.005	-.14	.505
Self-esteem	-.26	.025	-.48	.011	-.06	.685	-.31	.027	-.12	.637
Screen time	.12	.282	-.09	.633	.46	.006	.15	.293	.20	.353
Physical activity	-.01	.924	-.06	.701	-.03	.882	-.08	.612	-.02	.907
Vegetables	.06	.662	.20	.328	.03	.874	.07	.667	.01	.972
Fruits	-.05	.679	.03	.881	-.10	.556	.07	.669	-.26	.287
	Adj R^2 = .068		Adj R^2 = .100		Adj R^2 = .134		Adj R^2 = .174		Adj R^2 = .00	

Table A.15. – Multiple regression analysis to predict child self-esteem

	Total Sample n=86		**Boys n=40**		**Girls n=46**		**English[a] n=53**		**Spanish[a] n=33**	
Predictors	**Stand.β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Stand.β**	**Sig.**
Peer accept	.04	.673	-.02	.902	.03	.866	-.09	.455	.28	.071
Parent role model	.05	.613	.02	.868	.11	.484	.09	.529	.04	.777
Parent encourage	.40	.000	.40	.008	.54	.005	.35	.023	.50	.001
Funphysical exertion	.07	.466	.01	.313	.01	.957	.06	.625	-.02	.903
Child BMI z-score	-.16*	.069	-.25*	.062	-.05	.694	-.16	.203	-.16	.222
	Adj R^2 = .344		Adj R^2 = .403		Adj R^2 = .276		Adj R^2 = .242		Adj R^2 = .506	

APPENDIX B

EFFICACY OF THREE INTERVENTION LEVELS IN PREVENTING UNHEALTHY WEIGHT GAIN AMONG HISPANIC CHILDREN AT-RISK OR OVERWEIGHT

1. INTRODUCTION

Childhood obesity prevalence has more than tripled over the past three decades, with recent data suggesting that prevalence in children and adolescents exceeds 17%, with an additional 35% at risk. (Ogden, Flegal et al. 2002; Hedley, Ogden et al. 2004; Ogden, Carroll et al. 2006; Wang and Beydoun 2007) Minorities are disproportionately affected by obesity and its co-morbidities, a disparity attributed to genetic factors as well as racial and ethnic differences in lifestyle behavior and socioeconomic status. (Cossrow and Falkner 2004) Compared to other ethnic minorities, Hispanic children and adolescents have the highest combined prevalence of overweight and risk for overweight (39.9%), and within this population, Hispanic boys aged 6 to 11 experience the highest proportion of extreme BMI (BMI $\geq 99^{th}$ percentile).(Freedman, Khan et al. 2006; Wang and Zhang 2006)

Despite the recognition of childhood obesity as a public health crisis, efforts directed at slowing or halting this trend have been unsuccessful, in part due to interventions limited in both impact and reach. (Kohn and Booth 2003; Lobstein, Baur et al. 2004) Preventive efforts have not been effective because the majority of programs target children in a single and limited environment - often a school. Although schools provide an opportunity to reach a large audience of children, school-based interventions rarely translate to improved child nutrition and physical activity behavior outside of the school setting. Treatment interventions (targeting already overweight children) also have failed to significantly impact child weight, as they typically focus on altering child behavior without involving parents or caregivers in the behavioral change process, thus essentially guaranteeing only short-term effects.

The present study, Activa Y Sana (Active and Healthy), was a two-year study designed to expand upon schools as the single intervention venue, and test the feasibility of a multi-level intervention (combining during school with after-school and family programs) on weight in an at-risk, predominantly minority population of children and their parents.

2. METHODS

2.1. Design

Three schools from the same school district in Tucson, Arizona were assigned to one of three interventions levels: Level 1, a school intervention based on state curriculum standards for nutrition and physical activity; Level 2, Level 1 intervention plus an after-school nutrition education and physical activity program co-sponsored by the YMCA; and Level 3, which included the first two levels plus a family intervention. Level 1 served as the comparison condition because it represented the minimal requirement, or "standard of care," for schools in the state of Arizona. Comparisons across levels allowed assessment of the added impact of each level, or intervention dose, on child weight status compared to the more typical school-based program. We hypothesized that the after-school and family programs (Levels 2 and 3) would decrease unhealthy weight gain and increase healthy behaviors when compared to the school-based program (Level 1).

2.2. Participants

The target population was children in 3rd and 4th grades with BMI at or above the 85th percentile for age and their parents (or primary caregivers). Ninety-six children and their parents volunteered to participate in the two-year study. The final sample was closely representative of the schools and community from which they were recruited (Sunnyside District is 88% Hispanic, 5% White, 4% Native American, 2% African American, and 1% Asian, with over 90% participation in subsidized lunch programs). The University of Arizona Human Subjects Protection Program Committee approved the study and written parental informed consent and child assent were obtained.

2.3. Intervention Design

The Activa Y Sana intervention was based on cognitive behavioral approaches that have been used extensively and effectively for the prevention and management of obesity for adults and children. (Beck 1967) (Wisotsky and Swencionis 2003) Within the cognitive behavioral framework, Activa incorporated concepts from Social Learning Theory (Bandura 1977), the Theory of Planned Behavior (Ajzen 1985), and the Social Ecological Model. (McElroy, Bibeau et al. 1988) Key concepts from these theoretical models included self-efficacy, environmental influences, behavioral capability, expectancies, self-control and performance, observational learning, reinforcement, and social norms that when taken together, suggest that the Activa after-school and family-based programs would have a greater impact on motivating and sustaining changes in health-related behaviors. Additionally, work by Epstein (Epstein, Valoski et al. 1990) has previously demonstrated the long-term effectiveness of family intervention versus child-only intervention, and thus a family approach was adopted as the central aspect of the intervention protocol for Level 3.

2.3.1. Level 1 – School-based program

Level 1 was considered the "standard of care," or control condition, as all four schools received it. Thus, the two Activa schools (A and D) receiving only Level 1 served as the comparison group for the other interventions.

The Level 1 intervention consisted of an enhanced nutrition and physical activity curricula developed within the Sunnyside School District by University of Arizona faculty and staff working in partnership with school district officials, and designed to meet the Arizona Comprehensive Health and Physical Activity Standards. Curricula development was funded through a three-year Federal Department of Education grant serving all fourteen elementary schools within the Sunnyside District (including the four Activa schools), enrolling a total of 8,500 children from low SES, minority families. Schools received physical activity equipment and teachers received eight in-service workshops each year, providing them with innovative physical education curricula aimed at increasing developmentally appropriate physical activity during the school day and enhanced nutrition education that was incorporated into the school health curriculum delivered in the classroom setting. Implemented in the fall of 2006 during P.E. and health classes, Level 1 was a combination of Great Body Shop (nutrition education) and CATCH P.E. curricula.

2.3.2. Level 2 – School-based + after-school program

Level 2 included the school-based program (Level 1) plus an onsite YMCA after-school program two days per week and every other Friday for a minimum of 10 days per month during the school year. Sessions began immediately after school and lasted for 2 hours, focusing largely on physical activity and individualized physical activity goals with a 10 minute nutrition lesson. Children receiving the Level 2 intervention participated in the Team Nutrition Healthy Snacks Program, which provided them with a portion-controlled snack and fruit serving to eat during the nutrition lesson.

Activities within the Level 2 intervention built on behavioral skills and content learned in the Level 1 program, and were structured to be student-centered (versus teacher-centered) and lifestyle physical activity-based (versus game- or sport-based). This was meant to increase child enjoyment of physical activity, promote the development of physical and behavioral skills necessary to increase cardiovascular fitness, promote social acceptance and support to be active, and assist children in developing their own programs. The focus on motivation through experiential activities, problem-solving skills, and provision of social and physical environments that support the students' physical activity opportunities are congruent with the social-ecological model.

The YMCA concepts of Respect, Responsibility, Caring, and Honesty were also integrated into the Level 2 lessons to create an environment conducive to the physical activity motivators of fun, success and social reinforcement. The YMCA donated a cargo van (dubbed "The Moving Van") to house and bring physical activity equipment (e.g. rollerblades, bicycles and other active play equipment) and active video games (e.g. Dance Dance Revolution) for use during the sessions.

2.3.3. Level 3 – School-based + after-school + family program

Level 3 which included the family component, integrated and reinforced the basic nutrition and physical activity information students received at school (Level 1) and during the after-school program (Level 2), and provided family members with strategies to work together to plan healthy menus, read food labels, and support each other in making healthy decisions about food consumption and physical activities through a series of nutrition education and physical activity classes ("Family Fun Nights") held at the school during the fall and spring semester of 2006 and 2007.

The family intervention consisted of twelve, two-hour sessions taking place on Thursday evenings between 5:30pm and 7:30pm. All sessions were taught in English with Spanish translation assistance and bilingual materials. Children and adults began each Family Fun Night together by participating in a group physical activity demonstration. This demonstration allowed adults and children an opportunity to be active together, and provided an interactive way to instruct families on using physical activity equipment. Prior to each family night, children in the after-school program were introduced to the physical activity equipment that would be given to them during that week's family intervention meeting, which allowed them to become familiar with equipment ahead of time, and "assist" Activa staff in instructing their parents. Physical activity demonstrations were followed by a "light meal" (which doubled as a food demonstration) where families were given the opportunity to try a "5-A-Day" recipe

utilizing seasonal fruits and vegetables prepared by study staff. Recipes and basic food preparation tips were provided during each session by a registered dietitian and Extension Nutrition Educator who circulated among the families as parents and children ate. Children and parents were then separated for the remainder of the evening (approximately one hour), spending the remaining time engaged in nutrition-themed physical activities (children) or discussion/nutrition activities (adults). (A copy of the family intervention session schedule and lesson topics may be found in Appendix D).

All family intervention sessions were team-taught by university staff and Cooperative Extension Nutrition Educators with assistance from guest speakers (e.g. Family Practice MD, YMCA staff) and school physical education staff. Lesson content was adapted from research-based nutrition and physical activity curricula (e.g. Expanded Food and Nutrition Program, University of Arizona's Cooperative Extension Service in Pima County; Eating Right is Basic—Enhanced, Michigan State University Extension, 2001; Healthy Weight 4 Life, University of Arizona Center for Nutrition and Physical Activity) and families participated in hands-on activities designed to help them apply nutrition and activity skills in a way that fit their available resources.

The physical activity component of the family intervention was based on the CHOICES Project (Reeves 2008), designed to introduce children and parents to the health benefits of physical activity, providing the motivational grounding for choosing a physically active life over a sedentary one – a first step in the goal-setting process. Physical activity was incorporated into each class using videos, interactive video gaming systems (e.g. Dance Dance Revolution; Nintendo Wii). Children received activity backpacks that during the first week of the intervention which provided a place to store equipment received during the program (e.g. Frisbee, Nerf ball) and contained ideas for family activities. Families also participated in physical activity self-assessments (e.g. pedometer logging), designed to address barriers to physical activity, encourage social support within the family, and develop action plans/goals to increase opportunities for family physical activity.

Level 2 and Level 3 intervention programs began after baseline measures were completed. (Figure B.1.) Children in School B (Level 2 only) had the opportunity to attend a total of 88 after-school sessions (65 sessions during year 1, and 23 sessions during the fall of year 2). Children in School C (Level 3 intervention) could attend a total of 82 after-school sessions (60 sessions in year 1, 22 in the fall of year 2). Children and parents in School C were also invited to attend 12 "Family Fun Night" sessions during the fall and spring of 2006 and 2007 (October 2006 to March 2007 with a two-month hiatus between weeks 6 and 7). Attendance at all intervention sessions was tracked via sign-in sheets.

2.4 Measurements

Primary outcomes were child BMI, % body fat, waist circumference, physical activity and food intake. Secondary measures included selected psychosocial variables related to physical activity and eating. All assessments were completed by trained staff. Behavioral measures were collected by individuals not directly involved in the

intervention to minimize demand characteristics around responses. Main outcomes were measured at baseline and after the conclusion of the Level 3 family night intervention (6 months). Each child and one parent/primary caregiver were assessed. Only child data are reported herein.

2.4.1. Anthropometry

Body weight and composition were assessed using the standard techniques described in the *Anthropometric Standardization Manual* (Lohman 1988) (Lohman, Roche et al. 1988) and *Applied Body Composition Assessment* (Heyward 2004). (Heyward and Wagner 2004) Body Mass Index was calculated from weight in kilograms divided by height in meters squared. Standing height was measured in duplicate (nearest millimeter) using the Shorr measuring board. Body weight was measured in duplicate (nearest 0.1 kg) using the Seca Model 770 scale calibrated with a standard weight. Abdominal circumference was measured in duplicate (nearest mm) using a standard anthropometric tape measure. Body composition was estimated from Bioelectrical Impedance Analysis (BIA). Resistance (R) and reactance (Xc) were measured twice using the RJL Systems Quantum II single frequency impedance analyzer, and the averages used to estimate body composition. Fat free mass (FFM) was estimated from resistance index (Ht^2/R) using a validated equation:

Child fat free mass =.61*((height*height/resistance) + .25* (weight) + 1.31 (Houtkooper, Going et al. 1992)

Body fat and % body fat were then derived from FFM and body weight.

2.4.2. Physical Activity and Nutrition Behaviors

The Children's Physical Activity Correlates questionnaire (CPAC) was used to assess child physical activity. The CPAC was a self-administered physical activity recall asking children to report level of participation ("none," "a little," "a lot") in 31 activities during the after-school period (e.g. "What did you do YESTERDAY after school?"), that was adapted from a similar questionnaire developed for the Pathways Study. (Stevens, Cornell et al. 1999) CPAC provided estimates of METS and activity type. Additional questions assessed active mode of transport to school, and whether the child participated in an organized club or team sport.

Child sedentary behavior was assessed with 2 questions from the Children's Habits Questionnaire: "How many hours of video games (like Game Boy, X-Box, Play Station) and computer games do you play every day?" and "How many hours of television do you watch every day?" Children's responses to these two questions were combined to estimate "screen time."

Diet behavior was monitored using the Child Diet Assessment Questionnaire (CDAQ) and The Children's Habits Questionnaire (CHQ) developed for the Choices study. (Ritenbaugh 2007) The CDAQ was designed to capture the eating habits thought to have the greatest impact on health, notably consumption of processed and convenience foods, the number of meals eaten away from home, milk and soft drink consumption, and

consumption of fruits and vegetables. The CDAQ consists of several subscales; the first subscale consists of 11 questions asking children to recall what they ate the previous day (e.g. "Yesterday, did you eat any vegetables?"). Additional subscales test nutrition knowledge (4 questions, asking children "Which is healthier?" choosing between 2 items). Estimates of breakfast frequency and beverage preference and frequency of consumption were obtained from the Children's Habits Questionnaire.

2.4.3. Psychosocial factors

Child psychosocial measures were assessed using the Children's Physical Activity Correlates (CPAC) instrument and the Children's Health Habits (CHQ) Questionnaire. The CPAC includes 44 items that together measure 10 constructs related to physical activity in children including liking of games, sports, and exercise, fun of physical exertion, perceived importance of exercise, peer acceptance, competence at physical activity, parent as a role model, parental support, parental encouragement, and child self-esteem.

The instrument is a combination of a number of validated scales including fifteen items from the Children's Attraction to Physical Activity (CAPA) scale (Brustad 1993), five items from Harter's perceived competence scale (Harter 1982), six items from Rosenberg's self-esteem scale and 18 items from a child socialization scale developed by Welk and colleagues.(Welk, Wood et al. 2003) The reliability and validity of the CPAC has been previously reported.(Schaben, Joens-Matre et al. 2004)

The CHQ also included eleven questions that evaluated child nutrition and physical activity self-efficacy ("How Sure Are You?") e.g. "I can eat a fruit every day." Responses were framed as a 4-point Likert scale, ranging from "I know I can" to "I know I can't." The CDAQ similarly evaluated dietary self-efficacy with eight questions that asked children "How Sure Are You?" when given a choice between two foods – e.g. "How sure are you that you can drink low fat or skim milk instead of whole milk?"

2.5. Statistical Analyses

Statistical analyses were completed using the Statistical Package for the Social Sciences (SPSS, version 15.0). Measures of central tendency and distribution were examined, as well as tests for normality and homoscedasticity.

Age- and gender-specific BMI z-scores were used for estimating changes in adiposity over time. Child BMI was adjusted for age and sex using Epi Info™ 3.4.3 software (Division of Integrated Surveillance Systems and Services at the Centers for Disease Control and Prevention). Epi Info™ provides a BMI z-score and precise BMI centile based on child sex, height, weight, and age using data from NHES and NHANES as the reference populations. (Kuczmarski 2000) Children above the 95^{th} percentile were considered overweight, while those between the 85^{th} and 95^{th} percentile were classified as "at risk for overweight." (Kuczmarski 2000)

Missing data were imputed using Multiple Imputation Chained Equations (WinMICE software, TNO Quality of Life, Leiden, the Netherlands, 2005). The WinMICE software generates multiple imputed data sets (typically five) by picking data values at random from the distributions of observed or predicted data for each of the

imputed variables (e.g. BMI z-score and % fat). Missing baseline data (n=3) was replaced with an observed % fat value from available baseline data. To fill in missing data at the 6-month follow-up (n=18 BMI z-scores and n=19 % fat values) WinMICE was directed to select, at random, values derived from the distribution associated with the regression of 6-month BMI z-score or % fat regressed on baseline BMI z-score or % fat, respectively. Each of the data sets were then analyzed using standard statistical tests.

Baseline differences between children who returned for measurements and those who did not were compared using independent t-tests. Analysis of variance was used to identify significant differences in child anthropometric variables, and in dietary, physical activity, and psychosocial variables among intervention levels at baseline and 6 months, as well as to assess differences in changes among groups in these variables between baseline and 6 months.

Within each intervention level and intervention dose, paired t-tests were used to assess significant changes between baseline and 6 months.

Predictors of change in BMI z-score and % fat were evaluated using multiple regression models with contrast variables adjusted for baseline levels of BMI z-score and % fat, testing the effects of Level 2 and Level 3 versus the control condition (Level 1) and Level 2 intervention versus Level 3 intervention on BMI z-score and % body fat changes between baseline and 6 months. Models using imputed data were compared with those using observed values only.

Independent t-tests were used to evaluate the effect of the Level 2 and Level 3 intervention "dose" on changes in anthropometric, nutrition/activity, and psychosocial factors, by comparing children who attended at least 50% of all after-school or after-school plus family sessions to those that attended fewer than 50% of sessions. As comparative data identifying optimal frequency of intervention dose needed to elicit specific behavior changes do not currently exist, 50% was chosen as the minimum dose necessary for children to be exposed to key concepts of the intervention program. Sample size did not permit other comparisons.

3. RESULTS

3.1. Baseline characteristics

Of the 96 children who initially consented to participate in the program, 81 completed baseline measures.Baseline age, anthropometric characteristics and body composition are given in Table B.1. There were no significant differences among intervention levels for any of these measures, although differences in weight between Level 2 children and Level 1 and 3 children approached significance. ($p<.10$) In each intervention level, over half of children were above the 85th percentile of BMI for age- and gender, with a mean % body fat at or above a level consistent with obesity. (Williams, Going et al. 1992)

Child nutrition and activity behaviors at baseline are given in Table B.2. Children in Level 1 reported consuming a significantly greater amount of sweetened beverages at baseline than children in the other two intervention conditions. ($p<.05$) Children above the 85th percentile reported significantly fewer breakfast consumption occasions per week than children who were below the 85th percentile (4.75 times/week compared to 6.5

times/week, p<.05). (Table B.3.) These children also reported significantly increased perceptions of parents as a healthy role model at baseline. (p<.05) All other differences were not significant.

Child psychosocial characteristics for each intervention level are given in Table B.4. There were no significant differences found among levels for these measures.

3.2. 6-month measures, changes between baseline and 6 months

Of those children measured at baseline, sixty-three (78% of baseline sample) returned for 6-month follow-up measures. Baseline characteristics of children who did not return for the first follow-up measures were compared to those who were measured at follow-up. The only significant differences found between the two groups was baseline fruit consumption (missing children reported 1.5 times more frequent consumption of fruit), p<.05. (Table B.5.)

Gender, weight status, age, weight, height, BMI, BMI z-score, % fat, and waist circumference for each intervention level at baseline and 6 months are given in Table B.6. Forty-three children (68%) measured at 6 months had maintained or decreased their BMI z-score from baseline, while twenty children increased their BMI z-score. There were no significant differences found among intervention levels at baseline or 6 months, or in changes from baseline to 6 months in anthropometric measures or body composition.

Within each intervention level, height and weight significantly increased from baseline. (p<.01 for both) Percent body fat decreased in all three levels between baseline and 6 months, although the only significant decrease was in the control condition. Increased waist circumferences were observed across all levels during this time, although increases were only significant in Level 3 children (p<.05).

Measures of child nutrition and physical activity behaviors for each intervention level at baseline and 6 months are given in Table B.7. Significant differences between intervention levels were observed for high fat snack intake between baseline and 6 month measurements (Level 1 children decreased their mean intake of high fat snacks compared to Levels 2 and 3 who increased their mean intake between these two time points). (p<.05) Significant differences in mean intake of sweetened beverages were also observed between baseline and 6 months for Levels 1 and 2 compared to Level 3 (p<.05), with level 3 increasing intake while levels 1 and 2 decreased intake. Within intervention levels, Level 1 children reported significant decreases in high fat food intake (p<.05), while Level 2 and 3 children reported increases (although these were not significant). Children in Level 2 and Level 3 reported significant increases in physical activity between baseline and 6 months (p<.05 for both).

Child psychosocial characteristics for each intervention level at baseline and 6 months are given in Table B.8. Children in Level 3 reported perceiving significantly higher degrees of parental support, encouragement and modeling of healthy behaviors than children in the other two conditions at the 6-month follow-up measure. Children in Level 2 reported significantly lower peer acceptance than those children in Level 1 at 6 months. (p<.05) There were significant differences in changes between baseline and 6 months found among intervention levels. Mean change in fun of physical exertion

decreased in Level 2, while Level 1 and Level 3 mean scores increased. ($p<.05$) Changes in child perception of parental support, encouragement, and perception of parents as healthy role model were significantly different between Level 1 and Level 2 (scores decreased for all three variables in both of these levels) and Level 3 (scores increased in this level) ($p<.05$ for all differences in changes).

Significant changes in psychosocial variables within intervention levels were observed between baseline and 6 months. Child perception of parental support significantly decreased in Level 1 and increased in Level 3 ($p<.05$ and $p<.01$, respectively). Child perception of parental encouragement and healthy role modeling also significantly increased in Level 3. ($p<.05$ for both) Fun of physical exertion significantly decreased in Level 2 children. ($p<.05$)

3.3. Intervention Effect

Standardized beta coefficients for intervention level contrast variables (adjusted for baseline BMI and % fat) in the multivariate models assessing predictors of BMI and % fat change from baseline to 6 months are given in Table B.9. Intervention level was not a significant predictor of change in BMI z-score between baseline and 6 months. Baseline BMI z-score and baseline % body fat, but not intervention level was a significant predictor of change in z-score and change in % body fat between baseline and 6 months.

3.4. After-school Program Participation (Level 2)

Average attendance for the after-school program was 55% (n=16 children) in School B. (Data not shown) To examine the effect of the Level 2 intervention dose on primary outcomes, children who attended at least 50% of the after-school were compared with those who attended fewer than 50% of sessions. Mean baseline, 6-month, and baseline to 6-month changes within and between groups are given in Table B.10.

At baseline, children who attended more than 50% of after-school sessions reported significantly lower perception of parental support and perception of their parent as a healthy role model than children who attended fewer 50% of the sessions, ($p<.05$ for both).

At the 6-month follow-up measure, children who attended 50% or more of the after-school sessions reported eating significantly more vegetables compared to those who did not attend at least 50% of the sessions. ($p<.05$) This same group reported eating significantly less fruit and consuming significantly fewer servings of sweetened beverages than children attending fewer sessions. ($p<.05$ for both)

Significant differences in weight change were found between the two attendance groups. ($p =.054$) Those who attended more than 50% of sessions gained an average of 2.1 kg while those who attended fewer than 50% gained 4.4 kg between baseline and 6 months. Significant differences in changes in sweetened beverage and juice consumption between baseline and 6 months were observed between the two groups (attenders decreased consumption while non-attenders increased consumption; these were significantly different changes, $p<.01$ for sweetened beverages, and $p<.05$ for juice).

Within each group, children gained significant weight and height between baseline and 6 months ($p<.01$ for both measures, both groups), and reported increased physical activity ($p<.10$). Children who attended at least 50% of Level 2 sessions also significantly decreased % body fat and waist circumference between baseline and 6 months. ($p<.01$ and $p<.05$, respectively) Children in this group also reported significantly decreased sweetened beverage consumption ($p<.01$), as well as decreased perceived fun of physical exertion during this same time. ($p<.05$) Children who attended fewer than 50% of sessions reported increased self-efficacy between baseline and 6 months ($p<.05$).

3.5. After-School plus Family Intervention Participation (Level 3)

Average Level 3 program attendance in School C was 47% at the after-school program and 41% at the family night program. (Data not shown) The effect of the Level 3 intervention (after-school program + family night program) dose on primary outcomes was evaluated by comparing children who attended at least 50% of the Level 3 intervention sessions (i.e. ≥50% of after-school sessions plus ≥50% of the family night program) to those who attended fewer than 50% of these sessions.

Mean baseline, 6-month, and baseline to 6-month changes within and between groups are given in Table B.11. At baseline, those who attended at least 50% of the sessions reported significantly lower fun of physical exertion, perception of parent support, and perception of parent encouragement compared to those who attended fewer than 50% of sessions, $p<.05$. At 6 months, children who attended 50% or more of the intervention sessions reported significantly lower self-esteem than those who attended fewer than 50% ($p<.05$).

Within both groups, children gained significant weight and height between baseline and 6 months ($p<.01$ for weight and height changes in both groups) and reported significant increases in physical activity and perception of parental support ($p<.05$ for changes in physical activity and parental support, both groups). Children who attended at least 50% of Level 3 sessions also significantly increased self-efficacy between baseline and 6 months, ($p <.05$), and reported a significant increase in perception of parental support ($p<.05$) and encouragement ($p<.01$), while those who attended fewer than 50% of sessions significantly increased waist circumference ($p<.05$).

4. CONCLUSIONS

We hypothesized that the after-school and family programs (Levels 2 and 3) would decrease unhealthy weight gain and increase healthy behaviors compared to the school-based program (Level 1), and that the addition of the family component (Level 3) would sustain these outcomes compared to the after-school and the school-based program. Overall, there were no significant differences in primary outcome measures (BMI, % body fat) among intervention levels at baseline or 6 months, or in changes from baseline to 6 months.

As expected, height and weight significantly increased from baseline within each intervention level ($p<.01$ for both measures), indicating child growth. At the same time, percent body fat decreased, although this decrease was only significant in the control condition. Increased waist circumferences were observed across all levels between baseline and 6 months, although increases were only significant in children participating in the family intervention ($p<.05$).

Children participating in the after-school program (Level 2) and those participating in the after-school + family intervention (Level 3) reported significant increases in physical activity between baseline and 6 months ($p<.05$ for both). Children participating in the after-school + family intervention also reported significant increases in perception of parental support, parental encouragement, and parent as a healthy role model between baseline and 6 months (these changes were significantly different from the changes that occurred in Levels 1 and 2, $p<.05$).

Analyses by Level 2 intervention dose (after-school program only) suggested significant differences at 6 months between groups based on attendance. Children who attended fewer than 50% of after-school sessions reported significantly decreased self-efficacy between baseline and 6 months ($p<.05$) while those attending more than 50% of sessions reported an increase in self-efficacy (although not significant). Children who attended 50% or more of sessions significantly reduced % body fat and sweetened beverage consumption, ($p<.05$ for both) while those who attended fewer than 50% of sessions did not change % body fat, and reported increased sweetened beverage consumption (although not significant). Children who attended more than 50% of after-school sessions reported significantly decreased perceived fun of physical exertion from baseline to 6 months. ($p<.05$)

Analyses by Level 3 intervention dose (after-school + family program) did not demonstrate any significant differences between groups based on attendance. Both groups (those who attended more than 50% of intervention sessions and those who attended fewer than 50%) reported significant increases in physical activity and in perception of parental support between baseline and 6 months. ($p<.05$ for both) Those who attended more than 50% of sessions also reported significantly increased perceptions of self-efficacy and parental encouragement. ($p<.05$ for both)

5. DISCUSSION

Activa Y Sana was a two-year pilot study designed to test the impact of different intervention levels on child weight. While overall weight and body composition outcome data do not support the efficacy of Activa to impact on child weight and body composition, several findings were significant with regard to behavioral outcomes. Self-reported physical activity significantly increased in both the after-school intervention and the after-school + family intervention compared to the school-only intervention. Encouragingly, children participating in the after-school + family intervention also perceived an increase in parental support, encouragement, and health-related behavior role modeling. Contrary to expectations, child perception of fun of physical exertion significantly decreased in children participating in the after-school

intervention. This finding was not replicated in children participating in both the after-school and family intervention, suggesting this effect may be related to parent support or participation.

This study had several limitations. There were several limitations in our study. This study was designed to test a trans-community obesity prevention and treatment program in low socioeconomic status 3rd and 4th grade Mexican-American children and their parents living in the Southwest. Our findings are specific to this population of school-aged children, and may not represent children of other ethnicities or body sizes.

Degree of attrition from the control condition (27% at 6 months) was significantly higher compared to Level 2 (18%) and Level 3 (6%). Although there were no significant differences between those who were measured at 6 months and those who were lost to follow-up, the limited sample size and uneven distribution among the intervention levels resulted in insufficient power to detect a change in BMI of less than 3.0 kg/m^2.

Average participation in intervention activities (after-school and family interventions) was only 55% (of those measured at baseline), preventing any conclusions from being made regarding the effect of intervention dose on outcome measures.

Except for anthropometric and body composition measures, data were collected via self-report, and the reliability of self-report data - particularly in young children - is questionable. (Goran 1998)

One of the strengths of this study was its 'trans-community' design. Activa was designed to expand upon schools as an intervention venue, and assess the feasibility of implementing a multi-level weight reduction approach in an at-risk predominantly Mexican-American population of children and their parents. In this regard, this study was successful in creating a collaborative model, bringing together four elementary schools, a community agency, Cooperative Extension, and children and families with the common goal of improving family and child health. Trans-community models such as this one represent one of the best possible options to promote and sustain lifestyle changes that support healthy families, as they link together existing resources (e.g. YMCA, schools) and provide families with a centralized meeting place and means to meet others within the community. Strengthening community ties by linking families to resources may be the way to provide a critical momentum that communities require to support - rather than obstruct - optimal health.

Although mean BMI z-score in overweight children enrolled in the Activa intervention did not significantly decrease over 6 months, neither did they increase. There remains no clear consensus regarding the clinical significance of weight outcomes in overweight children, and while a 5-10% weight reduction may be a meaningful goal in treatment of adult obesity, this is not necessarily appropriate for children. (Edwards, Nicholls et al. 2006) Treatment goals for children should take into consideration age, stage of growth and development, degree of overweight, and given these considerations, some experts have suggested weight maintenance (BMI decrease) as an appropriate outcome in overweight or obese children (Scottish Intercollegiate Guidelines Network 2003) (Eliakim, Kaven et al. 2002).

Baranowski and colleagues have suggested that behavioral intervention studies that do not demonstrate an effect are not necessarily poorly designed or executed, but that the intervention was unable to effect change in mediating variables. (Baranowski, Anderson et al. 1998) It is possible that this intervention did not target the correct mediators of weight and body composition change, or did not have a meaningful impact on these mediators.

Rather than conducting larger-scale behavioral interventions, future research efforts should first focus on cultivating a greater understanding of the mediators and moderators of childhood obesity, particularly in minority populations who are at disproportionately high risk.

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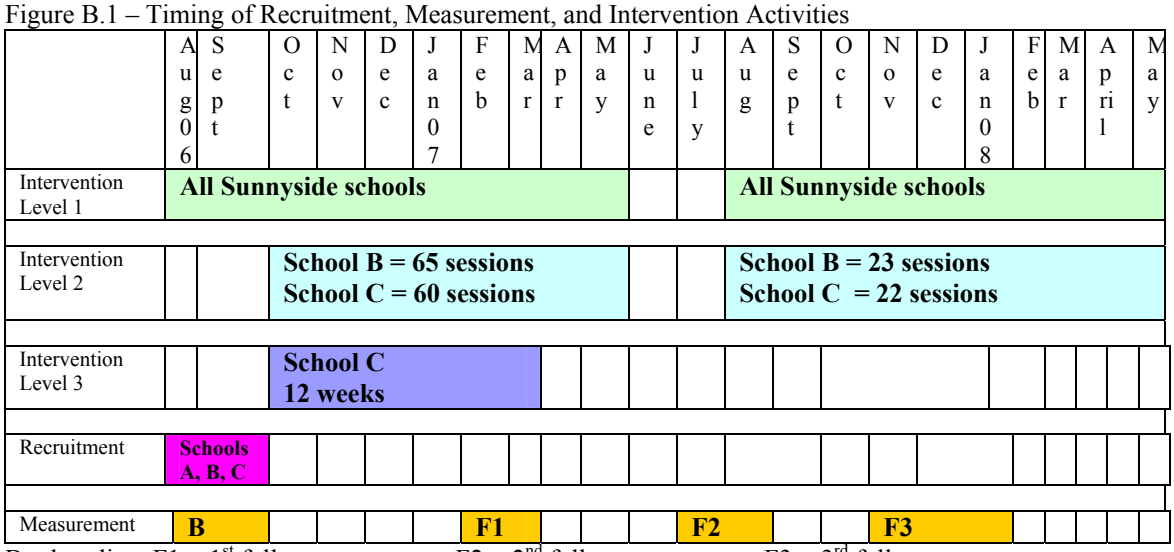
FIGURES

Figure B.1 – Timing of Recruitment, Measurement, and Intervention Activities



B = baseline; F1 = 1st follow-up measure; F2 = 2nd follow-up measure; F3 = 3rd follow-up measure

TABLES

Table B.1. – Baseline demographic and anthropometric measures by intervention level (mean ±SD)

	Level 1 n=16	**Level 2 n=32**	**Level 3 n=33**
Gender			
Female (n)	10	21	17
Male (n)	6	11	16
Weight status			
>=85th percentile BMI (n)	11	27	19
< 85th percentile BMI (n)	5	5	14
Age (yrs)	8.7 ± 0.67	9.2 ± 0.61	9.2 ± 0.59
Weight (kg)	40.4 ± 13.3	46.6 ± 12.7	39.8 ± 12.0
Height (cm)	133.6 ± 5.4	139.0 ± 6.9	136.6 ± 6.8
BMI (kg/m^2)	22.2 ± 5.7	23.8 ± 4.9	21.0 ± 5.0
BMI z-score	1.39 ± 1.1	1.71 ± 0.77	1.1 ± 1.2
Body fat (%)	30.2 ± 8.8	32.3 ± 6.5	27.3 ± 9.4
Waist circumference (cm)	69.6 ± 21.8	77.8 ± 15.3	72.9 ± 14.5

Table B.2. – Baseline child nutrition and activity behaviors by intervention level (mean ±SD)

	Level 1 n=16	**Level 2 n=32**	**Level 3 n=33**
Vegetables	1.4 ± 1.0	1.2 ± 1.1	1.1 ± 0.9
Fruits	1.6 ± 1.2	1.6 ± 0.9	1.3 ± 0.9
Milk	2.2 ± 0.6	1.9 ± 0.7	2.0 ± 0.6
Juice	1.1 ± 1.0	1.2 ± 1.0	0.9 ± 0.9
Sweetened beverages	2.5 ± 0.6*	2.2 ± 0.5	2.1 ± 0.5
High fat snack foods	0.5 ± 0.4	0.5 ± 0.6	0.3 ± 0.4
Breakfast	5.0 ± 2.3	5.1 ± 2.6	5.6 ± 2.1
Eating out	0.4 ± 0.9	0.6 ± 1.1	0.2 ± 0.8
Physical activity (METS/d)	153.5± 92.7	95.6 ± 77.6	128.3 ± 87.1
Screen time (hrs/d)	2.7 ± 1.3	2.6 ± 0.9	2.2 ± 0.6

*significantly different from Level 2 and Level 3 ($p<.05$); Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d

Table B.3. – Baseline differences, children ≥85th percentile BMI for age- and gender compared to those <85th percentile

	Children <85th percentile (N=24)	**Children ≥85th percentile (N=57)**
BMI z-score	0.01 ± 0.75	2.01 ± 0.51
Height (cm)	132.3 ± 5.4	138.9 ± 6.4
Weight (kg)	28.9 ± 3.9	48.3 ± 10.7
BMI (kg/m^2)	16.4 ± 1.4	24.8 ± 4.1
Waist (cm)	60.2 ± 5.1	80.2 ± 16.2
Body fat (%)	20.45 ± 6.0	34.1 ± 5.3
Vegetables	1.25 ± 1.2	1.18 ± 0.96
Fruits	1.42 ± 1.0	1.49 ± 0.94
Juice	1.0 ± 0.93	1.05 ± 0.97
Breakfast	6.54* ±1.2	4.75* ± 2.5
Food away from home	0.17 ± 0.56	0.52 ± 1.0
Sweetened beverage	2.16 ± 0.62	2.06 ± 0.50
Milk	1.91 ± 0.57	2.06 ± 0.72
High fat snacks	0.44 ± 0.38	0.37 ± 0.46
Physical activity	114.1± 79.1	124.5 ± 89.9
Screen time	2.5 ± 1.0	2.46 ± 0.86
Fun of physical exertion	2.85 ± 0.61	2.92 ± 0.74
Peer acceptance	2.87 ± 0.71	2.73 ± 0.71
Self esteem	3.25 ± 0.71	3.155 ± 0.60
Parent role model	2.68** ± 0.50	3.03** ± 0.54
Parent support	3.02 ± 0.48	3.089 ± 0.61
Parent encourage	3.14 ± 0.47	3.27 ± 0.60
Self-efficacy	3.07 ± 0.56	3.17 ± 0.56

*significantly different from each other, p<.01; **significantly different from each other, p<.05

Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d; psychosocial variables on 4-point scales (1 = low, 4 = high)

Table B.4. – Baseline child psychosocial characteristics by intervention level (mean ±SD)

	Level 1 n=16	**Level 2 n=32**	**Level 3 n=33**
Self-esteem	3.3 ± 0.5	2.9 ± 0.7	3.4 ± 0.5
Self-efficacy	2.9 ± 0.5	3.2 ± 0.6	3.2 ± 0.5
Percept. parental support	3.4 ± 0.4	3.0 ± 0.6	2.9 ± 0.6
Percept. parental encourage	3.2 ± 0.5	3.3 ± 0.6	3.2 ± 0.6
Percept. parental modeling	3.0 ± 0.4	2.9 ± 0.5	2.9 ± 0.6
Fun physical exertion	2.8 ± 0.9	3.1 ± 0.6	2.7 ± 0.6
Percept. peer acceptance	2.6 ± 0.9	2.9 ± 0.7	2.7 ± 0.5

All scores on 4-point scale: 1 = low, 4 = high

Table B.5. - Baseline differences, children who were measured at follow-up compared to those who were not

	Children who missed follow-up measure (N=18)	**Children who were measured (1st follow-up) (N=63)**
BMI z-score	1.31 ± 1.05	1.42 ± 1.05
Height (cm)	136.3 ± 7.3	137.1± 6.75
Weight (kg)	41.0 ± 11.5	43.0 ± 13.2
BMI (kg/m2)	21.8 ± 4.7	22.5 ± 5.4
Waist (cm)	71.1 ± 17.7	74.9 ± 16.3
Body fat (%)	29.2 ± 7.5	30.1 ± 8.7
Vegetables	1.5 ± 1.2	1.1 ± 0.9
Fruits	2.0* ± 1.1	1.3* ± 0.9
Juice	1.3 ± 1.1	0.97 ± 0.91
Breakfast	5.4 ± 2.4	5.3 ± 2.3
Food away from home	0.4 ± 0.9	0.4 ± 0.9
Sweetened beverage	2.2 ± 0.6	2.1 ± 0.5
Milk	1.97± 0.70	2.02 ± 0.68
High fat snacks	0.4 ± 0.62	0.4 ± 0.40
Physical activity	137.2 ± 74.3	117.6 ± 89.5
Screen time	2.25 ± 0.63	2.53 ± 0.95
Fun of physical exertion	3.0 ± 0.7	2.9 ± 0.7
Peer acceptance	2.87 ± 0.70	2.75 ± 0.71
Self esteem	3.31 ± 0.77	3.15 ± 0.59
Parent role model	2.98 ± 0.62	2.92 ± 0.53
Parent support	3.11 ± 0.44	3.06 ± 0.60
Parent encourage	3.18 ± 0.54	3.25 ± 0.57
Self efficacy	3.07 ± 0.48	3.16 ± 0.57

*significantly different $p<.05$

Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d; psychosocial variables on 4-point scales (1 = low, 4 = high)

Table B.6. - Anthropometric measures at baseline, 6 months; changes in measures (baseline to 6 mo); mean ±SD

	Level 1 (n=14)				**Level 2 (n=23)**				**Level 3 (n=26)**			
	B	**6 mo**	**P†**	**Δ††**	**B**	**6 mo**	**P†**	**Δ††**	**B**	**6 mo**	**P†**	**Δ††**
BMI %ile												
>=85th (n)	9	10			19	18			17	18		
<85th (n)	5	4			4	5			9	8		
Age (yrs)	8.8± 0.68	9.2± 0.70	.000	0.47	9.2± 0.60	9.7± 0.60	.000	0.48	9.2± 0.56	9.6± 0.56	.000	0.47
Weight (kg)	40.8± 13.9	43.6± 15.1	.000	2.76	45.7± 13.6	48.6± 14.4	.000	2.90	41.8± 12.4	44.9± 12.9	.000	3.12
Height (cm)	133.7± 5.5	137.2± 5.8	.000	3.46	138.7± 6.8	142.6± 6.8	.000	3.80	137.4± 6.7	141.0± 7.0	.000	3.56
BMI (kg/m^2)	22.4± 6.0	22.7± 6.2	.183	0.32	23.4± 5.3	23.62± 5.4	.488	-0.18	21.7± 5.1	22.3± 5.1	.087	0.42
BMI z-score	1.36± 1.18	1.34± 1.15	.586	-0.02	1.64± 0.82	1.60± 0.76	.462	-0.03	1.26± 1.15	1.26± 1.18	.937	0.00
Body fat (%)	29.8± 9.0	27.7± 8.5	.024	-2.11	32.0± 6.6	30.9± 6.3	.058	-1.18	28.3± 10.0	28.2± 9.4	.161	-0.81
Waist (cm)	72.0± 19.6	73.6± 13.9	.657	1.68	76.2± 16.0	81.3± 12.1	.052	5.09	75.1± 15.0	76.9± 14.2	.014	2.10

†significance of paired t-test, baseline versus 6-month measures; ††change between baseline and 6-month measures

Table B.7. - Child nutrition & physical activity behaviors at baseline, 6 months; changes in measures between baseline and 6 months (mean ±SD)

	Level 1 (n=14)				**Level 2 (n=23)**				**Level 3 (n=26)**			
	B	**6 mo**	**P†**	**Δ††**	**B**	**6 mo**	**P†**	**Δ††**	**B**	**6 mo**	**P†**	**Δ††**
Vegetables	1.43± 1.0	1.71± 1.2	.30	0.28	1.17± 1.0	1.05± 0.94	.51	-0.20	0.92± 0.79	1.19± 1.13	.16	0.26
Fruit	1.64± 1.15	1.71± 0.91	.80	0.07	1.35± 0.77	1.15± 1.0	.47	-0.20	1.15± 0.78	1.46± 1.02	.11	0.30
Milk	2.16± 0.59	1.84± 0.50	.13	-0.32	1.96± 0.77	2.03± 0.53	.16	0.17	2.01± 0.64	1.96± 0.63	.73	-0.05
Juice	1.0± 1.0	0.86± 0.94	.68	-0.14	1.04± 0.87	0.80± 0.83	.49	-0.20	0.88± 0.90	1.15± 1.0	.29	0.26
Sweet bev	2.41± 0.67	2.04± 0.29	.060	-0.36	2.00± 0.38	1.90± 0.51	.40	-0.83	1.94± 0.43	2.1± 0.46	.062	0.18*
HF snack foods	0.51± 0.38	0.19± 0.22	.012	-0.32**	0.41± 0.46	0.46± 0.39	.57	0.06	0.30± 0.28	0.44± 0.45	.066	0.13
Breakfast	5.14± 2.4	3.92± 2.4	.25	-1.3	5.05± 2.5	5.32± 2.6	.21	0.61	5.58± 2.1	5.29± 2.4	.36	-0.50
Eating out	0.50± 1.0	0.29± 0.82	.55	-0.21	0.52± 1.0	0.60± 1.0	.54	0.15	0.27± 0.82	0.65± 1.16	.086	0.38
Physical activity	141.6± 92.4	188.1± 92.6	.24	37.2	87.7± 84.6	159.4± 122.0	.009	83.1	131.4± 88.9	201.5± 105.7	.001	83.9

Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d

†significance of paired t-test, baseline versus 6-mo measures; ††change between baseline and 6-mo measures; *Level 3 change significantly different from Level 1 and Level 2, p<.05; **Level 1 change significantly different from Level 2 and Level 3, p<.05

Table B.8. - Child psychosocial measures at baseline, 6 months; changes in measures baseline to 6 mo; mean ±SD

	Level 1 (n=14)				Level 2 (n=23)				Level 3 (n=24)			
	B	**6 mo**	**P**[+]	**Δ**[++]	**B**	**6 mo**	**P**[+]	**Δ**[++]	**B**	**6 mo**	**P**[+]	**Δ**[++]
Self-esteem	3.22± 0.55	2.95± 0.69	.43	-0.26	3.00± 0.67	2.99± 0.63	.88	0.02	3.25± 0.53	3.32± 0.61	.66	0.06
Self-efficacy	3.00± 0.50	3.15± 0.47	.26	0.15	3.25± 0.61	3.30± 0.55	.57	0.06	3.15± 0.58	3.16± 0.67	.77	0.06
Parental support	3.34± 0.45	2.80± 0.70	.020	-0.40	2.95± 0.60	2.66± 0.72	.087	-0.28	2.98± 0.65	3.34*± 0.64	.004	0.49*
Parental encourage	3.16± 0.50	2.89± 0.66	.24	-0.26	3.29± 0.64	3.06± 0.58	.29	-0.17	3.26± 0.56	3.45**± 0.46	.022	0.30*
Parental modeling	3.00± 0.38	2.75± 0.47	.14	-0.26	2.92± 0.57	2.77± 0.57	.18	-0.17	2.88± 0.58	3.23*± 0.52	.030	0.39*
Fun P exert	2.69± 0.89	2.73± 0.79	.72	0.13	3.12± 0.59	2.64± 0.83	.014	-0.57	2.75± 0.64	2.64± 0.83	.19	0.28
Peer acceptance	2.58± 0.93	2.85± 0.51	.33	0.30	2.77± 0.72	2.28***± 0.85	.11	-0.33	2.83± 0.54	2.61± 0.53	.17	-0.18

[+]significance of paired t-test, baseline versus 6-mo measures; [++]change between baseline and 6-mo measures; *Level 3 significantly different from Level 2 and Level 1 at 6 months, p<.05; **Level 3 significantly different from Level 1 (but not Level 2) at 6 months, p<.05; ***Level 2 significantly different from Level 1 (but not Level 3) at 6 months, p<.01; Scores on 4-point scale, 1=low, 4=high

Table B.9. - Effect of Level 1 vs Level 2 and 3, and Level 2 vs Level 3 on BMI z-score and % body fat, baseline to 6 months (adjusted for baseline BMI z-score and % fat levels); *models 1b and 2b use imputed data

	MODEL 1a		**MODEL 1 b***			**MODEL 2a**		**MODEL 2b***	
Predictors of change in BMI z-score	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**	**Predictors of change in % body fat**	**Stand. β**	**Sig.**	**Stand. β**	**Sig.**
Baseline BMI z-score	-0.15	0.27	-.28	0.02	Baseline % body fat	-0.33	0.01	-0.44	.000
Level 1 vs Levels 2 & 3	0.02	0.89	-.01	0.94	Level 1 vs Levels 2 & 3	0.18	0.16	0.11	0.29
Level 2 vs Level 3	0.06	0.63	.13	0.24	Level 2 vs Level 3	0.00	0.99	0.08	0.48
	Adj R2 = .00		Adj R2 = .074			Adj R2 = .00		Adj R2 = .074	

Table B.10. - Changes in anthropometric, nutrition, physical activity and psychosocial variables from baseline to 6 months in children in the after-school program (Level 2) by attendance (mean ±SD)

	Children attending ≥50% of after-school sessions N=15				**Children attending <50% of after-school sessions N=8**				
	Baseline	**6-months**	**P†**	**Δ††**	**Baseline**	**6-months**	**P†**	**Δ††**	**P†††**
Weight (kg)	45.6± 14.3	47.7± 15.0	.001	2.10	45.96 ± 13.3	50.3 ± 14.2	.007	4.38	.054
Height (cm)	139.6± 7.36	143.2± 7.6	.000	3.58	137.24 ± 6.03	141.4 ± 5.3	.000	4.21	.18
BMI (kg/m^2)	23.1± 5.53	21.7± 7.8	.311	-1.34	24.13 ± 5.2	24.9 ± 5.5	.183	0.78	.25
BMI z-score	1.52± 0.96	1.47± 0.86	.338	-0.06	1.85 ± 0.50	1.85 ± 0.48	.912	0.008	.50
Body fat (%)	31.9± 7.2	30.25± 6.52	.008	-1.67	32.4 ± 5.83	32.15± 6.23	.853	-0.26	.26
Waist (cm)	77.8± 12.4	79.9± 11.5	.014	2.12	80.7 ± 13.8	84.1± 13.7	.025	3.40	.10
Vegetables	1.20± 1.2	2.32*± 0.63	.088	-0.57	1.13 ± 0.84	1.83*± 0.98	.328	0.67	.060
Fruits	1.33± 0.82	0.79*± 0.69	.151	-0.50	1.38 ± 0.74	2.00*± 1.26	.296	0.50	.099
Milk	1.88± 0.71	1.95± 0.56	.514	0.10	2.12 ± 0.90	2.22± 0.45	.076	0.33	.40
Juice	1.13± 0.83	0.57± 0.64	.055	-0.57	0.88± 0.99	1.33± 1.0	.328	0.67	.044
Sweet bev	1.99± 0.28	1.75*± 0.37	.003	-0.25	2.04± 0.55	2.25*± 0.67	.226	0.30	.005
HF snacks	0.37± 0.47	0.46± 0.41	.229	0.16	0.50± 0.46	0.45± 0.36	.444	-0.16	.18
Breakfast	4.64± 2.8	5.0± 2.7	.281	0.58	5.75± 1.9	6.0± 2.4	.566	0.66	.93
Eating out	0.53± 1.1	0.43± 0.85	.547	-0.14	0.50± 1.1	1.00± 1.54	.185	0.83	.064
Physical activity	70.4± 68.0	135.1± 74.3	.065	56.1	117.5± 106.7	216.2± 191.5	.081	142.4	.15
Screen time	2.57± 0.96	2.32± 0.63	.256	-0.32	2.87± 1.1	2.83± 0.51	.611	.083	.36
Self esteem	2.88± 0.59	3.00 ± 0.65	.735	0.087	3.21± 0.81	2.97± 0.66	.786	-0.10	.67
Self-efficacy	3.15± 0.15	3.29± 0.45	.309	0.17	3.44± 0.71	3.33± 0.78	.037	-0.16	.19
Parent support	2.76* ± 0.50	2.57± 0.69	.146	-0.31	3.28*± 0.67	2.88± 0.82	.448	-0.20	.73
Parent encourage	3.19± 0.59	3.25± 0.54	.269	-0.21	3.48± 0.75	2.98± 0.59	.803	-0.10	.76
Parent role model	2.65* ± 0.53	2.65± 0.53	.414	-0.12	3.38* ± 0.28	3.05± 0.62	.346	-0.30	.53
Fun of PA	3.0± 0.64	2.5± 0.79	.033	-0.65	3.33± 0.47	2.88± 0. 93	.305	-0.40	.59
Peer acceptance	2.67± 0.68	2.19± 0.73	.271	-0.30	2.95± 0.83	2.5± 1.1	.261	-0.40	.82

†significance of paired t-test, baseline versus 6-mo measures; ††Δ between baseline and 6-mo measures; †††p for difference in Δ between groups

*children in group 1 significantly different from those in group 2, p<.05

Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d; psychosocial variables on 4-point scales (1 = low, 4 = high)

Table B.11. – Changes in anthropometric, nutrition, physical activity and psychosocial variables from baseline to 6 months in children in the after-school + family program (Level 3) by attendance (mean ±SD)

	Children attending ≥50% of after-school + family program sessions N=8				**Children attending <50% of after-school + family sessions N=18**				
	Baseline	**6-mo**	**P†**	**Δ††**	**Baseline**	**6-mo**	**P†**	**Δ††**	**P†††**
Weight (kg)	39.2± 13.1	42.2± 14.4	.019	3.00	42.9±12.3	46.1±12.5	.000	3.17	.886
Height (cm)	137.2± 7.4	140.2± 7.7	.000	3.01	137.5±6.7	140.2±7.76	.000	3.81	.039
BMI	20.4± 5.2	20.5± 5.6	.24	0.54	22.3±5.1	23.0±4.9	.22	0.37	.755
BMI z-score	0.86± 1.5	0.89± 1.52	.69	0.02	1.44±0.97	1.43±0.96	.88	-0.01	.698
Body fat (%)	27.8± 7.4	28.6± 7.1	.67	-0.49	28.6± 11.3	28.0± 10.3	.17	-0.95	.714
Waist (cm)	71.3± 15.7	73.2± 15.2	.16	1.88	76.9±14.8	78.5± 13.9	.050	2.20	.856
Vegetables	1.25± 0.70	1.50± 1.3	.45	0.25	0.78± 0.80	1.06± 1.0	.26	0.27	.947
Fruits	1.38± 0.91	1.75± 1.16	.47	0.37	1.06± 0.72	1.33± 0.97	.13	0.28	.819
Milk	2.04± 0.84	2.08± 0.38	.86	0.04	2.0± 0.57	1.90± 0.72	.63	-0.09	.688
Juice	1.13± 0.99	1.38± 0.74	.64	0.25	0.78± 0.87	1.06± 1.16	.35	0.27	.961
Sweetened bev.	1.81± 0.38	2.08± 0.48	.16	0.27	2.00± 0.45	2.14± 0.46	.22	0.14	.528
High fat snacks	0.33± 0.33	0.34± 0.27	.090	0.32	0.29± 0.27	0.34± 0.27	.43	0.05	.085
Breakfast	4.88± 2.3	5.50± 2.3	1.00	0.00	5.89± 2.05	5.22± 2.6	.32	-0.66	.605
Eating out	0.50± 1.06	0.63± 1.18	.78	0.12	0.17± 0.70	0.67± 1.18	.058	0.50	.433
Physical activity	76.0**± 47.0	183.9± 72.0	.041	95.3	155.2** ± 93.1	209.3± 118.6	.004	79.0	.702
Screen time	2.18± 0.59	2.56± 1.05	.32	0.37	2.25± 0.60	2.22± 0.49	.87	-0.02	.266
Self esteem	3.27± 0.37	2.95*± 0.53	.24	-0.37	3.25± 0.59	3.49*± 0.58	.11	0.25	.044
Self-efficacy	3.06± .78	3.36± 0.69	.045	0.45	3.19± 0.50	3.07± 0.67	.70	-0.09	.319
Parent support	2.73*± 0.29	2.97± 0.74	.008	0.57	3.09*± 0.73	3.50± 0.53	.045	0.46	.751
Parent encourage	2.86*± 0.71	3.31± 0.46	.016	0.61	3.44*± 0.40	3.51± 0.45	.27	0.16	.092
Parent role model	2.77± 0.51	3.16± 0.45	.20	0.41	2.93± 0.62	3.26± 0.56	.094	0.38	.936
Fun of PA	2.27*± 0.32	2.93± 0.76	.14	0.52	2.96*± 0.64	2.92± 0.83	.52	0.17	.460
Peer acceptance	2.83± 0.75	2.62± 0.45	.45	-0.17	2.83± 0.46	2.61± 0.58	.28	-0.19	.936

*children in group 1 significantly different from those in group 2, p<.05; **children in group 1 significantly different from those in group 2, p<.10

†significance of paired t-test, baseline versus 6-mo measures; ††Δ between baseline and 6-mo measures; †††p for difference in Δ between groups

Food reported in number of servings; meals in frequency per day; physical activity in METS; television and video game playing in hours/d; psychosocial variables on 4-point scales (1 = low, 4 = high)

APPENDIX C

CHALLENGES TO RECRUITMENT, RETENTION, AND PARTICIPATION IN A TRANS-COMMUNITY OBESITY INTERVENTION TARGETING LOW-INCOME MINORITY CHILDREN AND THEIR PARENTS

INTRODUCTION

"Social differences in health in the United States are large and persistent." (Braveman and Egerter 2008) These health disparities are particularly evident when we examine racial and ethnic differences in childhood obesity prevalence. Although obesity affects children of all ethnic and social backgrounds, overweight and its associated co-morbidities are disproportionately prevalent among minorities. (Flegal, Ogden et al. 2004; Freedman, Khan et al. 2006) Hispanics are at particularly high risk. Data from national health surveys suggest rates of overweight in Hispanic children and adolescents exceed the national average by almost 10 percentage points, with Hispanic boys aged 6-11 experiencing the highest prevalence of extreme BMI ($\geq 99^{th}$ percentile). (Freedman, Khan et al. 2006; Wang and Zhang 2006)The disproportionate rise in obesity prevalence among ethnic minorities has been attributed to racial/ethnic differences in lifestyle behaviors and economic disadvantages as well as genetic factors. (Cossrow and Falkner 2004)

Advancements in obesity prevention and treatment in minority populations have been hindered in part by low levels of participation of racial/ethnic minorities in health behavior research, resulting in a limited evidence base from which to inform the design of appropriate and effective intervention programs.

Reasons for lack of participation are unclear, although it is likely that a combination of factors come into play. Behavioral intervention trials are typically more difficult to recruit to than other types of studies as they require significant time and effort investments by participants. This high burden imposed on an already limited-resource population might be compounded by additional challenges (e.g. a second job, lack of childcare) that form barriers to participation. Some degree of investigator distrust may also be a barrier. Mexican-American populations – particularly those living in the western and southwestern regions of the U.S. - are increasingly comprised of immigrants, some of whom may be residing in the United States illegally, or may have family members who are doing so. Questionable legal status may contribute to a general distrust of persons perceived to work for government agencies, further reducing the inclination to provide personal information (e.g. demographics, contact information) or sign consent forms. Cultural factors may also influence participation, such as fatalistic attitudes regarding personal health status (e.g. "I can't change my health so why bother") or a social norm that prevents recognition of child overweight as a health issue (e.g. "My child is just big-boned").

A lack of consistent reporting of recruitment and retention statistics by race and ethnicity in peer-reviewed publications has contributed to an overall paucity of data. A 2005 meta-analysis of literature examining the effects of exercise and diet on weight- and fitness-related outcomes in healthy adults found that only 14% of 231 publications reported race/ethnicity, compared to 89% and 96%, respectively, that reported outcomes by age and gender. (Gibson, Kirk et al. 2005)

Taken together, the issues of low participation of minorities in behavioral health research coupled with the lack of transparent reporting of study outcomes by race/ethnicity represent significant barriers to reducing health disparities.

While improved reporting of outcomes by race and ethnicity is easily remedied (as it is under full investigator control), far more time and effort needs to be devoted to understanding barriers to- and facilitators of recruitment and retention of racial and ethnic minorities to behavioral research studies and for those enrolled in studies, barriers to participation (i.e. "compliance") in program activities. In a recent review, Yancey and colleagues identified 95 studies published between 1995 and 2005 that described methods of increasing minority enrollment in research. (Yancey, Ortega et al. 2006) While general recruitment and retention considerations (Table C.1.) hold true for all potential research populations regardless of ethnicity and race, Yancey and colleagues identified additional areas around which investigators could modify their efforts in order to successfully engage minority participants. (Table C.2.) (Yancey, Ortega et al. 2006)

Very few studies have investigated the effects of population-specific strategies to optimize recruitment and retention to-, and participation in behavioral research programs. "Intensive" follow-up and contact (although this is not defined) with potential participants has been suggested as the primary method to improve participation and retention rates in two studies – one of Alzheimer's patients and their caregivers, and the other a cohort of African-American women. (Connell, Shaw et al. 2001; Russell, Palmer et al. 2001) However, these studies were both in adult populations, and only one in a minority group.

The purpose of this paper is to identify challenges to successful recruitment and retention to- and participation in a trans-community obesity prevention study in a low-income, predominantly Hispanic population of young children and their parents, where many of the recommended strategies identified by Yancey et al as best practice guidelines were applied. (Yancey, Ortega et al. 2006).

We believe the challenges we encountered while working to recruit and retain participants are representative of those often experienced when conducting community-based behavioral change interventions, and we hope that our discussion of 'lessons learned' will help guide future recruitment and retention efforts in similar populations.

ACTIVA Y SANA: A Trans-Community Intervention

Activa Y Sana was a two-year study, designed to develop and evaluate a trans-community approach to prevent and treat childhood obesity. The overall objective was to slow excess weight gain in overweight or at risk children, and thereby allow height increases to naturally decrease BMI over time. The target population was children in 3rd and 4th grades with BMI at or above the 85th percentile for age and their parents or primary caregivers.

Three elementary schools from one school district in Tucson, Arizona, were assigned to one of three interventions: Level 1, usual school-based activities only representing the comparison condition or "standard of care;" Level 2, school-based activities plus an after-school program co-sponsored by the YMCA; or, Level 3, school-based program, plus the after-school program, plus a family program taught by community-based paraprofessionals which addressed factors believed to contribute to the risk of childhood obesity. The content included, but was not limited to family food

choices and method of preparation, family exercise type and quantity, family TV viewing/video games, child self-image, and personal health goals. (Lederman 2004)

Each intervention level was designed to build upon the previous one, i.e. Level 2 included the Level 1 intervention, and Level 3 included Levels 1 and 2, in order to assess the impact of each added component on child weight and body composition. (Table C.3.)

Recruitment goals for each level (n=40 children from each level) were initially set based on results of a power analysis to assess ability to detect at least a 1.0 kg/m^2 difference in BMI between groups. Timing of recruitment, measurement, and intervention activities is depicted in Figure C.1. Recruitment activities took place during late summer and fall of 2006 and 2007, and are detailed below. Baseline measurements were completed in late summer and fall of 2006 (Cohort 1) and late summer and fall of 2007 (Cohort 2). Six month follow-up measurements were completed during February and March of 2007 (Cohort 1), and 12 month measurements in July and August of 2007 (Cohort 1). Cohort 2 follow-up measures were conducted at 4 months (December 2007). Primary outcome measures were weight and body composition and changes in these measures over time. All assessments were completed by trained staff who were not directly involved in the intervention in order to minimize demand characteristics around responses. Each child and one parent/primary caregiver were assessed.

Several weeks prior to each of the measurement time points, reminder letters were mailed to families. Parents and children were then contacted by phone for measurement scheduling, and reminder phone calls (up to three attempts per family) were made 3 to 5 days prior to scheduled measurement sessions. All measurement sessions took place at the child's school, with every effort made to provide families with a substantial window of time (2:30 to 7:30pm) on different days of the week in order to accommodate different schedules.

The intervention program began after baseline measures were completed. (Figure C.1.) Children enrolled in Cohort 1 (Level 2 and Level 3) had an extended exposure to the after-school intervention (3 semesters), compared to Cohort 2 children (1 semester only); therefore, the number of total possible after-school sessions differed between these two groups (children in Cohort 1 could attend a total of 88 sessions (School B) and 82 sessions (School C), whereas children in Cohort 2 could attend 23 sessions (School B) and 22 sessions (School C)). Cohort 1 and Cohort 2 children participated in Level 2 intervention together during the fall of 2007. The Level 3 (family intervention) program was offered to Cohort 1 participants at School C during the fall of 2006 and spring of 2007 (12 sessions spread over 4 months). Cohort 2 families enrolled in Level 3 were invited to attend the same program in fall of 2007. Session topics were identical to those covered in the Cohort 1 program, but condensed into 8 consecutive weeks beginning in September and ending in November 2007.

Intervention dose in Level 2 and Level 3 was documented through process evaluation activities. These included records of the intervention context (e.g. nutrition, physical activity, or general health lessons); format and content of activity; length of activity (number of minutes, days); the interventionist (teacher, YMCA staff, university staff) as well as which participants attended. Reach was documented by recording attendance at all program activities out of total possible participants (i.e. those consented

to participate). An estimate of exposure (percentage of the target audience that actually received the intervention components) was extracted from attendance data. Fidelity to protocols was measured by direct observation on a random selection basis. The evaluator used a checklist to verify that all major components of a presentation were covered. The checklist was developed based on the content used in training. Acceptability and feasibility were assessed using surveys and semi-structured interviews in children, parents, and interventionists (Nutrition Educators, University research staff) who attended the intervention program.

RECRUITMENT METHODS

Children along with one parent or primary caregiver were recruited from an eligible pool of 3rd and 4th graders attending four schools within the same school district. Children and parents were recruited as two cohorts in fall of 2006 and fall of 2007, respectively. The recruitment of two cohorts allowed adjustments to be made to the initial recruitment/retention approach using the process evaluation data collected from during Cohort 1 activities to guide the Cohort 2 approach. Recruitment of the first cohort took place at Schools A, B, and C during the fall of 2006. A fourth school was added to replace the original control school (Level 1) when recruiting a second cohort during Year 2. (Children in this school also received the Level 1 intervention.) Recruitment of the second cohort took place in Schools B, C, and D during the fall of 2007. In both cohorts, recruitment efforts included both passive (indirect contact) and active (direct participant contact) strategies as suggested by Yancey, et al. (Yancey, Ortega et al. 2006) (Table C.4.).

Cohort 1 Recruitment

The majority of Cohort 1 recruitment activities (Table C.4.) were timed with the advent of school in order to gain access to parents and children at "Back to School" and "Meet Your Teacher" nights. These venues provided research staff the opportunity to interact with parents and children in a non-threatening setting, allowing staff to become familiar with school grounds and meet key school staff members and administrators, all the while generating a "buzz" about the study. These activities were preceded by flyers sent home with all 3rd and 4th grade children, announcing the opportunity to enroll. Flyers used ethnic- and age-matched photos and listed incentives for participation (e.g. "You and your child will receive gift cards after completing each of three sets of measures") and reasons to participate (e.g. "You will help us learn how to improve nutrition and physical activity programs for children and families.") Parents or caregivers of children who expressed a verbal interest in participating at the Back to School or Meet Your Teacher nights were asked to fill out an eligibility screening form.

Since the primary aim of Activa was to slow weight gain in at-risk and overweight children heavier children were over-sampled through selective screening during recruitment activities. Parents were asked to provide their child's height and weight on a screening form which study staff used to estimate BMI. Although children with a wide range of weight-for-height were enrolled, the intent was to over-recruit children at or above the 85th percentile BMI for age- and gender. Child BMI percentile as well as parent responses to screening questions were used to determine eligibility and

children meeting criteria were invited to participate in the study via follow-up phone call by study staff and mailed a consent packet.

Follow-up recruitment strategies involved school administrators and personnel. Physical education teachers were asked to announce the study in their 3rd and 4th grade classes, and the school nurse at each of the schools identified children who would be eligible based on BMI and worked with the school prevention specialist (or similar parent liaison) who contacted parents via phone to assess level of interest. Parents and children who expressed interest in participating were mailed consent forms and scheduled for baseline measures. The school principal at School C (Level 3 intervention) hosted a "Back-to-School BBQ" where parents and children could learn more about the program from study staff and participate in the screening process. Ethnicity- and gender-matched staff were enlisted for recruitment activities whenever possible.

Cohort 2 Recruitment

Anticipating the recruitment of the second cohort in Year 2, study staff asked Cohort 1 parents (Level 3) what they believed would optimize recruitment rates for the new group of families. Recommendations included "getting the word out through TV, newspaper" as well as "sending out invitations to all the parents [in other grades] so that they all have the opportunity to participate." Although these and other similar suggestions were taken under consideration when revising the recruitment plan for Cohort 2, *a priori* age, district, and grade criteria (8-10-year old, 3rd and 4th grade) limited our ability to act on them.

Cohort 2 recruitment efforts focused on the addition of participants to each intervention level to meet original recruitment goals (of n= 40 in each condition). In order to meet these goals, we required fourteen additional families in Level 1, eight additional families in Level 2, and seven families in Level 3.

As with Cohort 1, the primary recruitment venues were at the "Meet Your Teacher" and "Back to School Night" events. However, rather than using a 2-part process to screen and then later consent interested families, the number of recruitment staff at each of these events was doubled and simultaneous screening and consenting was implemented with some staff conducting the initial screening, while others assisted interested families in filling out consent forms.

Phone calls by the nurse and prevention specialist, principal-hosted BBQ, and PE teacher announcements were not used to recruit Cohort 2 participants, as these strategies did not result in any additional participants when used during Cohort 1 activities. A letter from the principal to prospective participants (as identified by school personnel) endorsing the study was used at School C. Several Cohort 1 participants indicated they were willing to help recruit families to Cohort 2, although these participants (n=4) did not return subsequent phone calls or attend a pre-arranged meeting to discuss their possible role.

RETENTION METHODS

As with recruitment strategies, Cohort 1 retention strategies were chosen based on recommendations made by Yancey and colleagues (Yancey, Ortega et al. 2006) (Table C.5.)

All children and adults who consented to participate in baseline measures (all 4 schools) were invited to return for follow-up measures. Similar strategies as those used for baseline measures - e.g. reminder letters and phone calls, centralized measurement locations, flexible time window - were used to engage participants in follow-up measures. Minimal staff turnover, free child care at measurement and intervention activities, and timely provision of incentives (related to both measurement and intervention participation) were used to encourage attendance.

Significant differences in retention strategies existed between Cohort 1 and Cohort 2. (Table C.5.) Some adjustments were intentional (e.g. increasing % of ethnic- and gender-matched staff; redistribution of the incentive structure in family program) while others were changes made in response to external events (e.g. school staff turnover). In Schools B and C (Level 2 intervention), school staff turnover during the summer between year 1 and 2 of the study resulted in two new PE teachers (one at each school). New teachers were trained by university staff to deliver the Level 2 Activa intervention to returning Cohort 1 participants and to Cohort 2 participants during the fall of 2007. New YMCA staff (also due to staff turnover) were similarly trained and supported. University intervention staff remained consistent throughout the duration of the study. Staffing turnover also necessitated a change in the delivery of the Level 3 intervention. Cooperative Extension EFNEP Nutrition Educators were not available to teach family night activities for the second cohort. A university-based research dietitian supported by several bilingual research staff led the Cohort 2 family night program. Staff delivering the Cohort 2 family night program was noticeably younger than those delivering the programming for Cohort 1, more closely matching the average age of the participants.

The reduced number of participants enrolled in Cohort 2 (approximately one-third of the number enrolled in Cohort 1) also allowed for greater flexibility of Level 3 intervention delivery. Since Cohort 2 was a much smaller group, the parent format was slightly modified to be more discussion-oriented, allowing parents to choose the order of topics (as long as all were covered) and spend more time talking to other parents (versus listening to instructors).

In Cohort 1, incentives were provided each week to encourage attendance at the family night sessions. However, in Cohort 2, incentives were held until the final week of the family sessions, to encourage children and parents to work toward meeting attendance goals together and “compete” with other families for the best attendance. A large communal sign-in poster was used to track attendance in this cohort, where all participants could see their and other participants’ progress each week.

Families participating in the final session of the Level 3 family night session from each cohort were interviewed by measurement staff using a semi-structured questionnaire that included four open-ended questions. The questionnaire was designed to capture perceived utility of the intervention to parents as well as assess any challenges to implementing recommended behavioral changes. Parents in Cohort 1 were also asked what they thought would improve participation rates in a future program at their school.

RESULTS

Recruitment and measurement

The number of participants by intervention levels is given in Table C.6. A total of one hundred forty-one children and their parents or caregivers volunteered to participate in the study (37 children in Level 1 (control condition), 54 children in Level 2, and 50 children in Level 3). Sixty-eight percent (96 children) of consented children completed baseline measures (22 children in Level 1 or 59% of consented; 43 children in Level 2 or 80% of consented; and 41 children or 82% of consented in Level 3). One family from each intervention level dropped prior to baseline measures, and the remainder did not attend measurement sessions despite multiple reminder phone calls and attempts at rescheduling.

Despite a multi-pronged approach, Cohort 1 recruitment goals (n=40 families in each condition) were not achieved during the fall of 2006. Level 1 (School A) proved to be the most challenging to recruit to, yielding the fewest participants.
Follow-up recruitment strategies at all three schools as described above (e.g. phone calls made by school personnel, principal- or school- sponsored events) did not yield additional participants.

The addition of Cohort 2 participants during the fall of 2007 allowed us to meet sample size goals at Schools B and C (Level 2 and Level 3). Despite the addition of a fourth school (School D) to increase sample size in Level 1, recruitment numbers again fell short in this condition (n= 22 children total).

Attrition was significant at both 6-month and 12-month follow-up measures in Cohort 1. (Table C.6.) Eighty-eight percent (n=14 children) from Level 1, seventy-two percent (n=23) from Level 2, and seventy-three percent (n=24) from Level 3 returned for 6-month follow-up measures. Six families moved prior to 6-month measures and two families withdrew, and the remaining families who did not return for measures (n=14) were considered lost to follow-up. At 12 months, thirty-eight percent (n=6 children) from Level 1, fifty-three percent (n=17) of children from Level 2, and forty-five percent (n=15) of children in Level 3 returned for follow-up measures. Between the 6-month and 12-month measures, an additional five families moved and five more withdrew.

Similar losses-to-follow up were observed with Cohort 2 at 4 months for Level 1 and Level 2 (33% and 64% of children returned for measurements, respectively), but not Level 3, in which all Cohort 2 participants measured at baseline (n=8) returned for follow-up measures. (Table C.6.)The schools did not report any mobility for Cohort 2 participants, nor did any officially withdraw. Subsequently, the eight families that did not return for follow-up measures were considered lost to follow-up

Intervention Participation

Overall average attendance (both schools, both cohorts) in the after-school program was 57%. Attendance trends were similar between cohorts, with initial higher rates of attendance followed by a steady decline in attendance as the program progressed, as shown in Figures C.2. and C.3.The greatest variability is seen in School B, Cohort 1 shown in the upper panel of Figure C.2. The large increase at day 23 coincides with the return of children from the winter holiday. The large increase at day 64 coincides with

the return of children from the spring break holiday. Average after-school program attendance in School B was very similar between cohorts (55% in Cohort 1 compared to 58% in Cohort 2). In School C, differences were significant in terms of percentages (47% average attendance in Cohort 1 compared to 68% in Cohort 2). As children in each school participated in after-school activities together (regardless of which cohort they belonged to), meaningful comparisons regarding the differences in attendance between cohorts are not possible.

Average family intervention attendance for Cohort 1 was 41%.Attendance trends over time are shown in Figure C.4.The highest attendance occurred during the second week of the program with a steady decline thereafter. A slight increase was observed during the final week of the family intervention.

Average family intervention attendance for Cohort 2 attendance was 67%. Attendance trends over time can be seen in Figure C.4. Although percent attendance of Cohort 2 families was significantly higher than Cohort 1, the overall pattern of attendance was very similar between the two cohorts, with the highest attendance occurring during the second week of the program followed by a drop off in attendance in subsequent weeks. Also similar to Cohort 1, a slight increase was observed during the final week.

CONCLUSIONS

Despite using "best-practice" recruitment and retention strategies recommended by experts, and adjusting strategies between our first and second cohorts based on process evaluation data, we did not attain our recruitment goals (n=40 per intervention level) in the Level 1 (control condition) and attrition from this condition exceeded 20%. Although we met initial sample size goals in the other two intervention levels with the addition of the second cohort, significant numbers of children failed to return for follow-up measures, resulting in a study that was insufficiently powered to detect changes in the primary outcome (BMI). Program participation (as determined by attendance) was highly variable, and overall, appeared to decline with time (both in the after-school intervention and the family intervention).

DISCUSSION

Our study enrolled parent and child volunteers from four schools within the Sunnyside School District in Tucson, Arizona. We were unable to survey those who were eligible but did not volunteer or those who were lost to follow-up so are forced to speculate regarding why parents and children did not participate, or if enrolled, did not return for follow-up measures.

As the Level 1 condition offered nothing beyond the "standard of care" school-based curricula, parents may have perceived little value to enrolling in a study that did not provide their children or themselves with immediate benefits (other than a small monetary incentive for completing measurements).

While both the after-school and family interventions offered children and parents tangible rewards for participation in addition to the monetary incentive for completing measurements (e.g. YMCA membership, physical activity equipment and instruction), it is possible that these items did not hold a significant value for the participants, or that the

perceived effort in obtaining these items (i.e. participation in intervention activities) outweighed their value.

Measurement sessions, although flexible with regard to time of day, were approximately two hours in length. This is a significant amount of time and parents may have perceived this length of time as an undue burden.

It is also possible that recruitment materials, designed to appeal to potential participants with regard to ethnicity and gender, may not have appealed to deeper values or beliefs with regard to child health or altruism.

Exit interview data (Tables C.7. to C.10.) indicated that several parents felt it was important that children from other grades were invited to participate in the study. Perhaps recruitment rates might have improved if the program was open to the entire school (making it a more "community-oriented" program) rather than exclusive to 3rd and 4th graders. Limiting study participation to 3rd and 4th graders (while established as inclusion criteria and therefore not mutable) may have limited final recruitment numbers.

Overall, there was negligible improvement in after-school intervention program participation between Cohorts 1 and 2. It is unclear whether the improvement in family intervention attendance noted between cohorts was due to changes made in retention strategies or to the smaller sample size (resulting in more individual attention).

Feedback provided by parents during exit interviews provided some insight as to why intervention program retention rates remained relatively low despite best efforts. Parent comments suggested that those who regularly attended the sessions appreciated the information provided and benefited from the sessions; however, time was cited as a major barrier to attendance. Future intervention programs may experience improved recruitment and retention rates if they are sensitive to this perception by shortening the required number of sessions or reducing the duration of sessions (one hour seems to be the maximum). Key teaching points could be conveyed in one hour through the use of activities that engage parents and children in a hands-on manner that teaches them a skill that they may then apply immediately upon their return home. It is also noteworthy, however, that time was also thought to be a major factor in program adherence, and it may be that the issue of time management should be more explicitly addressed within the intervention materials themselves.

Involvement of family members and children from other grades in the Activa program was another recurring theme in the exit interview. Involving the entire family (including siblings and extended family e.g. grandparents) to the extent possible may be important in promoting sustainable change. Parents reported that some of the biggest barriers to healthy behavior change were engaging the entire family and getting children to try new and healthy foods. One child and one parent may have difficulty advocating change to the entire family.

Two strategies recommended by Yancey et al (e.g. multiple friend and family contacts to minimize mobility-related loss to follow-up and provision of social support) were not actively pursued with either cohort, either due to unintentional exclusion or study design and budget constraints. Employing these two strategies may have improved retention rates for both measurement and the intervention program.

Despite Activa's low rates of recruitment, retention, and intervention participation, we suggest that these data are not unique, but instead are representative of the general difficulty encountered when recruiting participants to behavioral change interventions, and the specific challenges encountered when recruiting and retaining families with young children to group-based programs where time and location cannot be tailored to fit each family's needs. Limited-resource audiences such as those recruited to Activa may have different priorities and challenges than more affluent populations and may not have the same time and energy to devote to improvement of dietary or activity behaviors.

With very few exceptions, existing family intervention studies have recruited from primarily upper-socioeconomic status, intact, white families. (Brownell, Kelman et al. 1983; Epstein, Koeske et al. 1984; Epstein, Wing et al. 1986; Graves, Meyers et al. 1988; Epstein, Valoski et al. 1990; Flodmark, Ohlsson et al. 1993; Epstein, McKenzie et al. 1994; Epstein, Valoski et al. 1995; Epstein, Paluch et al. 2000; Epstein, Paluch et al. 2004; Edwards, Nicholls et al. 2006; Dreimane, Safani et al. 2007) (Kirschenbaum, Harris et al. 1984; Israel, Stolmaker et al. 1985; Israel, Solotar et al. 1990; Golan, Fainaru et al. 1998; Golan and Crow 2004; Jiang, Xia et al. 2005; Sacher, Chadwick et al. 2005; Golley, Magarey et al. 2007; Kalavainen, Korppi et al. 2007; Nowicka, Pietrobelli et al. 2007; Rodearmel, Wyatt et al. 2007; Shelton, LeGros et al. 2007) The majority of programs were conducted out of obesity clinics or hospital outpatient settings, which limits their generalizability to other populations. Typical sample sizes ranged between 30 and 60 children/parent pairs, average length of follow-up was 1 year, and typical losses to follow-up varied between 3-58% (median 15%).

Given these data, Activa Y Sana numbers, although low, are not lower than other intervention studies. Activa was the first obesity prevention and treatment intervention conducted at the community level (versus hospital or treatment center) that also involved a community agency. As there are no comparable intervention program data, we must turn to qualitative data in similar populations to provide some context for our results.

Snethen and colleagues conducted three focus groups (n=12 mothers, 12 fathers, 8 boys, 4 girls ages 10-12) to understand one Latino community's perspectives about childhood overweight. (Snethen, Hewitt et al. 2007) Emerging themes included parents' demanding work schedule, lack of time, transportation issues, lack of opportunities for PA, and lack of meal preparation skills. Notably, knowledge did not appear to be a barrier with these participants.

Styles, et al conducted eight focus groups in low-income families to understand parent attitudes toward child overweight (two Hispanic groups included). (Styles, Meier et al. 2007) Similar to Snethen's findings, participants cited lack of time as the number one concern, and difficulty with time management as number two. Feeling inadequate as role models for their children and feeling unsupported by child doctor and schools were three and four, while cost of healthy foods and exercise facilities and concern about child safety rounded out the barriers to helping their child maintain a healthy weight.(Styles, Meier et al. 2007)

The findings of Styles and Snethen echo many of the comments made by parents in the Activa population. (Tables C.7. to C.10.) Given that time is an oft-cited concern of parents and that involvement of other children was suggested as a possible barrier to recruitment and retention, future studies should be designed to allow entire families to participate (not just children), and programming to be flexible in terms of the intervention protocol and in time that the intervention can be delivered. Two-hour blocks each week may not be a feasible option for working parents with other young children at home.

Although adjusting the recruiting process to combine screening and the consenting process was much more efficient than screening first and consenting at a later date, it is unclear whether this technique would ultimately yield a greater number of participants. However, if perceived lack of time is a barrier to participation, then condensing study enrollment activities to one session may help improve initial recruitment rates.

Transparent reporting of ethnicity, initial sample size, attrition rate, along with frank discussion of challenges encountered in behavioral interventions is a necessary, not optional, step in reporting results of any intervention trial. These data will help prevent other researchers from "reinventing the wheel" and will hopefully lead to the development of more effective programs.

Lastly, we must consider redefining recruitment and retention "success" in minority populations that often have different priorities and resources.
Failure to recruit and retain adequate numbers of participants to community health interventions must be considered as an opportunity to reframe our expectations. Rather than comparing community-based programs to a more traditional hospital or clinic-based RCT, we must consider the community-based design as a new model of participant engagement, separate from hospital and outpatient clinic programming and adjust our expectations and intervention approach accordingly. Testing new and creative approaches to community-based recruitment and retention of families to intervention studies should be a top priority, and is a better use of current resources than trying to "fit" community interventions into a framework that does not allow for any flexibility or accommodations to be made based on changes in locations or population demographics.

There currently remains a very limited evidence base in intervening in underserved and minority populations. Future research should include qualitative methods in order to better understand the challenges that families face, and should focus on identifying behavior-change models that are applicable to diverse populations in order to maximize both program attendance and participation.

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FIGURES

Figure C.1. – Timing of Recruitment, Measurement, and Intervention

	Aug 06	Sept	Oct	Nov	Dec	Jan 07	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan 08	Feb	Mar	April	May
Intervention Level 1	**All Sunnyside schools**												**All Sunnyside schools**									
Intervention Level 2			**Schools B & C C1**										**Schools B & C C1 + C2 (combined)**									
Intervention Level 3			**School C C1 only**												**School C C2 only**							
Recruitment	**School A , B, C C1**												**School B, C, D C2**									
Measurement	**C1 -B**						**C1-F1**					**C1-F2**	**C2-B**			**C1-F3 C2-F1**						

C1 = Cohort 1; C2 = Cohort 2; B = Baseline; F1 = 1st Follow-up; F2 = 2nd Follow-up; F3 = 3rd Follow-up

Figure C.2. - After-school Program Attendance, Cohort 1

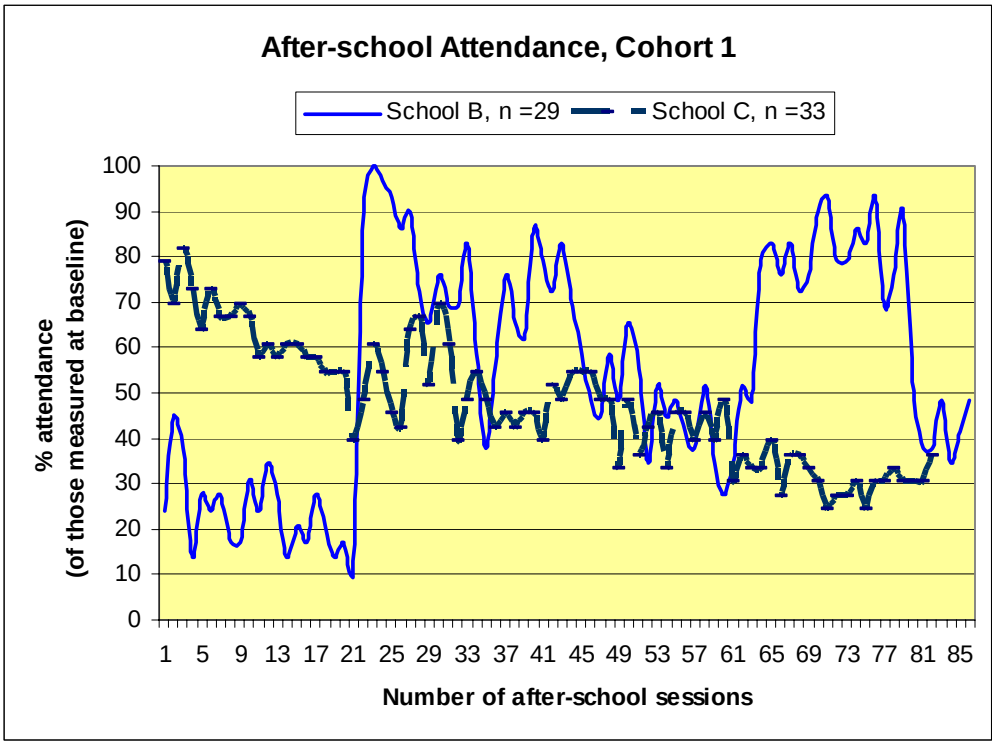


Figure C.3. – After-school Program Attendance, Cohort 2

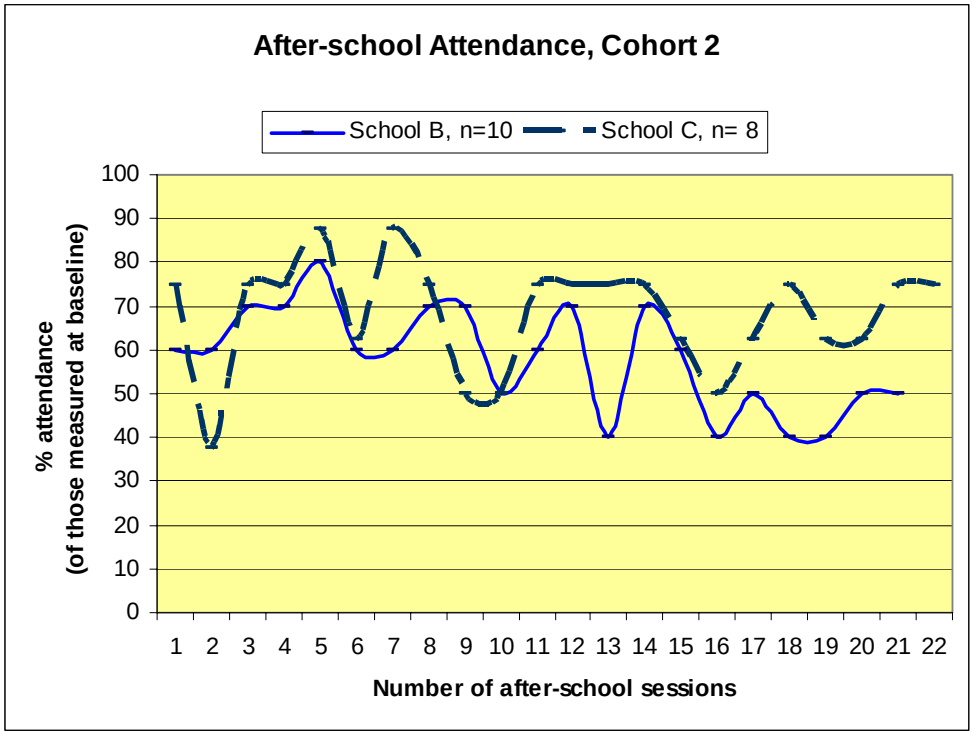
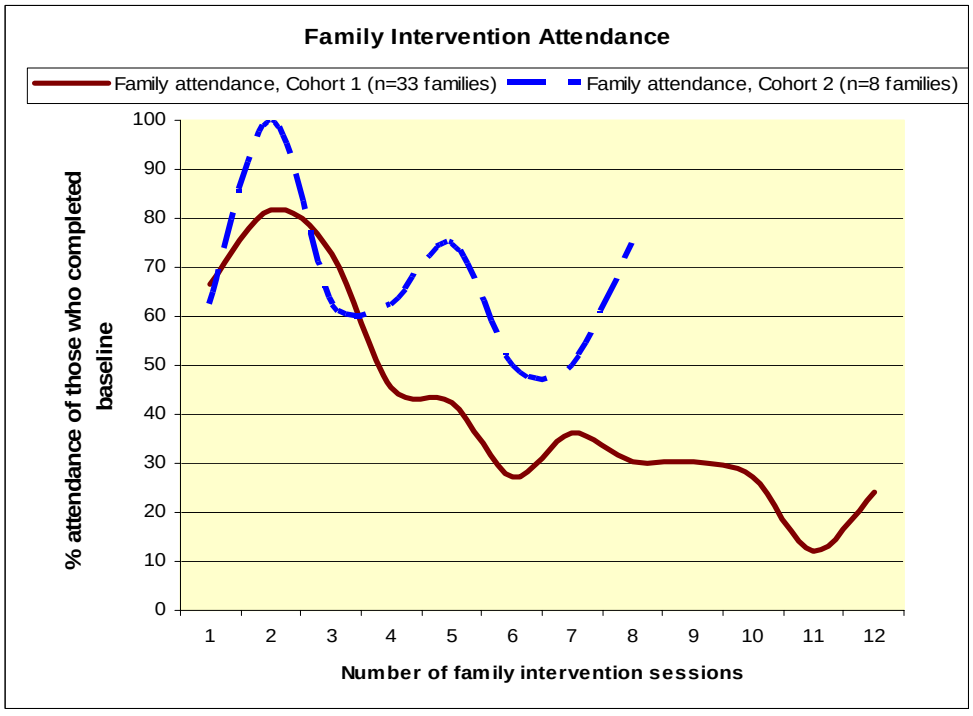


Figure C.4. – Family Program Attendance (Cohorts 1 and 2)



TABLES

Table C.1. – General Recruitment and Retention Considerations
(Yancey, et al 2006)

- communication of respect and benefits without coercion
- minimal risk
- convenience; easily accessible locations for data collection and intervention programming
- compensation for expenses related to participation
- private data collection
- communication of appreciation for investment of time & effort
- assurances of anonymity and confidentiality
- full informed consent
- ethical conduct
- (timely) provision of incentives
- maintenance of contact
- offer delayed or alternative interventions to control group
- low research staff turnover
- staff from the targeted community
- provision of social support to participants

Table C.2. – Additional areas of focus when engaging minority participants
(Yancey, et al 2006)

- Sampling approach/identification of targeted participants, (e.g. community-based sampling versus population-based)
- Community involvement/nature and timing with prospective participants, (e.g. referrals by a friend)
- Incentives and logistics, (e.g. importance of timely payment of incentives)
- Cultural adaptations, (e.g. trained lay advocates from community as recruiters, culturally-tailored approach letters)

Table C.3. – Description of Intervention Levels and Dose

Intervention Level	**Target audience**	**Instructors**	**Estimated intervention dose**
Level 1 standard school health curriculum	Children only	School PE and health teachers	Physical education: 30 minutes/week during school year Health Education: 30 minutes/week During final 9 weeks of school year
Level 2 standard school health curriculum + after-school program	Children only	School PE and health teachers, university staff, Cooperative Extension Nutrition Educators , YMCA staff	Level 1 + 1 ½ hours physical activity, 15 minutes nutrition education 10 days each month
Level 3 standard school health curriculum + after-school program + family program	Children and parents	School PE and health teachers, university staff, Cooperative Extension Nutrition Educators	Level 1 + Level 2 + "Family Fun Nights": 1 hour physical activity (children), 30 minutes nutrition education over 10-12 sessions

Table C.4. – Recommended Recruitment Strategies and Frequency of Use in Activa Y Sana, Cohort 1 and Cohort 2

Strategies suggested by Yancey, et al 2006	**Strategies used - Cohort 1**	**Strategies used - Cohort 2**
SAMPLING APPROACH/IDENTIFICATIONS OF POTENTIAL PARTICIPANTS		
Community-based recruitment approach	Potential participants recruited through schools	Same as Cohort 1
COMMUNITY INVOLVEMENT/NATURE AND TIMING OF CONTACT WITH PROSPECTIVE PARTICIPANTS		
Mass mailings	Flyers sent home with each 3rd and 4th grade child (announcing recruitment meetings)	Same as Cohort 1
Personal contact (by study staff or proxy)	Open House/Meet Your Teacher night booth (research staff) – **participant screening***	Open House/Meet Your Teacher night booth (research staff) – **participant screening PLUS simultaneous consenting if eligible and interested***
	Follow-up phone calls from school intervention specialist or nurse to potential participants to assess level of interest*	Not used
	School principal hosts recruiting event (BBQ) at School C*	Not used

Strategies suggested by Yancey, et al 2006, continued	**Strategies used - Cohort 1**	**Strategies used - Cohort 2**
Personal contact (by study staff or proxy)		**Letter written by principal endorsing study in School C sent to prospective participants***
	PE teachers announce study to children, send consent packets home*	Not used
Word-of-mouth recruitment (other participants)	Not available for use given short time between initial recruitment and program	**Word of mouth (research staff asked enrolled participants to tell other families)***
Number of eligibility criteria or hurdles to enrollment	Relaxed eligibility guidelines to include children <85th percentile BMI for age and gender	Same as Cohort 1
INCENTIVES AND LOGISTICS		
Telephone follow-up	Telephone contact following initial screening contact	Same as Cohort 1
Provision of incentives	Gift cards to local "superstore" offered to participants upon completion of measurements ($10, $20, $30 for children; $10 for adults) at each measurement time point	Same as Cohort 1
Minimize participant burden	Measurement/intervention activities took place at the schools during the hours of 2:30 and 7:30pm to allow for maximum attendance	Same as Cohort 1
Compensation for participation	None, other than incentives	Same as Cohort 1
Offering delayed intervention for those in control condition	Study design and financial constraints prohibited this	Same as Cohort 1
CULTURAL/COMMUNITY ADAPTATIONS		
Personalized letters (tailored to population) with health statistics	Not used	Not used
Racial/ethnic matching of participants depicted in recruit materials	Used in recruitment brochures	Same as Cohort 1
Language accomodations	Bilingual consent forms; translation assistance	Same as Cohort 1
Experienced recruiters with community ties	School staff; research staff had school-based study recruitment experience	Same as Cohort 1
Culturally/ethnically matched project recruitment staff	**Ethnic- and gender-matched staff (50%)***	**Ethnic- and gender-matched staff (75%)***

*bold font indicates differences between Cohort 1 and Cohort 2

Table C.5. – Recommended Retention Strategies and Frequency of Use in Activa Y Sana, Cohort 1 and Cohort 2

Strategies suggested by Yancey, et al 2006	**Strategies used Cohort 1**	**Strategies used Cohort 2**
INCENTIVES AND LOGISTICS		
Multiple friend and family contacts to reduce mobility-related loss to follow-up	Did not request this information from participants	Same as Cohort 1
Flexibility of intervention protocols	**Not used – curricula set *a priori* and not adjusted during Cohort 1 intervention***	**Smaller number of participants allowed for greater curriculum flexibility (participants chose order of topics and sessions were more discussion oriented)***
Minimal turnover of field staff and intervention staff	Consistent staffing for all levels during the intervention which included: Level 1 - school PE teachers; measurement staff Level 2 - YMCA, school PE teachers, university interventionist **Level 3 – EFNEP Educators**	Consistent staffing for all levels during the intervention Level 1 - **new school PE teachers*** Level 2 - **new school PE teachers***, **new YMCA staff*** **Level 3 - university research dietitian***
Strategies suggested by Yancey, et al 2006	**Strategies used Cohort 1**	**Strategies used Cohort 2**
Accessible locations for data collection & intervention activities	School-based measurements and intervention programs	Same as Cohort 1
Timely payment of incentives	Children and parents received gift cards immediately upon completing measurements	Same as Cohort 1
	Level 3 participants received a 6-mo family YMCA membership; healthy meal demos; physical activity equipment**; weekly raffle (board games, physical activity equipment)***	**Percent attendance at family night program made participants eligible for additional "superstore" gift cards at the end of the intervention***
Telephone, other reminders	Reminder phone calls (three per family)	Same as Cohort 1
Strategies to decrease respondent burden	Free child care offered concurrent with measurement and intervention sessions to encourage attendance	Same as Cohort 1

Strategies suggested by Yancey, et al 2006, continued	**Strategies used Cohort 1**	**Strategies used Cohort 2**
CULTURAL OR COMMUNITY ADAPTATIONS		
Staff from targeted community	**EFNEP Nutrition Educators***	**Demographically-matched translator assisting research dietitian in program implementation***
Language accomodations	**Ethnic- and gender-matched staff (50%)***	**Ethnic- and gender-matched staff (75%)***
	Bilingual materials; translation assistance	**Same as Cohort 1**
Provision of social support	Not used	Same as Cohort 1

*bold font indicates differences between Cohort 1 and Cohort 2

Table C.6. – Children consented and measured by intervention level and measurement time point

	# in 3rd, 4th grade*	Screened	Assented	Mobility	B	Mobility	F1	Mobility	F2
Level 1 School A, School D	232 + 239	C1 = 28 C2 = 15	C1 = 22 C2 = 15	C1= 1 M	C1= 16 C2 = 6	C1= 1 M	C1= 14 C2 = 2	C1= 4 M	C1= 6
Level 2 School B	197	C1 = 45 C2 = 15	C1 = 39 C2 = 15	C2= 1 D	C1= 32 C2 =11	C1= 1 D, 1 M	C1= 23 C2 = 7	C1= 3 D	C1= 17
Level 3 School C	188	C1= 41 C2 =15	C1= 35 C2 = 15	C2 = 1 M	C1= 33 C2 =8	C1= 1 D, 4 M	C1= 24 C2 = 8	C1= 2 D, 1 M	C1= 15

C1 = Cohort 1; C2 = Cohort 2; M = Moved; D = Dropped; B = Baseline measures; F1 = Follow-up measure; F2 = 2nd follow-up measure

*Total # of 3rd and 4th graders enrolled in Activa schools during 2006-2007 school year (October Enrollment by Grade in Sunnyside School District Elementary Schools published Feb 2007 Research and Evaluation Section Arizona Department of Education http://www.ade.az.gov/researchpolicy/AZEnroll/2006-2007/Default.asp **Accessed on January 6, 2008)**

Table C.7. – Exit Interview Responses, Parents Participating in Family Intervention

Question 1: "What are the biggest challenges to eating healthier and being more physically active?"
Cohort 1 (n=9 families surveyed, 4 Spanish speakers; 9 responses)
"Time is always short in a family with working parents"
"Time"; "Being physical and taking part in the program is a challenge"
"Sticking to healthy eating with no sweets"
"Getting kids to eat healthy"
"Getting the whole family involved"
"To teach my husband and children to eat fruits and vegetables and stop eating at McDonald's, etc. Also to stop eating [so many] fats and salt" (Spanish speaker)
"One of the barriers is TV because I struggle a lot so that the kids wouldn't turn it on and also with sodas…" (Spanish speaker)
"The biggest barriers to stay healthier are my culture and my eating habits because I'm so used to the big portions and excess of grease!" (Spanish speaker)
"Doing activities that are okay for our body" (Spanish speaker)
Cohort 2 (n = 3 families surveyed (1 Spanish speaker), 3 families responded)
"Not to use so much of the fatty foods – like salad dressing, bacon, etc" "With physical activity, the time cause I'm always working during the week – we're doing good on the weekends"
"We eat healthy food already" "We are already active" (Spanish speaker)
"Trying new foods with the family is challenging"; "time"

Table C.8.– Exit Interview Responses, Parents Participating in Family Intervention

"What was the most helpful thing you learned by participating in Activa?"
Cohort 1, (n=9 surveyed, 9 responses)
"To change the eating habits to more healthy foods"
"Learning what other people think about [the program] which is very helpful"
"How to cook healthy foods"
"Eating healthy and physical activity will help you live longer"
"How to motivate my child and use common vocabulary when talking about health"
"I learned how to cook in a healthier way and shop for healthier meals that are also low in fat" (Spanish speaker)
"I learned that to exercise is healthy for the body and avoid obesity and some sickness and also to have good nutrition" (Spanish speaker)
"I learned that to eat more fruits and vegetables, how to stay more physically active and how to be more aware of the downfalls of fast food" (Spanish speaker)
"That by eating the right portion you can stay more active and healthier and also by exercising" (Spanish speaker)
Cohort 2, (n=3 surveyed, 1 response)
"Healthy cooking demo"

Table C.9. – Exit Interview Responses, Parent Participating in Family Intervention

"What should we change about Activa to make it better?"
Cohort 1, (n=9 surveyed, 8 responses)
A different time – usually work during the meetings
Set up more programs for kids + parents so that they can spend time together
It was good!
Continue to convey positive friendly attitude that all staff displays – thank you!
First of all to put in practice everything we learned in the program – to advertise the program to the whole school (Spanish speaker)
Everything was good about the information we were given and it helped us a lot! (Spanish speaker)
Continue with these meetings and give us more ideas about how to eat healthier (Spanish speaker)
Invite children from other grades (Spanish speaker)
Cohort 2 (n = 3 surveyed, 2 responses)
Everyone should make a healthy recipe and exchange
Keep going, you are doing great!

Table C.10.- Exit Interview Responses, Parents Participating in Family Intervention

"What could we do to encourage more families to regularly attend Activa?" **Cohort 1 only (9 surveyed, 4 responses)**
Tell kids from school to come with their family for at least 1 session
Make meetings shorter
Make family night meetings shorter (1 hr to 1.5 hours) – time is precious
Motivate children at the entire school so that they share this with their parents (Spanish speaker)

APPENDIX D

Description of Activa Y Sana Intervention Materials

Level 1 Intervention: Health Curricula adopted by Sunnyside Unified School District

Curricula development for Level 1 was funded through a three-year Federal Department of Education grant serving all fourteen elementary schools within the Sunnyside District (including the four Activa schools), enrolling a total of 8,500 children from low SES, minority families. Schools received physical activity equipment and teachers received 8 in-service workshops each year, providing them with innovative physical education curricula aimed at increasing developmentally appropriate physical activity during the school day and enhanced nutrition education that was incorporated into the school health curriculum delivered in the classroom setting.

Nutrition Education

The Food Pyramid Creative Pockets for Educators (Grades K-2)
This is a learning tool that focuses on the health messages of eating right and being fit. The curriculum comes with an apron and 17 Activity Cards with over 75 nutrition-based activities.
Training workshops provides teaching tips and presentations skills for instructors working with children, ideas and ways on how to get and keep the attention of young children, instructor assistance in creating healthy classroom and learning environments, creative lesson plans and activities for the classroom, tips and suggestions on how to include parents and the home environment in the nutrition education, community outreach plans and suggestions, and hands-on instructional activities to help teach nutritional values in a creative way.

<u>Lesson Topics</u>
MyPyramid; Healthy Snacks; One Size Doesn't fit all; Grocery Store; In the Kitchen; Milk; Breakfast; Servings; Vegetables; Grains; Dinner; Nutrients; Meat; Water; Fats, Oils and Sweets; Fruit; Lunch

The Great Body Shop (Grades 3-5)
Children's Health Market, Inc.
P.O. Box 7294
Wilton, CT 06897
The Great Body Shop provides nutrition information as part of the new health curriculum. A training workshop for interventionists provides guidance for in the delivery of Great Body Shop curriculum, providing information regarding application of various teaching aids including: parent letter, pre/post tests, critical thinking lessons, parent bulletin, weekly lessons, and homework for children. Interventionists are educated on teaching children about the importance of their food choices and the basis for making choices in order to change eating behavior.

3rd Grade Lesson Topics
Nutrients and digestion; Healthful food, less healthful food; Food Labels; Healthful habits
4th Grade Lesson Topics
The digestive process, what helps and what hurts; The balancing act-calories and nutrients; It's your choice…or is it?; Becoming a careful consumer
5th Grade Lesson Topics
Beyond the basics; Life cycle and nutrition; What can go wrong; Making a difference

Physical Education
Three evidence-based curricula were chosen for adoption and training in the Sunnyside School District: CATCH, Physical Best and FITNESSGRAM/ACTIVITYGRAM and Project Adventure Activities for Elementary Schools. CATCH P.E. is a developmentally appropriate physical education program which develops health-related fitness, skill competency, and cognitive understanding regarding the importance of physical activity for all children. CATCH P.E. instruction provides a variety of learning experiences which address the wide-range of student ability in physical education class, enhancing movement skills, sports skills, physical fitness, social development, integrates nutrition education and subsequently promotes lifelong physical activity. The outcomes of CATCH P.E. are to:

- Provide meaningful movement experiences which target individual fitness and skill levels of all learners.
- Increase moderate-to-vigorous physical activity in physical education class.
- Promote adequate amounts of physical activity now and throughout life.
- Maximize time on task and learning opportunities.
- Engage students in fun and motivating activities

Physical Best is an evidence-based adolescent fitness education program complemented by *FITNESSGRAM* fitness assessment program, both of which have the goal of promoting lifelong PA habits. The program educates, challenges, and encourages all children to develop the knowledge, skills and attitudes needed for a healthy and fit life. The overarching goal is to move students from dependence to independence for their own fitness and health by promoting regular, enjoyable physical activity.
The FITNESSGRAM/ACTIVITYGRAM assessments promote health for everyone with a focus on lifetime activity. The FITNESSGRAM assessment module contains a complete battery of health-related fitness items that are scored using criterion-referenced standards. FITNESSGRAM is the first health-related fitness test to use such standards, which are age and gender specific and based on how fit adolescents need to be for good health. The software produces an individualized report card that summarizes the student's performance in each component of health-related fitness and provides suggestions for promoting and maintaining good fitness. The database structure within the program allows for long-term

tracking of each student's fitness over time. Schools can also generate a variety of reports for analyzing results and sharing information with each student and with their parents.

Level 2 Intervention: After-school Program Curricula

Nutrition Education

Exploring the Food Pyramid with Professor Popcorn (Grades 3-5)
YMCA curricula include Exploring the Food Pyramid with Professor Popcorn. These curricula provide nutrition and health information as well as the opportunity to practice new skills related to nutrition and activity. Goals for participating youth include: understand that good health is, in part, about the food and activity choices that they make daily; choose and use foods for food health that are consistent with the Food Guide Pyramid and the 2000 Dietary Guidelines for Americans; improve practices in food selection, safety, and preparation; and enjoy being physically active.

Lesson Topics
My Pyramid; Grains; Fruits & Vegetables; Milk; Meat; Food Safety

Physical Education

The Activa Pyramid Power Physical after-school program is a vertically oriented program in which skills, fitness level, and competencies build through grades 3 -5 consistent with AZ physically active standards. Developed by Ms. Jennifer Reeves in the Tucson Unified School District, this curriculum provides opportunities for mastery of basic skills (locomotor, non-locomotor, and manipulative activities) and understanding of motor skills related to a variety of physical activity so that each individual can make positive decisions about activity choices. The Pyramid Power curriculum allows youth to become competent in a select number of lifetime physical activities that they can enjoy and succeed in. Opportunities are also provided to improve social and cooperative skills, and gain a respect and appreciation for diversity. Activa Pyramid Power Lessons are divided into four parts: team time warm up, nutrition activity, group theme activity based on the activity pyramid, and student choice.

Level 3 – Family Intervention

The family component integrated and reinforced the basic nutrition and physical activity information students received at school (Level 1) and during the after-school program (Level 2), and provided family members with strategies to work together to plan healthy menus, read food labels, and support each other in making healthy decisions about food consumption and physical activities. The physical activity portion of the Activa Family component was based on the CHOICES Project (a developmental study testing the use of the 12-session group office visit model to provide an obesity treatment intervention for children 9-11 years of age). The goal of the physical activity lessons was to introduce students to the health benefits of physical activity, providing the motivational grounding for choosing a physically active life over a sedentary one.

The family intervention consisted of twelve, two-hour sessions taking place on Thursday evenings between 5:30pm and 7:30pm. All sessions were taught in English with Spanish translation assistance and bilingual materials. Children and adults began each Family Fun Night together by participating in a group physical activity demonstration. This demonstration allowed adults and children the opportunity to be active together, and provided a fun way to instruct families on a new piece of physical activity equipment. Prior to each family night, children were introduced to the physical activity equipment that would be used in that week's family intervention during the after-school program. This allowed them to become familiar with equipment ahead of time, so that they could assist Activa staff in instructing their parents. (At the conclusion of each family night, each family was given the equipment to keep and use at home together.) Each physical activity demonstration was followed by a "light meal" (which doubled as a food demonstration) where families were given the opportunity to try a "5-A-Day" recipe (utilizing seasonal fruits and vegetables) prepared by study staff. Recipes and basic food preparation tips were provided during each session by a registered dietitian and Extension Nutrition Educator who circulated among the families as parents and children ate. Children and parents were then separated for the remainder of the evening (approximately one hour), spending the remaining time engaged in nutrition-themed physical activities (children) or discussion/nutrition activities (adults). (A copy of the family intervention session schedule and lesson topics may be found in Appendix D).

All family intervention sessions were team-taught by university staff and Cooperative Extension Nutrition Educators with assistance from guest speakers (e.g. Family Practice MD, YMCA staff) and school physical education staff. Lesson content was adapted from research-based nutrition and physical activity curricula (e.g. Expanded Food and Nutrition Program, University of Arizona's Cooperative Extension Service in Pima County; Eating Right is Basic—Enhanced, Michigan State University Extension, 2001; Healthy Weight 4 Life, University of Arizona Center for Nutrition and Physical Activity) and families participated in hands-on activities designed to help them apply nutrition and activity skills in a way that fit their available resources.

Parent topics on food, nutrition and health included "making the most of your food dollars"; quick and easy meals; keeping food safe; healthy eating without dieting; healthy food choices away from home; MyPyramid; the importance of breakfast; and food and nutrition for children and adolescents. Parents were encouraged to set weekly goals with their child (related to what the child learned in that week's lesson), as well as setting a personal goal guided by topics discussed at the family night intervention meeting.

Child nutrition topics included making healthy food choices using "Whoa, Slow, Go" food categories, appropriate portion sizes, healthy beverages (focusing on water for thirst), making good choices when eating out, and the importance of eating fruits and vegetables. Nutrition education was delivered in the context of physical activity (e.g. "Salad Bar Hoopla," "Fast Food Scramble"), which allowed the children to remain physically active and engaged during the entire session.

The physical activity component of the family intervention was based on the CHOICES Project (Reeves 2008), designed to introduce children and parents to the health benefits of physical activity, providing the motivational grounding for choosing a physically active life over a sedentary one – a first step in the goal-setting process. Physical activity was incorporated into each class using videos, interactive video gaming systems (e.g. Dance Dance Revolution; Nintendo Wii). Children received activity backpacks that during the first week of the intervention which provided a place to store equipment received during the program (e.g. Frisbee, Nerf ball) and contained ideas for family activities. Families also participated in physical activity self-assessments (e.g. pedometer logging), designed to address barriers to physical activity, encourage social support within the family, and develop action plans/goals to increase opportunities for family physical activity.

Below is the lesson grid for the Cohort 1 family intervention.

Activa Y Sana Family Intervention Topics

Main Lesson Title	**Lesson Objectives** **Participants Will:**	**Key Activities Each Week** **A = Review of Previous Week plus Weigh-In, Food Log/Activity Log Review** **B = Nutrition Experience** **C = Physical Activity Experience** **D = Nutrition Skill Building** **E = Family Physical Activity** **F = Family Planning, Goal-setting** **G = Resources Needed (food, equipment, etc)**
Week 0 **Exploratory Session**	• Introduce Activa program, meet Activa staff • Review expectations for 2-year program • Get to know other participants • Voice challenges to healthy eating/regular physical activity • Use a pedometer as a self monitoring tool to determine baseline	A: B: fruits, vegetables, yogurt dip, roasted red pepper dip, cheese, crackers C: Pedometer activity D: None this week E: Baseline Steps G: Recipe of the Week (fruit dip, vegetable dip) Pedometer for each participant
Week 1 **Energy Balance and Goal Setting** Whoa,Go Slow Foods Intro to Goal Setting	• Check-in, weigh-in, eat • Brainstorm w/each other to formulate ground rules for Activa family meetings • Recognize calorie-dense foods (fats/oils, added sugars, refined carbohydrates) and categorize them as Whoa Slow Go (Red, Yellow, Green) • Determine individual activity levels and set daily and weekly physical activity goals with pedometer	A. Overview B: Bean salad, jicama fruit salad, chips/salsa C: Pedometer goal setting D: What is Whoa Slow Go; Food Checklist E: Pedometer Baselines and 10% increase/Activity Backpack #1 Parachute and Backpack F: Goal setting – Nutrition & PA G. Whoa Slow Go Checklist; Recipe of the Week (Bean Salad)

Week 2 **Breaking Barriers:** Portion Size Matters Overcoming Physical Activity Barriers	• Check-in, weigh-in, eat • View examples of how foods have dramatically increased in the U.S. • Learn appropriate portion sizes of commonly consumed foods • Use a pedometer as a tool to assess if previous activity goals have been achieved • Identify barriers to physical activity and good nutrition and problem solve solutions	A: What worked from last week? B: Turkey sandwiches, cucumber salad, fruit C: PA barrier checklist and problem solving discussion D: Food logs: how to measure and record food intake E: Activity Backpack #2 Jump Ropes and Chalk F: Healthy limits: when meals served/what foods served G: Food models/fat tubes/sugar tubes; food/drinks; Commonly Consumed Portions Handout; Recipe of the Week (Turkey Sandwich)
Week 3 **Planning Ahead** Shopping/Planning Ahead is the Key to Good Nutrition Planning For Family Physical Activities and Fun	• Check-in-, weigh-in, eat • Learn basic meal planning and shopping skills, as well as stretching food dollars to maximize healthy food purchases • Understand the types of physical activities with physical activity pyramid • Develop a list of physical activities that family members can do by self, with a friend, or family member	A: What worked from last week? B: Yogurt fruit parfaits, peanut butter banana roll-ups, 100% fruit juice punch C: Understanding PA Pyramid and Planning for Activity D: Menus for a Week – Family writes down ideas together; Cost/benefit of eating healthy (adults); Pantry activity (kids) E: Activity Backpack #3 Hoppity Ball and Dynaband F: Family discussion of meal planning & preparation G. Sample Menus with Shopping List with Accompanying Pantry List; PA- Physical Activity; Building My Pyramid Plan, jump ropes and chalk; Recipe of the Week (PB roll-up, yogurt parfait)

Week 4 **Putting it All Together** Healthy Food *Can* Taste Good! Cooking at Home Physical Activity Goal Setting Plan Short and Long Term	• Check-in, weigh-in, eat • Discuss how healthy food does not mean poor-tasting food • Watch healthy food demo • Learn basic food safety • Learn how to substitute ingredients to improve quality and lower kcal • Learn strategies of how to make mealtime family time (limiting outside distractions, coming together to prepare food, etc) • Develop strategies to reach short and long term physical activity and nutrition goals	A: What worked from last week? B: Chicken Vegetable Stir-Fry, fruit, 100% fruit juice punch, rice C: Physical Activity Goal Setting D: Food demonstration E: Parent/Child Activity Challenges (Activity Backpack #4) Dance CD F: Making Mealtime Family Time G: Healthy Traditional Foods handout; Cookbook from Coop Ext; Recipe of the Week (stir-fry)
Week 5 - **REVIEW**	• Check-in, weigh-in, eat • Discuss challenges and successes from holiday season • Family Feedback Survey • Portion Distortion Quiz (Nicole Hollis) • Family Scavenger Hunt	A: What happened over holiday break? B: Entrée Salad C: Family Scavenger Hunt D: Portion distortion quiz E: Family Scavenger hunt F: G:
Week 6 **1.25.07** **Healthy Choices** Eating Out Moderate to Vigorous Physical Activity	• Check-in, weigh-in, eat • Learn extent of fast food influence by watching clip of SuperSize Me • Learn strategies on controlling portions (and fat/sugar) when dining out • Identify key words on a menu that indicate healthier choices and practice choosing healthy meals when dining out • Participate in a range of moderate, and vigorous physical activities as a family using the activity backpacks	A: B: White chili, low-sugar cornbread C: Moderate to Vigorous PA Activities D: Fat, sugar demo; use real menus to practice identifying healthier meal choices (parents only) E: Activity backpack #6- Frisbee F: G. PA-Frisbee- MVPA Family Marathon worksheet; Key Words to Look for When Dining Out and Tips

Week 7 **2.1.07** **TV and Health** Fathers as a Model for Healthy Lifestyle PA Role Modeling	• Discuss the role TV plays in affecting behaviors (related to health) • Learn national recommendations for TV watching (kids/adults) • Learn how to keep track of TV viewing and learn definition of purposeful viewing • Learn role of fathers in kids health • Use a Nerf ball as an exercise tool	A: B: Enchilada bake (vegetarian), fruit salad or green salad C: PA role-modeling Family PA Goal Commitment Worksheet D: Food and TV – what is the relationship? E: Activity backpack #7-Nerf Ball F: Fathers are models for PA & HE Creating boundaries around TV G. TV log (at least 1 day decided ahead of time)
Week 8 2.08.07 TV Turnoff Challenge Overcoming Physical Activity and Healthy Eating Barriers	• Check-in, weigh-in, eat • Review TV log; set goals for TV Turnoff • Participate in facilitator-led 'negotiation activity' – how to get kids to buy into healthy eating/activity (parents only) • Use physical activity as a stress buster • Use scarves to create fun activities (kids)	A: What worked from last week? B: Quiche (vegetarian) with whole wheat bread crust, fruit salad or green salad C: What to do instead of watching TV D: Role-playing – how to get your kids to eat healthy (adults only) E: Activity Backpack #9 Kick Boxing/Yoga F: Negotiation Activity (parents only) G. Scarves (kids only)
Week 9 2.15.07 Healthy Beverages	• Check-in, weigh-in, eat • Discuss TV Turnoff Challenge Results • Try to identify different beverages and rate them by taste • Learn how to distinguish 100% juice from cocktails • Use a hands-on approach to determine how much sugar is in Coca-Cola • Review and understand healthy beverage guidelines with emphasis on decreasing soft drinks and increasing water	A: B: Albondigas soup (extra lean beef), rice pudding; 100% sparkling juice punch C: Whoa Slow Go Beverages (child physical activity) D: Healthy Beverage Taste Test (adults) E: Activity Backpack #8 Kickboxing DVD/Yoga Cards F: G. Recipe of the Week; Kickboxing DVD, Yoga Cards

Week 10 3.1.07 Family Fun Night & Resource Fair	• Review program highlights and key messages through visits to "stations" with interactive lessons and resources: Healthy Breakfasts, Bicas, Bobbing for Apples, Milk Taste Test Challenge, BMI, Climbing Wall, Moving Van • Bridge to Booster – teaser for upcoming sessions	A: Review of program highlights and key messages B: BBQ (chicken, roasted vegetables, brown rice pilaf) C: PA stations D: Nutrition stations E: PA stations F: G. Family Challenge Passport
Booster 1 4.12.07	• Participate in fun family activities: Dancing; Superman Fitness Cards; Making a Healthy Snack • Practice goal setting (PA and nutrition goals)	A B: Turkey pitas w/roasted red pepper dipping sauce and orange wedges; fruit smoothies C: PA stations D: Nutrition stations E: PA stations F: G: Superman cards; Activa T-shirts
Booster 2 5.8.07	• Participate in community resource fair	C: Sign up for summer YMCA camp (children) and 6-month membership to Y (families) D: Food bank, farmer's market information

APPENDIX F

Childhood Obesity Prevention & Treatment Studies Involving Parents/Caregivers, published 1980-2007

Childhood Obesity Prevention & Treatment Studies Involving Parents/Caregivers, published 1980-2007
Pub Med key words: "childhood" "obesity" "prevention" "treatment" "parents"; cross-referenced against Cochrane systematic reviews (2006)
Results: N = 26 studies (16 conducted in the United States – 7 of these by the same investigator (Epstein, L.) – only one demonstrates long-term weight loss (>1 year) (Epstein, 1990)

Author, Year, Location	Recruitment Method and Study N	Population	Research Question	Intervention Description	Findings	Retention & Follow Up
((Brownell, Kelman et al. 1983) United States	N= 42 overweight children Recruitment method not specified - "town of 35,000"	Obese,80% female adolescents 12-16 yrs ≥20% more than average weight for age, sex, ht and their mothers; white, lower middle class conducted as 2 cohorts	Effect of mother/child groups to mother/child separate and child-alone on weight and blood pressure changes	Groups: (1) mother, child separate (2) mother-child together (3) child alone; Duration: 16 weeks, 45-60 minute sessions; each group 5-8 people; 1 year maintenance period with bimonthly meetings Intervention: monitoring, contingencies, increasing skills, prompts/triggers/cues, social support, information regarding behavior and outcome; 100-page workbook that was given in parts Attendance: money deposits to get people to attend	Mother child separate group lost more weight than did the other 2 groups; differences increased at 1 year follow-up (same group maintained weight loss better than other 2 groups)	10% attrition at 16 weeks; 14% at 1 year follow-up
(Dreimane, Safani et al. 2007) United States	N=264 overweight children; must agree to attend at least 50% of sessions; referred by hospital staff, community physicians, school health personnel, or self-referral TOTAL of 417 children enrolled over 6 years	Mean age 11.5, BMI = 85th percentile or higher; 137 female, 73% Hispanic; 20 subjects enrolled in each session – 4 sessions per year	Evaluate the effects of a hospital-based, family-centered lifestyle program on weight and health in 7-17 yo children	Groups: A group of 115 had to wait 6 months before starting the program and were observed – Duration: Began with 8, 90 min sessions – after 1st group, changed to 12, 90 min sessions conducted in an outpatient setting by registered dietitians and physical therapists; Intervention: interactive nutrition and exercise sessions with behavior modification; each session (1) exercise 45 min (led by PTs) (2) nutrition ed behavior modification (led by RDs) (3) family involvement (led by MDs and social workers) – parents did not do the PA due to lack of medical clearance; children recorded daily dietary and PA activity during 1st , 4th, 7th weeks of the 8- and 12- week program (FFQ style) Participants chose 1 PA or nutrition goal when they began the program to work on throughout the duration - Attendance: Of 417 subjects, 264 (63%) attended at least half the sessions	Weight and BMI velocity and BMI, BMI z-score lower during the program than during pre-program observation period; subjects in 12-wk program had sign reduced gains in weight and greater losses in BMI than in 8 weeks; improvements in emotional well-being correlated with body loss – those who attended greater number of sessions experienced greater absolute change in z-score FINANCIAL OUTCOME: avg money spent per child (12 week program only) was $327.43 = $86,000 for 264 children	129 children who attended at least ½ sessions participated in follow-up program – 9 months – no long-term maintenance of weight changes

(Edwards, Nicholls et al. 2006) United Kingdom	N=37 families referred by physician; 33 families met criteria	Obese children aged 8-13 years	Efficacy study – acceptability of family based behave treatment to British families and health professionals within specialist hospital	Groups: Family based behavioral treatment out of hospital clinic – 4 groups of 6-10 families Duration: (8 weekly, then 4 fortnightly sessions over a 4 mo period) Intervention: (1) advice on whole family lifestyle change to modify micro-environment of the home and (2) behavioral weight control program for overwt child (self-monitoring, goal setting, stimulus control, relapse prevention) Attendance: NO DATA	3 month follow-up; 27 out of 33 families completed the session; children lost 8.4% BMI over time of treatment (maintained at 3 mo follow-up)	No follow-up past 3 months
(Epstein, Wing et al. 1984) United States	N=53 families recruited through physician and self-referral, media advertisement	Obese children (age 8-12) and parents; child and parent must be 20-80% over ideal weight for ht with SF >85th percentile, parent willing attend all meetings	Comparison of diet with diet-plus-lifestyle exercise in a sample of overweight children and parents	Groupds: (1) diet, (2) diet + exercise, and (3) control Duration: 15 sessions (1st 8 weekly, then the remaining spread out over 20 weeks) Intervention: parents were asked to employ "point economies" to reinforce child diet and/or exercise changes (parents checked off items from a pre-arranged incentive "menu" that they would supply – the children ranked these items in 3 groups according to how much they wanted each item; child rankings were then made equivalent to point values that could be earned – points only valid if parents checked off points in "habits book"); Diet = TLD; exercise = increasing EE from 1400kcal/wk to 2800kcal/wk (by week 12) Attendance: parents required to <u>deposit $85 before beginning the program</u>	at 1 year, parents given diet + exercise showed better weight losses than parents given diet alone parent and child weight during first 6 months of treatment were highly correlated, but those during months 6-12 were uncorrelated; BEST PREDICTOR OF 12-MO relative weight for both parents and children was initial relative weight; exposure to exercise program during treatment was predictor of maintenance of nonobesity	34 of 36 treatment families measured at 1 year NO DIFFER-ENCE found for children after 1 year ;controls began intervention at 6 months so no longer a good comparison
(Epstein, Wing et al. 1986) United States	n=41 families participated, 24 children had at least 1 obese parent Recruitment method not specified –	8-12 yo between 20 and 80% over ideal weight	Effect of parent weight (obese/nonobese) and parent control versus child self-control on the weight loss of obese preadolescent children over 3 years	Groups: (1) parent control or (2) child self-control; Duration: 8 weekly treatment meetings with 10 monthly meetings in which parents and children were seen separately over 1 year Intervention: 1200 kcal diet and lifestyle exercise program; point economy, in which children earned points backed up by activity and privilege reinforcers was used to regulate child eating and exercise habits; in both groups, determination of when goals were met initially made by therapists (parents trained, then children took over in self-control condition) Attendance: <u>parents deposited $85 to be returned for attendance</u>;	children of non-obese parents had significantly greater decrease in relative weight after 1 year than children of obese parents	at 3 years, no effect of parent weight; parent loss related to weight loss but not weight mainten-ance

(Epstein, Valoski et al. 1990) United States	185 families applied to be in the study; 76 families were randomized Recruitment method not specified -	6-12 yo obese children and their parents – intact families, white, middle-class	Effects of behavioral family-based treatment on % overwt and growth over 10 years	Groups: (1) child and parent (2) child (3) nonspecific Duration: all families received 8 weekly treatment meetings plus 6 additional meetings over following 6 months; Intervention: identical diet (TLD), exercise, and behavioral (contracting, self-monitoring, social reinforcement and modeling, contingency management) principles for all 3 groups Attendance: NO DATA	Group 1 children with best outcomes maintained over time; parents didn't maintain lost weight in any of the groups; FIRST EVIDENCE that treatment initiated early may impact children as they enter young adulthood	5 years (67 families), 10 years (55 families)
(Epstein, McKenzie et al. 1994) United States	N=44 families; Recruited from physicians, previous participants, and in response to PSAs	Child (8-12yo) 20-100% overwt	Effects of mastery criteria and contingent reinforcement in a family-based behavioral weight control program	Groups: control (educational materials received at same rate as subjects progressing through experimental group) and experimental (subjects progressed through treatment at their own rate based on mastery of information and behavioral skills, subjects split into 2 cohorts of 2 groups each with 11-15 families per group Duration: 16-18 weeks to move through the different intervention levels –weekly treatment meetings included weights and didactic lecture focused on weight control or behavior change – Intervention: participants were reinforced based on individual progress: 5 units including self-monitoring, diet, exercise, parenting, and maintenance WEIGHT LOSS CRITERIA FOR MOVING TO THE NEXT LEVEL, both treatments included training in behavior management and parenting education – parents in the experimental group asked to also provide and record praise and stimulus control – this was also individualized with parents meeting weekly with staff to review daily habit books and parenting checklist; exercise program, TL diet, behavioral principles, quizzes, contracts Attendance: NO DATA	0, 6, 12, 24 months significantly better relative weight change at 6 months and 1 year for children in the experimental compared to control group – these effects were not maintained at 2 years	39 families at 24 months
(Epstein, Valoski et al. 1995) United States	92 families screened - N=61 families as 2 cohorts, recruited through radio, TV, posters, referred by physicians and school nurses	8-12 yo children and parents; white, middle-class	Influence of reinforcing children to be more active or less sedentary on child wt	Groups: (1) reinforcing decreased sedentary activity; (2) reinforcing increased PA; (3) reinforcing decreased sedentary and increased PA Intervention: TL Diet; not all sedentary activities targeted for reduction; reduce from 35 sedentary hours to 15 sedentary hours per week; parents and child moved through levels independently; mastery approach used self-monitoring, stimulus control, reinforcement Attendance: NO DATA	Sign decreases in % overwt observed after 4 months between the sedentary and exercise groups (higher in sedentary); children in sedentary group increased liking for high-intensity exercise and reported lower caloric activity than children in exercise group	55 families completed 1 year; At 1 year, sedentary group had greater decrease in % overwt than the combined and exercise groups

Epstein, Paluch et al. 2000 United States	461 families interested; 171 screened N=90 obese children and parents randomized; recruited as 2 cohorts through physician referrals, posters, newspapers, television adverts	8-12 yr old children 20-100% overwt;	Compare influence of targeting decreases in sedentary behavior versus increases in physical activity in obesity treatment program	Groups: four groups = sedentary behaviors vs physical activity and treatment dose (low vs high) Duration: 6 month treatment program included 16 weekly meetings followed by 2 biweekly and 2 monthly meetings; families seen at 12 and 24 mo; Intervention: Low dose for decreasing sedentary or increasing PA = 10 h/week sedentary or 16.1 km EE and high dose = 20 h/week sedentary reduction or equivalent EE (32.2 km); workbooks for parents and children – TL Diet, specific activity program; behavior change techniques; maintenance of behavior change; 30 minutes of meetings were with individual therapists; Attendance: parents deposited $75 to be returned upon completing 75% of intervention sessions; parents paid $50 at 24 month follow-up	Results during 2 years showed targeting either decreased sedentary or increased PA was associated with sign decreases in % overwt and body fat and improved aerobic fitness; self-report activity increased and sedentary time decreased	82-91% attended 24 mo follow-up
Epstein, Paluch et al. 2004 United States	128 families screened; 72 met criteria (children had to read a manual and demonstrate they could complete self-monitoring of food activity; N=63 families participated Recruitment through physician referral, brochures, flyers, newspaper ads;	8-12 yo children and a parent	Compare treatments that differed in behavioral strategy to reduce sedentary behavior	Groups: (1) reinforced reduced sedentary behavior (praise and points for behavior change) (2) stimulus control (recording sedentary behaviors, changing home environment) Duration: 20 meetings over 1st 6 mo Intervention: individual meetings with therapist, then separate child and parent classes – ea 45 minutes Attendance: NO DATA	0, 6, 12 mo measures – no difference between groups for rate of overwt – both groups sig below baseline	60 families remained after 1 year
Flodmark, Ohlsson et al. 1993 Sweden	1906 children screened at school for obesity; 1774 agreed to participate; 49 defined as obese; N= 44 children (treatment), N= 50 children (control) agreed to be measured at follow up	10-11yr old children	Effect of family therapy on childhood obesity	Groups: (1) family therapy (14 F, 11 M) – not focused on weight, but on family functioning (2) conventional treatment group (9 F, 10 M) Duration: 14-18 months unclear number of sessions (5-10? Every 3 weeks Spread over 14 months?) Intervention: both diet counseling (with dietitian) and medical check-ups while one group also received family therapy; did not focus on parent skills – only child behavior change Attendance: NO DATA	Increase of BMI in family therapy LESS than convention treatment and control groups	11% drop out rate; 1 year follow-up after intervention ended, increase of BMI in family therapy less than convention and control

Golan, Fainaru et al. 1998 Israel	N=60 obese children recruited from public school system in middle class town (pop 100,000)	age 6-11 years – child >20% over expected wt	Family-based approach comparing parent-only with child-only on child weight	Groups: (1) children as agents of change or (2) parents as agents of change; Duration/Intervention: 30 sessions for children (1 hr support/educational sessions by clinical dietitian) and 14 sessions for parents 14, 1 hr group sessions conducted by a clinical dietitian – each family also attended 5, 15 min individual sessions Attendance: avg 70%	sign differences between 2 groups in reduction of exposure to food stimuli and changes in eating habits – mean weight reduction was greater in parent-only treatment group compared to child-only	Not specified
Golan, Kaufman et al. 2006) Israel	N=102 families screened; 32 families with obese children met criteria; recruited through newspaper advertisements	Children 6-11 yrs 20% overweight or more	Parents only vs parents and child (parenting style) on child weight	Groups: children divided into age groups (6-7, 8-9, 10-11) and randomized to (1) parents only or (2) parents and children ; Duration/Intervention: 16, 1 hr support and education groups held weekly (1st 10) then biweekly and once per month; also, 40-50 min individual appointments held once per month for each family in both groups during first 6 months of program Attendance: Avg 83%	Parents-only group resulted in sign reduction in % overwt at end of program and at 1 year follow-up	5 families dropped out before 1 year follow up
(Golley, Magarey et al. 2007) Australia	N = 111 families recruited through media publicity and school newsletters (July 2002 – Aug 2003)	6-9 years – overwt according to Int Obes Task Force definition	Relative effectiveness of parenting skills training as a key strategy to treat childhood overweight	Groups: Assigned to (1) parenting skills + intensive lifestyle education (2) parenting skills alone or (3) wait listed control (healthy lifestyle pamphlet) – Duration/Intervention: Classes conducted at teaching hospitals by dietitian (same one) -- 4 weekly 2-hr group sessions followed by 4 weekly then 3 monthly 15- to 20-minute individual telephone sessions – parents in (1) participated in an extra 7 sessions Attendance: NO DATA	All 3 groups experienced reduction in weight -- After 12 months, BMI z-score reduced by 10% with parenting skills plus intensive lifestyle education versus 5% with parent training alone or wait listing (not statist sign)	N = 91 left at 12 months
(Graves, Meyers et al. 1988 United States	N=40 obese children and their parents recruited through media announcements;	Children 6-12 yrs (mean 9 yrs) at least 20% overwt	Efficacy of including parent problem solving training in a behavioral weight-reduction program for obese children	Groups: children and their parents assigned to (1) problem-solving, (2) behavioral (self-monitoring, diet info, exercise info, stimulus control, family support, cognitive restructuring, peer relations, maintenance) or (3) instruction-only weight loss group (plus 15 minutes pa) Duration: 8 weeks of treatment Intervention: Attendance: NO DATA	39 families completed 8-week program; 3-6 month follow-up showed decline in differences (initially, problem-solving group showed the most loss (more than behavior); child weight loss sign correlated with parent problem solving ability	31 families followed up at 6 months

(Israel, Stolmaker et al. 1985) United States	N=33 children and their parents recruited through letters to physicians and school nurses and local newspaper adverts	Children 8-12 yrs; at least 20% overwt	Effect of explicit and additional training in general child management skills in the context of a behavioral treatment program	Groups: (1) behavioral weight reduction (9 F, 3 M), (2) behavioral weight reduction + parent training (8 F, 4 M), (3) control (6 F, 3 M); Duration: 3 overlapping cycles of treatment sessions (each cycle contained 1 group in each experimental condition) both treatment groups attended 9, 90 min sessions Intervention: parents in group 2 received child behavioral management training; CAIR=stimulus control CUES, ACTIVITY, food INTAKE, and REWARDS; Monitoring of food and activity divided between parent and child – homework given at each session – lecture/discussion format Attendance: NO DATA	Weighing at the end of the 9 weeks – discussion at 1, 2, 4, 6, 9, and 12 months – phone calls waned with discussion frequency; children and parents in treatment groups lost wt; control group gained wt; positive correlation between parent and child weight loss	20 families at 12 months; parent training wt status superior to behavior group alone
(Israel, Solotar et al. 1990) United States	36 children and their parents Recruited through newspaper, letters to physicians, letters to school nurses; N=34 met criteria	Obese 8-13 yr old and at least 1 parent	Examines contribution of the inclusion of a multiple component self-regulation intervention	Groups: (1) standard treatment (2) enhanced child involvement; Duration: 8 x 90 min sessions/wk; 5-7 families per group standard treatment followed by nine biweekly sessions; Intervention: child goal/target specified; parent – monitoring, contingencies, increasing skills, planning and implementation, prompts/triggers/cues, social support, homework — 4 prong approach: CAIR (Cue control, physical Activity, food Intake, Rewards)	26 families completed 26 weeks of treatment – of those 6 were not available for follow-up at 1 year and 3 years – children in both conditions achieved sign reduction in % overweight and TSF during 6 mo treatment period	1 year and 3 years – weight regain during follow up period
(Jiang, Xia et al. 2005) China	106 children invited to participate; N=75 families consented - N=68 families participated in the 2 year program	Obese middle school children (grades 7-9) and their parents	Efficacy study – can a familiy obesity treatment study work in China?	Groups: Treatment and control groups – treatment focused on dietary behavior modification (TL Diet) – and increased PA (20-30 minutes per days 4 days per week); Duration: 2 year treatment duration; Intervention researchers (doctors) visited family homes 1x/mo to observe environment Attendance: NO DATA	Measurements at baseline, 6 mo, 2 yr; Body fat sign reduced in treatment group but not control group after 1 year	61 measured after 2 years
(Kalavaine n, Korppi et al. 2007) Finland	N=70 obese children	Age 7-9 years; weight for height 115-182%	Compare efficacy of family group treatment with routine counseling	Groups: (1) routine counseling) or family-based group treatment Duration: families participating in routine counseling went to 2 appts; family-based group treatment went to 15 separate sessions for parents and children) ; Intervention: sessions included nutrition ed, PA, behavioral therapy; Attendance: high attendance (87-99%) in both groups and low attrition (3%)	Baseline, 6 mo, 1 year – children attending group treatment lost more weight for height than children receiving routine counseling; at 1 year changes were partly lost but still noticeable between the groups	6 months after end of intervention

(Kirschenbaum, Harris et al. 1984) United States	52 applied to be in program; 40 parent/child dyads met criteria for inclusion Recruitment through newspaper, radio, television, posters	9-13 years, 20% overwt or more; parents at least 10% overwt	Effects of parental involvement and family environment on weight loss in obese preadolescents	Groups: (1) parent + child (n=16) or child only (n=15) groups (plus n=9 control group); six treatment groups run by 2 therapists (clinical psych) – Duration: 9 weekly 90-min treatment sessions plus 3-month and 1-year follow-up assessment sessions; Intervention: the program was a CBT adapted from Johnson and Stalonas (1981): self-monitoring of foods, time, place, mood; graphing and increasing levels of exercise; nutrition education; stimulus control; planning of meals and exercise; self-reward; decelerated eating; coping techniques for managing negative self-talk Attendance: subjects charged a few $30 plus $50 deposit at the first session – refunds given contingent on attendance;	Children in both treatment groups lost significant amounts of weight during treatment and maintained losses through 1 year follow-up; children in control group gained sign weight by the 3 month follow-up	35 children completed study --- children in both treatment groups maintained loss through 1 year follow-up; parent + child group showed lower attrition than child-only group 25% drop out rate
(Nowicka, Pietrobelli et al. 2007) Sweden	54 children obese referred to outpatient clinic	6-17 yrs obese and extremely obese pediatric subjects	Influence of low-intensity solution-focused family therapy on childhood obesity	Groups: None Duration: Intervention: Families received solution-focused family therapy provided by multi-disciplinary team of outpatient obesity clinic Attendance:	11 children treated for 6-12 months; 33 for more than 12 months (families received avg of 3.8 family sessions); intervention resulted in a mean decrease in BMI z-score of 0.12 – self-esteem improved	81% (n=44) of children and their parents participated in f/u
(Rodearmel, Wyatt et al. 2007) United States	America on the Move study; N=192 families recruited from Denver area via print materials and/or emails sent to schools, physicians, health organi, community organizations – 828 families screened, 298 qualified, 216 attended (24 did not complete baseline measures)	7-14 yr old overwt or at risk and parents	Evaluate whether small changes in diet and PA could prevent excessive wt gain in overwt children	Groups: (1) America on the Move and (2) self-monitor Duration: 6 month study;families met with study staff on 6 occasions Intervention: America on the Move group (2 small lifestyle changes: walk additional 2000 steps per day above baseline and eliminate 100 kcal per day from typical diet by replacing sugar with non-caloric sweetener and (2) self-monitor – use pedometers to monitor but not change diet Attendance?	Both groups of children showed decreases in BMI for age (sign) – the AOM group showed a sign higher % of children that maintained or reduced BMI for age	184 children (of 218 at baseline) completed 6 mo assessments 220 (of 262) parents 16% attrition rate

(Sacher, Chadwick et al. 2005) United Kingdom	N=11 obese children and their families recruited via school nurses, pediatricians, local newspapers	9.6 years (avg) old 17 parents measured (7 were obese, 8 overwt)	Evaluate feasibility and acceptability of a new community based childhood obesity treatment program	Groups: all families together in one group Duration:2x/week x 12 weeks in the evenings at a sports center Intervention: 8 nutrition-focused sessions, 8 behavioral modification sessions, and 18 fun-based physical activity sessions Attendance: avg 78%	Baseline, 3 m, 6m -- BMI sign improved at 3 months but lost significance at 6 months	1 drop out
(Schwarz, Hamre et al. 2007) United States	91 eligible children from 14 practices enrolled between April 2004 and November 2004 (age3-7yr) presenting for well-child care visits having; no children above 95th - English speaking parents with telephone	15 MDs and 5 RD were assigned to (1) control (2) min intervention (MD only) or (3) intensive intervention (RD + MD) Children with BMI at or greater than 50th percentile (50% were between 85th percentile but lower than 95th	Determine whether pediatricians and dietitians can implement office-based obesity prevention program using MI as primary intervention	Groups: (1) control (2) minimal intervention (pediatrician only) or (3) intensive intervention (MD + registered dietitian) Duration: 6 month intervention - pediatric primary care setting – Intervention: parents of children in minimal intervention group received 1 MI session from the MD (10-15 minutes); parents in intensive group received 2 MI sessions each from MD (10-15 minutes each) and RD (45-60 minutes each) Attendance: NO DATA	Change in BMI %ile at 6 months were not sign different between groups although all groups decreased (0.6, 1.9, 2.6 for control, minimal, and intensive) ; 94% of parents reported that the intervention helped them to think about changing family diet habits	67% of participants completed the study -- Pt drop out rates high = control group 10%, minimal intervention group 32% and 50% for intensive intervention
(Shelton, LeGros et al. 2007) Australia	N=43 participants recruited through physician, nurse, school guidance officer referrals from general public brochures, flyers, media	Children 3-10 yrs and at risk or overweight	Evaluate 4 x 2 hr weekly group parent education program targeting overwt children on child and parent weight	Groups: control and intervention Duration: initial assessment followed by 4 group sessions at weekly intervals (2 hr duration) attended by parent only; MD, RD, Psych, Ex Phys; Intervention: different educational methods used Attendance: NO DATA	At 3 months there was a sig reduction in BMI after treatment – no change in parent weight	No long-term follow-up
(Wadden, Stunkard et al. 1990) United States	58 girls interviewed – N= 47 African American girls enrolled in study families recruited through advertisements in paper, school nurses, attending physicians; subjects attended 1 hr screening interview with PI	Mean age: 14.0 years- at least 10kg overweight for age, sex, ht	Efficacy of behavioral weight control program in black female adolescents	Groups: (1) child alone n=19 (2) mother and child treated at same session n=14 (3) mother and child treated in separate but concurrent sessions n=14; Duration: 16-wk program with different levels of parent participation:sessions (1 hr) and delivered to groups of 8-10 persons after school or Saturday mornings by clinical psychologist Intervention: treatment principles described in manual for Weight Reduction and Pride (WRAP) program developed for this population: track food, limit consumption of high-kcal snacks and fast foods, limit time and place of eating, increase PA, modifying self-defeating thoughts Attendance: mother required to deposit $35 at outset to return to daughters on weekly basis for attendance	87% of the total sample achieved reduction in BMI -- At end of the 16 weeks, children in 3 conditions lost 1.6, 3.7, and 3.1 kg respectively – differences were not statistically significant – however, secondary analysis showed the greater then # of sessions attended by mother, the greater the daughter's weight loss	28 completed baseline measures; 31 of the 36 children participated in 6 mo follow-up – no long-term benefit from this program – BMI returned to baseline

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