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Evaluation of the T.O.D.A.Y. Project: The Impact of a Diabetes and Obesity
School-Based Prevention Program on the Behavior and Knowledge of

5th Grade Students

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DEDICATION

Isaiah 26:12 “Lord, you establish peace for us; all that we have accomplished you have done for us.” Father, this life and this thesis are yours.

I would like to thank my parents, Jose and Jeannette Chavez, who helped me to get through this process.

Thank you Alfonso and Lourdes Labrador, Wowi, Tio Mean, Jose Jr., Alejandra, Luca Dondi and to all of my friends from my small group, church and school for your encouragement.
ABSTRACT OF THE THESIS

Evaluation of the T.O.D.A.Y. Project: The Impact of a Diabetes and Obesity School–Based Prevention Program on the Behavior and Knowledge of 5th Grade Students

by

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Overweight and obesity are serious health concerns that impact the health of individuals at many levels. Families and communities are also impacted by the overweight and obesity epidemic. Current estimates of children who are overweight in the United States are 17% of children ages 6 to 11 and 17.6% of children ages 12 to 19. Although overweight and obesity rates are high among the general population; rates are even higher among minority and low-income populations. Schools have been researched for their effectiveness in reducing overweight and obesity prevalence; along with increasing behaviors such as healthier nutrition and physical activity and knowledge. However, few studies exist that examine the impact of school-based interventions on primarily low-income, minority populations. The purpose of this study was to evaluate the impact of TODAY (Transforming Obesity and Diabetes Awareness in Youth), a school-based intervention with the goal of preventing obesity and diabetes in the fifth grade population at two low-income, primarily Hispanic/Latino elementary schools in Escondido, California. The study examined nutrition, physical activity and health knowledge variables. A sample of 123 children, all 5th grade students who attended either Felicita or Lincoln elementary schools were recruited to participate in the project. The changes in nutrition and physical activity variables were measured by questions adapted from the School Physical Activity and Nutrition Questionnaire (SPAN) created by Coordinated Approach to Child Health (CATCH). The knowledge variable was measured by questions based on the health curriculum that pertained to nutrition and physical activity. It was hypothesized that children who participated in the project would demonstrate increases in healthy nutrition behavior such as fruit and vegetable consumption and decrease soft-drink consumption; demonstrate increase in physical activity behavior and decrease sedentary behavior of screen time; lastly the students would increase knowledge of nutrition and physical activity concepts taught in the intervention. Statistical analyses included Wilcoxon rank sum test and Wilcoxon signed rank test. Results from the pre/post test indicated that the children who participated in the TODAY Project, increased fruit and vegetable consumption, physical activity and health knowledge. Findings of this research are consistent with previously published articles on school-based interventions. However, unlike previous research this study was unable to demonstrate significant decreases in soda consumption and sedentary behavior. Understanding the impact of the school on the health of its students will allow for effective school based interventions that are capable of curving the overweight and obesity epidemic, especially among the most at-risk populations.
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CHAPTER 1

INTRODUCTION

Overweight and obesity is a growing public health problem in the United States. Statistics from a recently published study by the Centers for Disease Control and Prevention (CDC) show that numbers as high as six out of the ten children in the United States are either overweight or obese. (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). The health complications of overweight and obesity create a burden on the child, their family and community. Overweight and obese children experience negative health consequences, and also face psychological, social and economic challenges. (Daniels et al., 2005; Eisenberg, Neumark-Sztainer, & Story, 2003; Goodman & Whitaker, 2002). The family and larger community are also impacted and bear the burden of economic and healthcare consequences associated with the obesity epidemic (Colditz, 1999).

Statistics show that children in the United States become overweight or obese at a young age (Ogden et al., 2010). Preventative measures and interventions can be implemented to promote nutritious eating and physical activity in children in order for them to develop life-long health habits. The school is an ideal environment to implement prevention programs and has been identified as a place where healthy eating habits and active lifestyles can be encouraged (Brown & Summerbell, 2008). School-based interventions have shown successful results (Caballero et al., 2003; Harrell et al., 2005; Spiegel & Foulk, 2006; Taylor et al., 2008; Trevino et al., 2004; Wiecha et al., 2004). A recent study utilizing a school-based intervention showed reduction in obesity, increases in physical activity, improved decision making and healthy attitude (Berenson, 2010) Therefore, it is important to identify school-based programs that are effective in preventing childhood obesity and type II diabetes. This study will examine the “Transforming Obesity and Diabetes Awareness in Youth” Project (TODAY), a school-based program that utilized a screening and in-class intervention to prevent obesity and type II diabetes in children. This project was implemented in two low-income, primarily Hispanic/Latino elementary schools. The schools Felicita and Lincoln elementary school are located in Escondido, California. The demographic profiles of
the schools show that the student populations are primarily minority and low-income (School Accountability Report card for School Year 2007-2008, 2009a, 2009b). Evidence suggest that minority and low-income children have an increased risk of being overweight or obese and are also at a higher risk of developing type II diabetes compared to their Caucasian, high-income peers (Lieb, Snow, & DeBoer, 2009). This study will also examine the community collaboration that initiated and implemented a school-based intervention that addressed the obesity epidemic in the school environment of a low-income, minority population.

**CLASSIFICATION OF OVERWEIGHT AND OBESITY AND DIABETES IN CHILDREN**

Overweight and obesity is the abnormal or excessive fat accumulation that presents a risk to health (Obesity, 2009). Body Mass Index (BMI) is an indicator of body fatness and is an assessment tool used to classify individuals as normal, overweight or obese (Dietz & Bellizzi, 1999; Nihiser et al., 2007). BMI is calculated by dividing the child’s body weight in kilograms by their height in meters squared (Centers for Disease Control and Prevention, 2009a). For children, the BMI score is plotted on the CDC’s BMI-for-age growth charts to obtain percentile ranking; the percentile designates a relative position among children of the same age and sex (Centers for Disease Control and Prevention, 2009a). The classification of BMI for children is as follows: a normal BMI for a child will fall in the 5th to 85th percentile, an overweight child will have a BMI that falls between the 85th to 95th percentile, and a child that is classified as obese will have a BMI that is equal to or greater than the 95th percentile (Centers for Disease Control and Prevention, 2009a). The BMI-for-age relates to associated clinical health risks for cardiovascular disease such as hyperlipidemia, increased insulin and high blood pressure (Centers for Disease Control and Prevention, 2010).

The progression of type II diabetes is determined by a complex interaction between genes and environment (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003; Ludwig & Ebbeling, 2001). A fasting glucose level of 100 mg/dL or higher is considered to be abnormal for both the crude and adjusted profiles (American Diabetes Association, 2002). The clinical presentation occurs when the body does not produce enough insulin or the cells ignore the insulin (American Diabetes Association, 2009). The criterion for the diagnosis of diabetes is the same for children, adolescents and adults. Diabetes may be diagnosed with the presence of polydipsia in addition to a random plasma glucose level greater than 200 mg/dL.
Classification of the type of diabetes depends on observation of the clinical features and course or can be accomplished with data from additional testing (Copeland, Becker, Gottschalk, & Hale, 2005).

Throughout the last three decades, childhood obesity and type II diabetes has been on the rise. Trends show that over the past twenty years, overweight and obesity rates have doubled for children ages 2 to 19 (Centers for Disease Control and Prevention, 2009b). Consequently, type II diabetes, a disease associated with overweight and obesity has been increasing in the pediatric population. A recent studied showed that between 8% and 45% of recently diagnosed cases of type II diabetes were found in children (Alberti et al., 2004).

In 2002, 20.8% of children ages 5 to 20 in California were overweight (National Center for Health Statistics, 2002). In the same year, 20.4% of children ages 5 to 20 in San Diego county were overweight. The highest rates of overweight children in San Diego were American Indian/Alaskan Natives, Hispanics and Caucasians (National Center for Health Statistics, 2002). Surveillance from the California Department of Education found a high rate of overweight children in the district of Felicita and Lincoln Elementary schools. The rate was slightly higher than both San Diego County and the state of California. (Kao, Stone, Craypo, Adess, & Samuels, 2002). Research has demonstrated that physical activity plays an important factor in weight control (National Institute of Health, 2005). The percentages of students at Felicita and Lincoln passing the California physical fitness test is much lower than the state percentages. In California 67.4% of all of the students met the Healthy Fitness Zone for Body Composition in 2006 (California Department of Education, 2006a). Only 6% of fifth graders at Felicita Elementary School and 5% of fifth graders at Lincoln Elementary School met the Healthy Fitness Zone for Body Composition for the most recent testing period (School Accountability Report Card for School Year 2007-2008, 2009a, 2009b). The physical activity rates of both of the elementary schools are relatively low and may be a contributing factor to the high rates of overweight children.
PURPOSE OF THE STUDY

Overweight and obesity have become a public health concern and much attention has been given to the issue by researchers, communities, schools, government and faith-based organizations. Recommendations by the U.S. government to prevent obesity promote a model of community coalitions and partnerships to address overweight and obesity and combat the increasing rates among children (Khan et al., 2006). TODAY is a unique intervention aimed at addressing the overweight and obesity epidemic. It was developed by a community action council consisting of nurses, teachers, after-school providers, Health and Human Services county representatives, school representatives and community members. A sustainable partnership between the two schools and Palomar Pomerado Hospital (PPH) resulted from this collaboration. (Palomar Pomerado Health, 2010). Due to the collaboration, elementary schools throughout San Diego have been provided risk assessment screenings at their school sites, in-class nutrition and physical activity instruction, health assemblies, parent nutrition classes and have linked students to local clinics to access medical care.

The purpose of this study was to evaluate the impact of TODAY on the fifth grade students at two low-income, primarily Hispanic/Latino elementary schools in Escondido, California. The study design was a non-experimental pretest posttest. The data analysis assessed whether any changes occurred in the knowledge and behaviors of fifth grade students who participated in the intervention between baseline and follow-up. The study examined whether the intervention was differentially effective for males and females. Based on a review of the literature three hypotheses were tested:

**H1:** Fifth grade students who participated in the TODAY intervention will demonstrate healthy nutrition behaviors by increasing fruit and vegetable consumption and reducing soft-drink consumption.

**H2:** Fifth grade students who participated in TODAY will increase physical activity behavior and decrease sedentary behavior of screen (computer and television) time.

**H3:** Fifth grade students who participated in TODAY will have increased knowledge of nutrition and physical activities such as: how to read a nutrition label, proper serving sizes and recommended time for physical activity and television watching.

**H4:** There will be no significant differences between males vs. females or between weight classifications (unhealthy vs. healthy weight) for each variable in the intervention.
CHAPTER 2

LITERATURE REVIEW

INTRODUCTION

Overweight and obesity results from an imbalance between energy intake and energy expenditure (Daniels et al., 2005). Genetic and biological factors may influence individuals’ risk of overweight and obesity; however, increases of obesity prevalence among genetically stable populations indicate environmental and possibly other factors that contribute to the childhood obesity epidemic (Ebbeling, Pawlak, & Ludwig, 2002). The three primary risk factors for obesity, for people of all ages, are poor dietary habits, inadequate physical activity and a sedentary lifestyle (Gortmaker et al., 1999a). The combination of the three aforementioned risk factors and the influence of the environment have produced unparalleled rates of childhood obesity along with increases in type II diabetes among children in the United States (Ludwig & Ebbeling, 2001).

ETHNIC AND SOCIO-ECONOMIC DIFFERENCES IN OVERWEIGHT, OBESITY AND DIABETES RATES AMONG CHILDREN

While high rates of childhood obesity are prevalent among the general population; rates are even higher among ethnic minorities and low-income communities (Kumanyika & Grier, 2006). Overweight rates as high as 35% of the elementary school populations have been identified among low-income, urban, African American and Hispanic communities (Slusser, Cumberland, Browdy, Winham, & Neumann, 2005). Overweight status and the likelihood to be obese have been found to be more severe in Hispanic children than black or white children (Benson et al., 2009). Non-Hispanic black girls and Mexican-American boys have the fastest increases in overweight rates, with prevalence rates anticipated to reach 31.1% and 32.9%, respectively by 2015 (Wang & Beydoun, 2007).

The highest incidence rates of type II diabetes in youth ages 10-14 were found in American Indian (25.3%), followed by African American (22.3%), Asian/Pacific Islander (11.8%) and Hispanic (8.9%) (The Writing Group for the SEARCH for Diabetes in Youth...
Group Study, 2007). Minority pediatric populations who live in low-income regions have a higher risk of developing type II diabetes and have fewer resources available to them to deal with the disease. (Lieb et al., 2009). Due to the fact that children from poor families have an increased risk of diabetes, early detection and intervention programs are needed. (Trevino et al., 2008).

**DIET, PHYSICAL ACTIVITY, AND SEDENTARY BEHAVIOR AS RISK FACTORS FOR OVERWEIGHT AND OBESE STATUS IN CHILDREN**

The three contributing risk factors of diet, physical activity and sedentary behavior to overweight and obese status in children will be discussed in more detail in the following sections.

**Diet and Overweight and Obesity in Children**

Changes in diet that have contributed to the overweight and obesity epidemic include high caloric intake from nutritionally poor and energy dense foods, increased sugar sweetened drink consumption, larger portions, and intake of food from a location other than the home (Kaur, Hyder, & Poston, 2003). One way that diet quality is measured is by the Healthy Eating Index (HEI), which is a dietary assessment tool designed to measure the conformity of a diet to that of the 2005 Dietary Guidelines for Americans (Center for Nutrition Policy and Promotion, 2009). Higher scores for the component of saturated fat, sodium and extra calories from solid fats and added sugar indicate lower intake of calories from these types of foods. According to the HEI-2005, the scores for saturated fat, sodium, and extra calories were about fifty-percent lower than the maximum score for children ages 2-17, indicating high intake of these foods (Center for Nutrition Policy and Promotion, 2009). The Dietary Guidelines for Americans suggest that added sugar account for no more than 10% of the daily energy intake (USDA Home and Garden Bulletin, 2000); however, a study that examined the diets of American children and adolescents found that low-nutrient dense (LND) foods, such as visible fat; table sweeteners; candy and sweetened beverages; baked and dairy desserts; salty snacks and miscellaneous, accounted for more than 30% of daily energy (Kant, 2003).
The HEI-2005 also revealed that children’s diet were inadequate in dark green and orange vegetables and legumes. To identify the correlates of fruit and vegetable intake among children in the United States, a descriptive study assessed the quality of current intake compared to the dietary guidelines for Americans in US children and adolescents (Lorson, Melgar-Quinonez, & Taylor, 2009). The primary source of vegetable intake for children and adolescents was French fries, which accounted for more than 28% of vegetable intake (Lorson et al., 2009). The primary source of total fruit intake was 100% fruit juice. Among children ages 2 to 5, juice accounted for significantly more than 40% of fruit intake compared to children ages 6 to 11 year olds and 12 to 18 year olds (Lorson et al., 2009). The study also showed that as children age, they eat less fruits and vegetables. Six to eleven year old children were 2.7 more likely to not meet the recommended fruit intake guidelines and 1.5 more likely to not meet the vegetable intake guidelines compared to 2-to-5 year olds (Lorson et al., 2009).

Fruit and vegetable consumption among ethnic groups show inadequate intake among ethnic minorities. Mexican-American children were two-thirds less likely to eat adequate levels of fruit than non-Hispanic white children (Lorson et al., 2009). The disparity seen in ethnic minorities is also found in low-income children. Children who lived in households below 130% of the poverty-income ratio were 1.6 to 1.7 times more likely to not consume the recommended intake for fruit (Lorson et al., 2009). An evaluation of diet quality and weight status of children from low-income socioeconomic environments found that more than 75% of participants, ages 9 to 13, did not meet the recommended servings for grains, vegetables, dairy and fruit groups and the mean intake for each of these food groups were significantly lower than the recommendations (Langevin et al., 2007).

The increasing trend of over-consumption of nutritionally poor and energy dense foods parallels the trend of soda-consumption. A study observed increases in the consumption of soda with age; for instance, 50% of preschoolers, 64.1% of school-age children and 82.5% of adolescents consumed soft-drinks daily (Harnack, Stang, & Story, 1999). Soft drinks were found to take the place of milk and fruit consumption in the diets of children and adolescents, especially among those who consumed high levels of soft drinks (Harnack et al., 1999). One study found that for one extra daily serving of sugar-sweetened
drink consumed, there were increases in both BMI and frequency of obesity (Ludwig, Peterson & Gortmaker, 2001).

Furthermore, the amount of processed or fast food consumed has increased in the United States. For instance, over a twenty year period in the United States, energy consumption in the home decreased by 12% (Nielson & Popkin, 2003). One-third of the total daily calories consumed by youth in the US are foods that are prepared away from the home (Popkin, 2006a). During the period of 1994 to 1998, larger portion sizes for a majority of foods were found at fast-food chains (Nielson & Popkin, 2003). As a result of fast food consumption, there has been decreased diet quality and increased caloric consumption. One study found, that children, who ate at fast-food restaurants compared to those that did not, consumed 187 more calories, more energy per gram of food, more total carbohydrates, more added sugar, more sweetened beverages, less milk and fewer fruits and vegetables (Bowman, Gortmaker, Ebbeling, Periera, & Ludwig, 2004). Low income communities have higher exposure to fast food outlets (Smoyer-Tomic et al., 2008). Minority and low-income communities have fewer than average supermarkets and convenience stores that have fresh, good-quality, affordable foods compared to affluent communities (Morland, Wing, Roux, & Poole, 2002). The ethnic inequality of obesigenic environments was demonstrated in a study conducted in New York, which found a higher density of fast-food restaurants in mostly Black areas compared to mostly White areas (Kwate, YipYau, MengLoh, & Williams, 2008).

Physical Activity and Overweight and Obesity in Children

The physical activity recommendation for children is 60 minutes of moderate-to-vigorous physical activity every day of the week (Centers for Disease Control and Prevention, 2008b). The three types of physical activity recommended for children and adolescents ages 6 to 17 are aerobic, muscle training, and bone-strengthening (Centers for Disease Control and Prevention, 2008a). Physical activity helps to reduce blood pressure (Folsom et al., 1985), reduce risk for type II diabetes (Hu et al., 1999), heart disease (Morris, Glasg, Heady, Oxdia, & Raffle, 1953) stroke (Evenson et al., 1999) risk of osteoporosis (Skelton, 2009) and symptoms of depression and anxiety (Paluska & Schwenk, 2000). Adolescents who had higher physical activity levels and higher self-efficacy for healthier eating had lower BMI percentiles (Gamble, Parra, & Beech, 2009).
Physical activity levels have decreased and this could be attributed to factors such as the reduction of physical activity at schools, increased mechanization, fewer opportunities for walking and biking, increased opportunity for sedentary behavior among other factors (Kaur et al., 2003). Evidence suggests that less than 50% of children ages 6 to 11 are physically active for the recommended 60 minutes (Troiano et al., 2007). Children who do not do the recommended 60 minutes of physical activity are more likely to be overweight (Patrick et al., 2004).

Children from lower-socioeconomic status (SES) groups are less likely to attend schools that require physical education and are also less likely to participate in varsity or intramural sports or physical activity clubs, which places them at increased risk for becoming overweight or obese (Johnston, Delva, & O'Malley, 2007). Whites are more likely to be physically active than Blacks and Hispanics, and higher income families have reported higher levels of physical activity compared to lower-income families (Gordon-Larsen, McMurray, & Popkin, 2000; Pratt, Macera, & Blanton, 1999). The rates of children doing vigorous physical activity three or more times a week were highest among non-Hispanic white followed by Mexican-American and non-Hispanic black, for both males and females (Anderson, Crespo, Bartlett, Cheskin, & Pratt, 1998). Minority females have demonstrated the lowest levels of physical activity (Gordon-Larsen et al., 2000).

**Sedentary Behavior and Overweight and Obesity in Children**

Current prevalence estimates indicate that close to half of children in the United States ages 8 to 16 watch more than 2 hours of television a day (Crespo et al., 2001). Television watching along with other sedentary behaviors has been shown to be associated with decreased physical activity and increased eating and thus contribute to overweight and obesity (Epstein, Paluch, Gordy, & Dorn, 2000). Data from National Health and Nutrition Examination Survey (NHANES) III revealed that children who watched more than four hours of TV a day had a greater BMI and body fat-percentage compared to children who watched less than two hours a day (Anderson et al., 1998).

Close to 40% of children who had a TV set in their bedroom were more likely to be overweight and spent more time watching TV than children who did not have a TV in their bedroom (Dennison, Erb, & Jenkins, 2002). For every additional hour of television a day,
children are more likely to consume calories from energy-dense foods such as soft-drinks, fried foods and snacks (Wiecha et al., 2006). Low-income youth are more likely to have their own television sets and are more likely to watch the television while eating a meal, especially among Hispanics and African American populations (Kumanyika & Grier, 2006). Among Black and Hispanic children, evidence suggests higher levels of mean TV/video time compared to Whites (Crespo et al., 2001; Dennison et al., 2002; Woodard, 2000). The highest rates of children who watched more than five hours of television a day were found in non-Hispanic black children, followed by Mexican-American and non-Hispanic white children (Crespo et al., 2001).

All three factors: unhealthy diets, low levels of physical activity and sedentary behavior interact and result in rising rates of childhood obesity. The contributing dietary factors include consumption of high-fat foods (Center for Nutrition Policy and Promotion, 2009), inadequate intake of fruits and vegetables (Lorson et al., 2009), increased soft-drink consumption (Harnack et al., 1999) and eating from a location other than the home (Popkin, 2006b). Low levels of physical activity also lead to children becoming overweight or obese. Staggering statistics show that a majority of the children in the United States are not meeting the recommendations for physical activity (Troiano et al., 2007). In schools, levels of physical education have dropped by 14% from 1991 to 2003 (Lowry et al., 2004). As previously mentioned, there are fewer opportunities for children to participate in physical activity and more opportunities for children to participate in sedentary behavior (Kaur et al., 2003). Sedentary behavior includes television watching and playing video or computer games that involve minimal movement. The negative impact of television watching BMI and body fat percentage has been documented and illustrates the relationship between sedentary behavior and overweight and obesity in children (Anderson et al., 1998). The unhealthy lifestyles of children that lead to overweight and obesity also leads to complications and diseases associated with overweight and obesity.

**Medical Consequences of Overweight and Obesity in Children**

Overweight and obese children face immediate medical consequences as well as detrimental and disabling conditions that develop in the body over time. A short-term consequence of overweight/obesity is metabolic syndrome (also known as the insulin-
resistance syndrome), which is a collection of traits that include hyperinsulinemia, obesity, hypertension and hyperlipidemia (DeFronzo & Ferrannini, 1991). The prevalence of metabolic syndrome in the adolescent population is 4% overall, but is 30% to 50% in overweight children (Cook et al., 2003; Johnson et al., 2009). Overweight children have higher levels of fasting insulin, cholesterol concentration and blood pressure compared to normal-weight children (St-Onge, Keller, & Heymsfield, 2003). The Bogalusa Heart Study provides evidence that obesity during childhood and adolescence is a determinant of a number of cardiovascular risk factors including, atherogenic dyslipidemia (increased triglycerides, lowered high-density lipoprotein), hypertension, left ventricular hypertrophy, obstructive sleep apnea and atherosclerosis (Berenson, Srinivasan, Bao, & Newman, 1998). All-cause and cardiovascular mortality in adults has been associated with higher childhood BMI (Gunnell, Frankel, Nanchahal, Peters, & Davey-Smith, 1998). The pathological processes and associated risk factors for atherosclerosis cardiovascular disease, the leading cause of death in Western societies, begin in childhood (Steinberg & Daniels, 2003). Other complications of overweight and obesity include: respiratory difficulties; musculoskeletal problems; skin problems and infertility (Obesity, 2009).

**MEDICAL CONSEQUENCES OF TYPE II DIABETES IN CHILDREN**

Type II diabetes is often asymptomatic in its early stages and is reversible and potentially curable before beta-cell failure occurs (Ludwig & Ebbeling, 2001; Steinberg & Daniels, 2003). Previously known as an adult-onset disease, type II diabetes is now being observed in adolescents with a BMI greater than 30. A majority of children with type II diabetes are overweight or obese (Daniels et al., 2005; Steinberg & Daniels, 2003). Type II diabetes has also been associated with cardiovascular risk factors such as high blood pressure and hyperlipidemia (Steinberg & Daniels, 2003). A recent study of American Indian children found that childhood obesity and cardiovascular factors were strong predictors of premature death. The elevated blood sugar levels in the children of this study increased their frequency of death by seventy-three percent (Franks et al., 2010). Not only do overweight and obese children deal with physiological complications, they also face psychological and social consequences.
**Psychological and Social Consequences of Overweight and Obesity in Children**

Along with the medical burden of overweight and obesity, children also confront negative psychological and social stress at a young age. Goodman and Whitaker (2002) found that elevated BMI was related to depression in adolescents grades 7 to 12. Overweight children have fewer friends and according to social network mapping, seem to have more isolated and peripheral relationships (Daniels et al., 2005; Eisenberg et al., 2003). Weight-based teasing by peers and family members, which has been found to be pervasive among overweight individuals, has shown to be associated with low body satisfaction, low self-esteem, high depressive symptoms, and thinking about and attempting suicide (Eisenberg et al., 2003; Neumark-Sztainer, Story, & Faibisch, 1998). Overweight and obesity were found to come before low-self esteem among elementary school children (Hesketh, Wake, & Waters, 2004). Furthermore, obese adolescents with decreasing self-esteem are likely to state increased levels of loneliness, sadness, and nervousness and are more likely to smoke and drink alcohol (Strauss, 2000). Severely obese children and adolescents were found to have comparable physical, emotional, social and school functioning, to those having cancer and lower functioning than healthy children and adolescents (Schwimmer, Burwinkle, & Varni, 2003).

**Economic Consequences of Overweight and Obesity in Children**

If a child’s school absenteeism could be analogous to workdays missed by adults, overweight children would be at a disadvantage. Overweight children were found to be significantly more absent from school compared to their normal-weight peers (Geier et al., 2007). A study looking at childhood overweight and elementary school outcomes categorized three groups, ‘never overweight’, ‘became overweight’ and ‘always overweight’ and observed the children from kindergarten entry to the end of third grade (Datar & Sturm, 2006). Children who were placed in a ‘always overweight’ group were significantly more absent from school when compared to the other two groups, ‘never overweight’ and ‘became overweight’ (Datar & Sturm, 2006).

Health care cost disparities exist between normal weight and overweight children. Results of one study showed that the health care utilization of overweight and obese children
compared to normal/underweight children ages 6 to 19 differed greatly. An overweight child had $79 higher outpatient visit expenditures, $64 higher prescription drug expenditures, and $25 higher emergency room expenditures. Economic differences are even greater when comparing normal obese children to normal weight children, obese children had $194 higher outpatient visit expenditures, $114 higher prescription drug expenditures, and $12 higher emergency room expenditures (Trasande & Chatterjee, 2009). The economic consequences of overweight and obese children may be more pronounced due to their socioeconomic status. Children from low-income families are less likely to be insured, less likely to have a medical office visit or dental visit, less likely to have medicines prescribed and are more likely to have an emergency department visit compared to middle-income families (Simpson et al., 2005). Diabetes cost has also risen with the rising cost of the obesity epidemic. The estimated amount of health care expenditures due to diabetes is $91.8 billion (Simpson et al., 2005).

Prevention of overweight and obesity in children is needed in order to curtail the rising rates in the United States. Individually, children who are overweight or obese are at increased risk for health complications such as type II diabetes (Ludwig & Ebbeling, 2001; Steinberg & Daniels, 2003) and cardiovascular disorders (Steinberg & Daniels, 2003). Children also face negative psychological and social consequences that lead to further problems such as increased levels of loneliness, sadness, and nervousness and are more likely to smoke and drink alcohol (Strauss, 2000). The entire health system is impacted by overweight and obese children and health care costs increase for everyone in order to deal with the complications of overweight and obesity in children. Thus, prevention is needed in order to increase the quality of lives of children and sustain a healthy generation for the future.

**SCHOOL-BASED INTERVENTIONS**

Schools offer continuous and intensive contact with children; thus, provides an ideal setting for implementation of interventions (Brown & Summerbell, 2008). The majority of children, between the ages of five to seventeen, attend schools 180 days out of the year for six or more hours a day (Story, Kaphingst, & French, 2006). Physical activity can be promoted in the classroom, recess time, noncompetitive and competitive sports and
afterschool walking and running clubs (Peterson & Mary, 2007). Additionally, a considerable number of schools in the United States participate in the National School Lunch Program which offers breakfast, lunch and afterschool snacks (Food Assistance and Nutrition Research Program, 2002). In 2006-2007, federal legislation required that all schools that participate in the National School Lunch Program and the School Breakfast program implement a school wellness policy that includes: good nutrition education; physical activity and other school-based activities that promote student wellness and community involvement (Peterson & Mary, 2007). The CDC has identified eight components of the school settings that influence the students’ health: health education; physical education; health services; nutrition services; counseling, psychological and social services; healthy school environment; health promotion for staff and family and community involvement. When designing school based health programs; it is important for health professionals to consider the components identified by the CDC.

**APPlicable Theories From The Literature**

School-based interventions are often based on one or more theories and/or models. Commonly used theories are the Theory of Reasoned Action (TRA) (Montano & Kasprzyk, 2002), Health Belief Model (Janz, Champion, & Strecher, 2002), Social Ecological Model (Sallis & Owen, 2002) and the Social Cognitive Theory (SCT) (Baranowski, Perry, & Parcel, 2002). Developed in 1967, TRA was created to understand the relationship between beliefs (behavioral and normative), attitudes, intentions and behaviors (Montano & Kasprzyk, 2002). TRA asserts that behavioral intention is the most important determinant of behavior. A study conducted by Spiegel and Foulk demonstrated the use of TRA in a school-based intervention in which components involved journaling and class discussions which required students to confront their beliefs and attitudes towards healthy behavior. Attitude toward performing the behavior is a direct determinant and subjective norm is associated with the behavior (Montano & Kasprzyk, 2002). Underlying attitude is the individual beliefs about the outcomes or attributes of performing the behavior (Montano & Kasprzyk, 2002). The theory demonstrates a causal link between behavioral beliefs and normative beliefs to behavioral intention and behavior, through attitude and subjective norms (Montano & Kasprzyk, 2002).
The HBM is a framework used to guide health interventions as well as explain the change and maintenance of health-related behaviors (Janz et al., 2002). HBM is a value-expectancy theory that translates into: (1) the desire to avoid illness or to get well (value) and (2) the belief that a specific health action available to a person would prevent (or ameliorate) illness (expectation) (Janz et al., 2002). The components of the HBM are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy (Janz et al., 2002). Perceived susceptibility is the belief by an individual that they have a chance of getting a condition (Janz et al., 2002). A perceived benefit is the efficacy of the action to reduce risk, the action would have to be defined, described and clarified to the person. The barriers to accomplishing the behavior are known as perceived barriers (Janz et al., 2002). Cues to action, provide information, promote awareness and utilize reminders to participate in the behavior (Janz et al., 2002). In a school intervention, cues to action could include posters promoting a healthy diet and physical activity posted around the school. Lastly, self-efficacy is the confidence an individual has in his/her ability to take action (Janz et al., 2002). The long-term school based intervention; Lifestyle Improvements in the Family Environment (LIFE) integrated the HBM, intervention components included newsletter articles, poster contest, pedometers for teachers, family-based walking physical activities and cooking classes (Northup, Cottrell, & Wittberg, 2008).

Social Ecological Model highlights five levels of areas for prevention: intrapersonal factors, interpersonal processes and primary groups, institutional factors, community factors and public policy (Sallis & Owen, 2002). There are four guidelines for incorporating the social ecological model for health promotion. The first principle is that the environment is multidimensional linking physical, social, cultural elements that influence health outcomes (Stokols, 1996). The second core theme of the social ecological model is that human health is also influenced by genetics, psychological dispositions and behavioral patterns (Stokols, 1996). Third, the social ecological model acknowledges the relationship between the environment, multiple settings and life domains (Stokols, 1996). Lastly, the model is interdisciplinary, which requires multiple levels of analysis and diverse methodologies (Stokols, 1996). The Bienestar utilized the Social Ecological Theory and changed the physical context of the classroom, play ground, school cafeteria and home (Trevino et al., 2008).
The SCT depicts a reciprocal relationship between the environment, individual and behavior (Baranowski et al., 2002). The environment includes the social environment of friends, family, teachers and school staff and also includes the physical environment such as a classroom or school (Baranowski et al., 2002). Situation, is the person’s perception of the environment, perceptions can be real, distorted or imagined (Baranowski et al., 2002). The person must know the behavior and how to perform the behavior; this is termed behavioral capability (Baranowski et al., 2002). For example, Planet Health provided students with cognitive and behavioral skills to change their behavior and also increased the competence of the behavior among the students. The intervention also enhanced support in the classroom and by teachers (Gortmaker et al., 1999a). As a response to the behavior of the person, they receive positive reinforcement and increase the behavior. Outcome expectations are the anticipatory components of the behavior, in that people expect certain outcomes of the behavior before they partake in it (Baranowski et al., 2002). Outcome expectancies differ from outcome expectations; they are the values that a person places on a specific outcome (Baranowski et al., 2002). The confidence a person feels about doing the behavior, along with the confidence to overcome the behavior refers to self-efficacy (Baranowski et al., 2002). The Bienestar school-based diabetes mellitus prevention program utilized the Social Cognitive Theory and linked health knowledge and beliefs, utilized family, peers and teachers and targeted dietary intake and physical activity to change health outcomes (Trevino et al., 2008).

A theoretical framework for an intervention is necessary for effective behavior modification. The TODAY project did not utilize a specific theoretical framework to design the intervention. However, elements of SCT (Baranowski et al., 2002) and Social Ecological Model (Sallis & Owen, 2002) were present in the project. For instance, changes in the social environment were made, as staff and teachers were involved in teaching and modeling the health behaviors taught throughout the project. Students were also given the opportunity to gain confidence in their skills to live a healthy lifestyle from the lessons that were taught in class. Elements of the intervention that linked the outside community to the school were consistent with integrating the Social Ecological Model into the intervention.
SCHOOL-BASED SCREENINGS AND INTERVENTIONS

Health screenings in schools have focused on identifying and tracking overweight and obesity in children. The following section will discuss the methodology of BMI and diabetes screenings in the school setting.

Overweight, Obesity and Type II Diabetes Screenings in Elementary Schools

In 2006, 12 of the 52 states required schools or school districts to measure or assess students’ height and weight or body mass index. Of those states that conducted screenings, 72.7% required parent notification of the results (Brener, Wheeler, Wolfe, Vernon-Smiley, & Caldart-Olsom, 2007). Through the implementation of the Assembly Bill 265, California conducts surveillance in grades 5, 7 and 9 to assess the health and weight status of school-age youth (Nihiser et al., 2007). The primary goals of BMI screenings in schools are to: prevent and reduce obesity in the population; correct misperceptions of parents and children about the children’s weight; motivate parents and their children to make healthy and safe lifestyle changes, motivate parents to take at-risk children to medical care providers for further evaluation and, if needed, provide guidance and treatment and increase awareness of school administrators, teachers and other school staff of the importance of addressing obesity among students (Nihiser et al., 2007). BMI screening results are usually sent to the parents with their child’s personalized health information, an explanation of the results; recommended follow-up actions, if necessary; and information on healthy eating, physical activity and healthy weight management (Whitlock, Williams, Gold, Smith, & Shipman, 2005). An evaluation of student health report cards sent home found that among overweight children, parents from the intervention group were more likely to know their child’s weight status and planned medical help and physical activities for their overweight child (Chomitz, Collins, Kim, & Kramer, 2003).

Currently, there is limited evidence on conducting fasting glucose screenings in schools. However, the American Diabetes Association recommends the screening for type II diabetes mellitus in overweight children (BMI > 85th percentile for age and sex) who have 2 or more of the following risk factors: family history of diabetes in a first- or second-degree relative; American Indian, black, Hispanic, or Asian/Pacific Islander ethnicity or show signs of insulin resistance (hypertension, dyslipidemia, acanthosis nigricans, polycystic ovary
syndrome). Screening should be initiated at 10 years of age and subsequently every two years (American Diabetes Association, 2000).

Studies of anthropometric measurements in school-based interventions have produced mixed results. For instance, in one multidisciplinary school-based intervention, changes in BMI were observed in the student population. According the BMI measurements of this study, the intervention group demonstrated a 2% decrease in the number of youth who were overweight. (Spiegel & Foulk, 2006). In the same way, the Planet Health study, observed a decrease in the obesity prevalence in the intervention group (Wiecha et al., 2004). Similar results were also found in a school-based intervention that targeted television viewing, which showed statistically significant decreases in the BMI of the intervention group (Robinson, 1999). A trial study that implemented the Child Adolescent Trial for Cardiovascular Health (CATCH) approach along with community involvement in Travis County, Texas, found a considerable reduction in the overweight/obese prevalence of the school population (Hoelscher et al., 2010). The APPLE Project, a 2-year community based-obesity prevention initiative that targeted primary school children, utilized an activity coordinator to facilitate activity programs, involve parents and community members in providing basic nutrition education with a focus on reducing sugary drink intake and increasing fruit and vegetable intake. The goals of the project were to increase physical activity, increase fruit and vegetable intake and reduce intake of sugary drinks. The anthropometric measurements of height and weight were taken and BMI was calculated. At the two-year follow-up, the intervention participants sustained the initial reduction in adjusted BMI score (Taylor, et al., 2008). The school-based interventions, El Paso CATCH and Pathways were unable to demonstrate a decrease in prevalence of overweight and obesity. Two outcomes examined in the El Paso study were risk of overweight or overweight and body mass index (Coleman et al., 2005). The participants, 896 third grade students, 473 in the control schools and 423 in the El Paso CATCH intervention schools were 93% Hispanic (Coleman et al., 2005). The results of the El Paso CATCH study showed that in both the intervention and control groups, girls showed significant increases in risk for overweight or overweight between third and fifth grade; however, the rate of increase for El Paso CATCH was only 2% compared to 13% in the control group (Coleman et al., 2005). The rates of increase in boys were 1% in the El Paso CATCH and 9% in the control group. The objective of the Pathways intervention was to
reduce the percentage of body fat in American Indian school-children (Caballero et al., 2003). The intervention, which lasted three consecutive years, showed no significant differences between the control and intervention groups in weight, percent body fat, BMI, and triceps and sub scapular skin fold thickness (Caballero et al., 2003).

School-based studies have shown to be effective in reducing diabetes risk (Rosenbaum et al., 2007; Trevino et al., 2008). The primary outcome of the Bienestar study examined was fasting capillary glucose with secondary outcomes of percentage body fat, physical fitness level and dietary fiber and dietary saturated fat intake. The results of the Bienestar study showed significant differences in fasting capillary glucose levels, higher physical fitness levels and increased dietary fiber intake (Trevino et al., 2004). The Bienestar study was replicated to conduct a formative assessment of school-based diabetes risk prevention for African American children. The program, NEEMA, meaning wellness in Swahili, used the home, health class, physical education, school food service and after-school components of the Bienestar curriculum that had demonstrated success in the Mexican-American population (Shaw-Perry et al., 2007). School-based interventions have been able to reduce fat percentage from baseline and fasting capillary glucose, as seen in NEEMA. (Shaw-Perry et al., 2007).

**Dietary Intake**

Multiple studies have targeted dietary intake in school interventions and have observed increases in fruit, vegetable, and fiber consumption as well as decreases in daily energy intake, fat percentage and soft-drink consumption. (Caballero et al., 2003; Harrell et al., 2005; Speigel & Foulk, 2006, Trevino et al., 2004; Wiecha et al., 2004). A multidisciplinary school-based intervention done in four states (Delaware, Florida, Kansas and North Carolina) examined changes in consumption of fruits and vegetables and found positive results (Speigel & Foulk, 2006). Students filled out a 27-question survey responding to questions about their eating habits, physical activity, weight and other behaviors and attitudes (Speigel & Foulk, 2006). Teachers also collected data on student behavior in class and general health observations; such as what type of snacks and lunches the students ate. The intervention group showed a notable increase in fruit and vegetable consumption and physical activity. Students, teachers and parents reported changes in dietary habits both at
home and school (Speigel & Foulk, 2006). Planet Health, a randomized controlled field trial, sought to evaluate the impact of a school-based intervention on obesity among boys and girls in grades 6 to 8 (Wiecha et al., 2004). Over the course of the 2-year intervention, girls in the intervention group demonstrated a lower increase in estimated energy intake per day, compared to the control group. The girls in the intervention group also showed an increase in fruit and vegetable consumption (Wiecha et al., 2004). Bienestar, (well-being) Health Program, a randomized controlled trial assessed the impact of a school-based diabetes prevention program targeted towards low-income fourth grade Mexican-American students (Trevino et al., 2004). The program incorporated 50 sessions of health programming, reinforcement of behavior in the classroom, home, school cafeteria and after-school educational activities. Children were asked to set goals and encourage their peers and parents to practice 3 healthy behaviors. The results of the Bienestar study showed significant differences in increased dietary fiber intake between the control and comparison groups (Trevino et al., 2004). Pathways a school-based, randomized controlled trial, consisted of four components: classroom curriculum; food service; physical activity and family involvement (Caballero et al., 2003). The dietary intake was measured by direct observation; food intake was calculated by food left on the tray. At the end of the study, a single twenty-four hour dietary recall was performed with the 5th graders. Meal composition was analyzed by the Nutrition Data System at the University of Minnesota. The impact of the Pathways intervention on dietary intake showed significantly lower total daily energy intake and percentage of energy from total fat in the intervention group compared to the control group. This study found that in the intervention schools fewer calories and fewer calories from fat were served compared to the control group (Caballero et al., 2003). School-based interventions have been able to effectively reduce soft-drink consumption among children. (Harrell et al., 2005).

**Physical Activity**

Studies have examined the impact of school-based interventions on physical activity and have demonstrated mixed results. For instance, the Coordinated Approach to Child Health, formerly called Child Adolescent Trial for Cardiovascular Health (CATCH), utilized a multi-component school-based intervention that involved school food service, PE,
classroom curricula and family programs in California, Minnesota, Texas and Louisiana (Luepker et al., 1996). The intervention, a randomized control field trial, was done in twenty eight schools amongst third and fifth grade students. Researchers observed significantly higher levels of vigorous physical activity in the intervention group (Luepker et al., 1996). A study done in El Paso, Texas sought to replicate the national CATCH program to low-income elementary schools with a primarily Hispanic population and observed that CATCH schools had higher moderate-to-vigorous physical activity compared to control schools (Coleman, et al., 2005). Additionally, a multidisciplinary school-based intervention examined changes in physical activity and found positive results (Speigel & Fouk, 2006). The physical activity component of Planet Health focused on activity and inactivity themes, which included self-assessments, goal setting and evaluation of activity levels. However, there were no statistically significant differences in physical activity between the control and intervention groups in this study (Wiecha et al., 2004). The physical activity component of Pathways utilized a physical education (PE) program aimed at increasing energy expenditure in the school environment by at least 30 minutes sessions per week of moderate-to-vigorous physical activity (Caballero et al., 2003). Sports, Play and Activation Recreation for Kids (SPARK), supplemented by American Indian Games model served as the basis for the PE program. The physical activity outcome was measured by a self-reported activity questionnaire and a motion sensor. The Pathways intervention did not observe significant differences between control and intervention group in physical activity (Caballero et al., 2003). Since lower levels of physical activity may indicate increased levels of sedentary behaviors, school-based interventions have also targeted sedentary behavior.

**Sedentary Behavior**

Planet Health, measured sedentary behavior as an outcome and observed a reduction in television viewing time in both boys and girls in the intervention group (Wiecha et al., 2004). The ‘Switch-Play’ school-based intervention assessed the effectiveness of a school-based intervention on reducing sedentary behaviors and increasing skills in the enjoyment and participation of physical activity (Salmon et al., 2005). The ‘Switch-Play’ study was a cluster randomized trial that utilized a 2 X 2 factorial design that targeted 10 year old children. The components of the ‘Switch-Play’ intervention adopted components from Planet
Health and SPARK. The four schools were randomly allocated to one of four conditions: a behavioral modification condition (BM); fine motor skill condition (FMS); a combined BM/FMS; or a control/comparison condition (Salmon et al., 2005). The results of this study showed that the BM condition was able to reduce TV viewing by 20% and overall 72% of children in the BM and the BM/FMS group felt that the ‘Switch-Play’ lessons made a difference in the amount of television that they watched (Salmon et al., 2005). The ‘Switch Off—Get Active’ was a 16-week controlled health education intervention, the primary outcomes of this study were increases in physical activity, reduction of screen time and BMI in school children (Harrison, Burns, McGuinness, Heslin, & Murphy, 2006). The students received 10 lessons which focused on self-monitoring, budgeting of time and selective viewing (Harrison et al., 2006). The study concluded that the intervention was effective in increasing physical activity in school children; however, a longer follow-up would be needed to observe the intervention effects on BMI (Harrison et al., 2006). Along with, dietary intake, physical activity and sedentary behavior, health knowledge has been targeted in school-based interventions.

**Health Knowledge**

School-based interventions have been able to effectively increase health knowledge (Caballero et al., 2003; Harrell et al., 2005; Jan, Bellman, Barone, Jessen, & Arnold, 2009). Shape It Up: A school based education program that promoted healthy eating and exercise, based on the Social Cognitive Theory (Baranowski et al., 2002). The intervention delivered a 60 minute interactive workshop in school auditoriums and cafeterias and provided students with a booklet to the students to share with their family members (Jan et al., 2009). The study utilized a single-sample pre- and post-intervention design to evaluate the impact of the program on the knowledge and attitude towards exercise and healthy eating amongst the students. The Shape it Up study demonstrated increases in knowledge and attitude towards healthy eating and exercise among 6,421 participants (Jan et al., 2009). Pathways designed two-45 minute lessons delivered by the teachers of the course of 12 weeks to promote healthful eating behaviors and increase physical activity (Caballero et al., 2003). The classroom curriculum was made culturally relevant by linking the lessons of imaginary American Indian characteristics on their journey to healthy living. The intervention school
from Pathways also showed significant increase in knowledge, attitude and behavior compared to the control school (Caballero et al., 2003).

Increases in health knowledge have been demonstrated in school-based interventions (Harrell et al., 2005). One example is an intervention implemented among school children in rural Mississippi. The intervention was a result of a partnership between the school district and medical center. The multidisciplinary team of the medical center consisted of physicians, pharmacists, dietitians and exercise physiologist. The topics covered in the curriculum were related to a “heart healthy lifestyle” which integrated nutrition, physical activity, heart disease and diabetes. The primary outcome of the study was health knowledge of diet, physical activity, body weight, and cardiovascular health. The findings of this study showed a increase in the percentage of questions answered correctly (Harrell et al., 2005). The “Color My Pyramid” study a pilot project on nutrition education, conducted a pretest posttest quasi-experimental design and the results indicated a knowledge increase in the control group. The intervention utilized components of mypyramid.gov and the six classes were taught over a 3 month period to fourth and fifth grade students (Moore et al., 2009).

**Long-term School-Based Interventions**

Lifestyle Improvements in the Family Environment (LIFE) developed a continuous school-based heart-health screening and intervention had theoretical underpinnings of Social Cognitive Theory (Baranowski et al., 2002), Health Belief Model (Janz et al., 2002) and Stages of Change (Prochaska, Redding, & Evers, 2002). The objectives of this project were to identify cardiovascular risk in 5th graders and their families and to provide counseling, education services, and opportunities to change lifestyle routines that contribute to those risk factors. The awareness and knowledge tactics used in the first 3 years of the intervention incorporated school newsletter articles, poster contest, pedometers for teachers, family-based walking/physical activity programs and parent-child cooking and exercise classes. In addition to the previously stated tactics, the program added a nutrition newsletter, promotion of healthy party snacks and favors and a no-TV week in years 4-5. The LIFE project seeks to continue the program into the future and implement changes into the school infrastructure in years 6-7. Guiding principles from the LIFE project includes a screening focus emphasizing
health and risk factor concerns as related to health and a team approach within the school setting, with families and community partners (Northup et al., 2008).

The Kahnawake Schools Diabetes Prevention Project set out to reduce the prevalence of obesity in elementary school children. The main components of the intervention included: health education curriculum and community involvement. The health education curriculum was delivered to grades 1 through 6 and covered topics such as type II diabetes, healthy nutrition, physical activity, fitness and other healthy lifestyles. The community involvement consisted of participation of a local newspaper, radio, press coverage of events and contests, family activities, walking clubs and environmental policy change. The 8 year follow-up conducted in the Kahnawake project revealed that students had a significantly higher risk of having a higher BMI compared to baseline, physical activity and fitness levels increased in the middle years but then returned to baseline and television and video watching was reduced but improvements were lost. Significant decreases in high-sugar and high-fat foods; however, decreases in fruit and vegetable consumption were also observed (Harrell et al., 2005). The researchers of the Kahnawake project attributed the increase in adiposity to the increase in wealth of the overall community as well as to the increase of availability of fast food restaurants (Harrell et al., 2005).

The overwhelming rates of overweight and obesity in children requires prevention at many levels. The literature presents that the schools are a viable place to combat overweight and obesity in children. Few school-based interventions specifically target low-income, primarily Hispanic populations. As presented in the literature, low-income and Hispanic communities are among the highest risk groups for overweight, obesity and diabetes. The TODAY project was conducted in two school populations in low-income, Hispanic communities. Furthermore, the intervention involved outside community members, partnerships and agencies that supported the school in providing health screenings, in-class instruction and assemblies. The collaboration between a hospital, health and human service agency and others created and implemented this project, which has potential to continue into the future and link the school with outside community resources.
CHAPTER 3

STUDY DESIGN

TODAY, a school-based obesity and diabetes prevention program, utilized Body Mass Index (BMI) and diabetes screening and education components to educate 5th grade students about the benefits of adopting a healthy lifestyle. The BMI and glucose screening component of the intervention assessed the risk of the students. The two week in-class nutrition and physical activity curriculum was taught during school hours in the classrooms by trained Palomar Pomerado Health (PPH) staff. The classroom lessons used for the intervention were adapted from the PowerPlay curriculum created by Champions for Change Network for a Healthy California (Public Health Institute, 2006). The study design is a single-sample non-experimental pretest posttest examining changes in knowledge and behavior change among 5th grade students. The purpose of the study was to evaluate the impact of TODAY in increasing fruit and vegetable intake, physical activity and knowledge of a healthy lifestyle and decreasing soft-drink consumption and sedentary behavior among the students who participated in the project. The PPH Community Action Council designed the intervention so that the components of the TODAY project would be delivered to all 5th grade students at each school site; thus, random selection and random assignment were not possible.

SETTING & RECRUITMENT

PPH community action council and its collaborative partners identified diabetes and obesity as a health concern in the community of Escondido (Palomar Pomerado Health, 2010). Consequently, the PPH community action council of Escondido in partnership with Escondido School District, North County Health Services, Neighborhood Healthcare, County of San Diego Health and Human Services Agency, Bayer Pharmaceuticals and Network for a Healthy California, UCSD collaborated to develop TODAY. The objective of TODAY was to educate children, parents, teachers and the community about the risks associated with obesity, diabetes and cardiovascular disease and the benefits of adopting a healthy lifestyle.
PPH identified two low-income schools, Felicita and Lincoln in Escondido to implement TODAY. The two elementary schools were inherently similar based on age, ethnicity, SES and school district. The ethnic majority at both schools is Hispanic or Latino (Felicita at 93.61% and Lincoln at 88.72%) (School Accountability Report Card for School Year 2007-2008, 2009a, 2009b). Felicita and Lincoln elementary school both have high percentages of students who are socioeconomically disadvantaged and are English learners (California Department of Education, 2006a, b). English learners are students who report a primary language other than English and have been determined to lack the clearly defined English language skills of listening comprehension, speaking, reading and writing necessary to succeed in the school’s regular instructional programs (California Department of Education, 2006b). Eighty-four percent of students at Felicita Elementary and ninety-one percent of students at Lincoln Elementary school participate in the free or reduced price meal program (City Data, 2010). Principals, were asked to participate, and then volunteered their schools to participate in TODAY. All students enrolled in fifth grade were recruited to participate in the project. Students were required to return a signed parental permission form in order to participate in the screening component of the intervention. Prior to each child doing the screening, a PPH staff member described the screening and the child was given the opportunity not to participate in the screening if they felt uncomfortable with the process at any point of the screening. For the in-class instruction, PPH staff explained to the students that participation was voluntary and children verbally assented to participate. All 5th grade students participated in the intervention.

**PROCEDURES**

The pretest questionnaire was distributed to the students prior to the delivery of the first lesson. PPH staff was present to explain the project to the children and inform the children that participation in the project was voluntary along with clarifying and answering questions on the questionnaires. All questionnaires were all filled out in English. The students for each school site were given the pretest questionnaire on the same day. Posttests were administered to the students after the completion of the final lesson. The time between the pretest and posttest was two weeks.
The questionnaire used for TODAY was adapted from The School Physical Activity and Nutrition Questionnaire (SPAN) (Coordinated Approach to Child Health, 2004) designed by the Coordinated Approach to Child Health (CATCH). SPAN was created to assess the nutrition and physical activity behaviors, attitudes and knowledge among 4th, 8th and 11th grade students. The questionnaire was validated for reproducibility and validity (Thiagarajah et al., 2008). SPAN is a self-administered questionnaire and does not ask any sensitive questions and has previously been used for Robert Wood Johnson Foundation Projects, CATCH and SPAN 2002 and 2004. The TODAY questionnaire asked for first and last name and race/ethnicity identification. The name of the student was collected in order to link information of age and gender to each participant from a school database. Student data was then de-identified and placed in a separate file from the data entered in for analysis.

To test the first hypothesis (H1) that fifth grade students who participated in TODAY will increase fruit and vegetable consumption and reduce soft-drink consumption, two questions pertaining to fruit and vegetable intake and one question for soda intake was asked. Images of serving sizes were shown on the questionnaire for each question that asked about serving size. Q1, prompt asked, “In a typical day, how many servings of fruit do you eat?” Possible responses for this question ranged from 0 to 4 or more and were likewise coded: 0= “0 servings”, 1= “1 serving”, 2= “2 servings”, 3 = “3 servings” and 4= “4 or more servings. Q2 asked, “In a typical day, how many servings of vegetables do you eat?” Possible responses for Q2 were the same as Q1. A higher score on the fruit and vegetable questions represented greater consumption of fruits and vegetables. Consequently, a higher score on Q1 and Q2 represented a positive change in healthy nutrition behavior. Q3 inquired about soda consumption and stated, “In a typical day, how many sodas do you drink? A soda is a 12 ounce can of Coke, Pepsi, Sprite, etc”. Responses for Q3 were coded: 0= “0 servings”, 1= “1 serving”, 2= “2 servings”, 3 = “3 servings” and 4= “4 or more servings” and responses were reverse coded for analysis. Q3 was reverse coded so that a higher score indicated lower soft-drink consumption; thus, demonstrate a healthy behavior change (see Appendix A).

To test the second hypothesis (H2) that fifth grade students who participated in TODAY will increase physical activity behavior and decrease sedentary behavior of screen time, two questions were asked to assess sedentary behavior and physical activity. To assess sedentary behavior, Q4 inquired, “In a typical day, how many hours per a day do you usually
spend watching TV, playing video games, surfing the internet and instant messaging?”

Possible responses for Q4 were 0, 1, 2 to 3, 4 to 5 and 6 or more hours and responses were coded, 0 = “0”; 1 = “1”; 2 = “2 to 3”; 3 = “4 to 5” and 4 = “6 or more hours”. For data analysis, Q4 responses were reverse coded so that a higher response score indicated a reduced amount of hours of sedentary behavior and therefore represent a reduction in the amount of “screen time”. To measure changes in physical activity, Q5 asked, “How many days a week in the past week did you play actively or do physical activity for 60 minutes or more?”

Responses to this question were: 0 = “0 days”, 1 = “1 day”, 2 = “2 or 3 days”, 3 = “almost every day” and 4 = “everyday” (See Appendix A).

Five knowledge questions were asked to assess changes in knowledge among the children and test the third hypothesis. The third hypothesis (H3) stated that 5th grade students who participated in the TODAY project will increase their knowledge of nutrition and physical activity concepts. The following question is an example of one of the questions asked, “According to the nutrition label on the right, how many grams of saturated fat are there?” All the responses had one correct response and one to three incorrect responses. The responses were coded as 1 = “correct response” and 0 = “incorrect response”. A higher mean score on knowledge indicated a higher number of questions answered correctly concerning nutrition and physical activity concepts (see Appendix A).

**INTERVENTION**

The components of TODAY included (1) BMI and glucose screening to identify students at risk for overweight/obesity and diabetes, (2) educating students and their families regarding healthy lifestyle habits including eating and physical activity and (3) providing community resources to access medical care and low-cost or no cost health coverage. The first component of the intervention was to assess the risk of the students, by a BMI and glucose screening. The consent and release forms for the students to participate in the BMI and fasting glucose screening were sent home and all 5th grade students and their parents received an auto-dial reminder to return consent forms and to remind their child not to eat breakfast, in order to obtain a fasting glucose. The morning of the screening nurses administered the glucose test. The students lined up and staff re-checked the consent form. After the consent form was checked, height and weight measurements of each student were
taken. Height, weight and waist measurements were done privately, to ensure confidentiality. The students then proceeded to take the fasting glucose test, administered by a school and PPH nurses. The student then proceeded to the data station, where they turned in their results form. Height and weight were entered into the EZBMI software (School Health, 2009) and a BMI and BMI percentile were calculated for each student. The gender and age of each student was provided by the school and were entered into the database prior to the screening. All of the students in the class received free breakfast provided by the school. Results letter were sent home to each student that included all measurements that were taken on the day of the screening. A health flier accompanied the results letter that described the TODAY project. (See Appendix B). The health flier gave a description of BMI and risks for overweight and obese children and provided tips for living a healthy lifestyle. Both the result letter and health flier were translated into Spanish. For the students who had normal results for BMI and glucose, a results letter was sent home and the parents were not contacted for follow-up. If either the BMI or glucose fell in an abnormal range, a section was marked that recommended that the parents pursue follow-up with their medical provider. Parents of students who were identified as having either an elevated BMI percentile or glucose level were contacted to investigate the follow-up action that they had taken for receiving the health report from their child’s school. Parents were again contacted at two months to check on what follow-up action they had taken for their child.

A one-time parent education class was offered to all of the parents of the 5th grade students at each school site. The class was taught by a bilingual registered dietitian who taught the parents how to read nutrition labels and information on healthy snacks for their children. The parents were instructed to add more vegetables and use less fat and oil when cooking. Parents were also taught how to increase physical activity with their children. Only forty-seven (approximately 30%) parents from both schools attended the optional parent education class that was offered at the school sites.

The classroom intervention took place from May 5th to May 20th 2009. During this time, five 30-minute lessons were taught during school time in the classroom. Lessons were delivered twice during the first week and three times during the second week. The lessons were taught in the classrooms at the schools, during regular school time. The first lesson focused on limiting TV and video watching time and instead increasing physical activity.
Students shared physical activities that they could do instead of watching TV or playing video games. All of the students and their classroom teachers were given pedometers along with a “student passport” to track the number of steps they took each day. The students were instructed on how to use the pedometer, read the number of steps and how to reset it daily. For practice, the students placed the pedometer on their right hip and walked around the classroom and shared the number of steps that they took with their classmates.

The second classroom lesson focused on the daily recommended time for doing physical activity and the servings of fruits and vegetables for a child. The children were taught the difference between moderate and vigorous physical activity and asked to give an example of moderate and physical activity that they could participate in. The students were taught the recommended daily amount of fruits and vegetable servings they should eat and how to measure 1 cup of fresh, canned or frozen fruit or vegetables with their hands. After learning the new skill, students demonstrated the new skill to their fellow classmates.

The students learned how to read nutrition labels during the third lesson. The students were asked to estimate how many calories were in a bag of chips, a fruit roll-up and an orange. Students were then shown the actual number of calories present in each food item. Using percentages and fractions, the students calculated percentages from different nutrition labels. Fifth grade mathematical concepts were integrated into the lesson plan. The students were explained the importance of knowing how to read nutrition labels and how understanding the labels could help them make better nutrition decisions.

The fourth lesson reviewed the healthy lifestyle habits introduced from the earlier lessons. The focus of the fourth lesson was to assess the students’ ability to share the concepts and lessons that they learned in the intervention with their family and friends. The students reviewed sections of their workbook that covered: the importance of fiber, limiting fat and sugar, the importance of vitamins and minerals found in fruits and vegetables and the significance of sixty minutes of physical activity. Students were divided into groups and each group then presented a health-related topic from the workbook to the rest of the class. The last lesson was a “food critic” lesson, in which the children tasted various fruits and vegetables and rated if they liked the food or not.

Additionally, students were given a workbook for additional health activities and worksheets pertaining to health-related topics. The workbook included a worksheet called a
“Power Survey” that required students to survey each other about health topics such as fruit or vegetable intake and physical activity. The “Power Scramble” worksheet had a list of 15 rearranged words and the student had to match the scrambled word to one of the fruits or vegetables listed on the word list. Classrooms could do “The Power of Advertising” and “Creating Your Power Ad”, which allowed students to create advertisement on one of the topics that they learned and present their concept to an audience in a marketing format on their own time.

The final component of the intervention was a school-wide assembly at each school site, which took place after the classroom component. Ladanian Tomlinson, a professional football player for the San Diego Chargers, went to each school to speak about his personal experience with people in his life who have dealt with the consequences of obesity and diabetes. Tomlinson is a well-respected and popular athlete and was able to encourage the students to lead healthy lifestyles. He motivated the students to set “healthy goals” and each student signed a declaration of health. The declaration of health, also signed by Ladanian Tomlinson, read, “I will exercise every day to be strong, alert and ready for any challenge”, “I will eat healthy foods every day to give my body what it needs to grow” and “I will encourage others to do the same for all of us to be healthy, strong and active kids.”

**Statistical Analyses**

Completed survey forms were filed in locked cabinets and only authorized personal had access to them. The data was coded and given a unique identification number. The files that matched the names of individual participants to their code on the data set were filed separately from the data set that was used for analysis. All data analyses were conducted using Statistical Package for the Social Sciences (SPSS) version 17.0 (SPSS, Inc, Chicago, IL, 2009). After all the data had been entered, thirty-percent of the entries were randomly selected and checked against their hard copy for reliability and completeness. Missing or incomplete pretest or posttest data were not entered into SPSS for analysis. Data were analyzed using descriptive statistics and non-parametric statistical tests. To assess changes from pretest to posttest, Wilcoxon signed-rank tests were run on questions for fruit and vegetable intake, soda consumption, physical activity, sedentary behavior and knowledge for the entire sample. In order to assess differential effects of the intervention between males and
females versus between ‘healthy’ weight versus ‘unhealthy’ weight children, Wilcoxon rank-sum tests were conducted on pretest-to-posttest change scores. Due to the small sample size, statistical analysis between children with normal glucose levels compared to children who had elevated glucose levels was not conducted.
CHAPTER 4

RESULTS

PARTICIPANTS

One-hundred and eighty five 5th grade students were screened for BMI percentile and one-hundred and seventy eight students were screened for fasting glucose in March 2009. A student was not screened for glucose if their parent did not sign the section that authorized nurses to take glucose measurements. One hundred and twenty three completed the pretest and posttest. If a student was absent on the day of the pretest or posttest or did not completely fill out the questionnaire they were not included in the data analysis. Sixty questionnaires were omitted from analysis due to absent or incomplete pretest or posttest, resulting in a total of 123 matched pretests and posttests being analyzed. The average age of the 5th grade participants was 10.9 years (SD=.38), 53.7% were males and 46.3% were females (see Table 1). The ethnic breakdown included 0.7% American Indian or Native American, 2.2% Asian, 2.9% African American, 2.2% White Caucasian, 87.6 % Latino and Hispanic and 4.4% other (see Table 1). According to the BMI percentile screening, 1.6% of participants were underweight, 61.0% were a healthy weight, 13.8% were overweight and 23.6% were obese. The glucose results showed that 1.6% of students had low blood sugar levels (less than 70), 82.9% had normal blood sugar levels (70 to 100) and 15.4% who had elevated blood sugar levels (more than 100) (see Table 1).

INTERVENTION EFFECTS OF TODAY

The following paragraphs will discuss the results of each variable studied: food intake, physical activity, sedentary behavior and knowledge.

Pretest to Posttest Analysis of Food Intake

To test the first study hypothesis, Wilcoxon signed-rank tests were conducted to identify significant differences between pretest and posttest scores in the entire sample. The mean pretest score for fruit intake was 2.70 (SD = 1.03) and the mean posttest fruit intake score was 2.94 (SD=.91) (see Table 2). A higher score represented higher fruit consumption.
Table 1. Child Demographic Characteristics, Weight and Glucose Classification

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean/Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong> (SD)</td>
<td>10.9 years (SD=.38)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>53.7% (66)</td>
</tr>
<tr>
<td>Females</td>
<td>46.3% (57)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>American Indian or Native American</td>
<td>.7% (1)</td>
</tr>
<tr>
<td>Asian</td>
<td>2.2% (3)</td>
</tr>
<tr>
<td>African American</td>
<td>2.9% (4)</td>
</tr>
<tr>
<td>White Caucasian</td>
<td>2.2% (3)</td>
</tr>
<tr>
<td>Latino and Hispanic</td>
<td>87.6% (107)</td>
</tr>
<tr>
<td>Other</td>
<td>4.4% (5)</td>
</tr>
<tr>
<td><strong>Weight Classification</strong></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>1.6% (2)</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>61.1% (75)</td>
</tr>
<tr>
<td>Overweight</td>
<td>13.8% (17)</td>
</tr>
<tr>
<td>Obese</td>
<td>23.6% (29)</td>
</tr>
<tr>
<td><strong>Glucose classification</strong></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.6% (2)</td>
</tr>
<tr>
<td>Normal</td>
<td>82.9% (102)</td>
</tr>
<tr>
<td>Elevated</td>
<td>15.4% (19)</td>
</tr>
</tbody>
</table>

The change in fruit consumption was significant (p < .01). Likewise, there was a significant change in vegetable consumption (p<.05). The mean pretest score for vegetable consumption was 2.34 (SD=1.09) and the mean posttest score was 2.55 (SD= 1.07). There were no significant change in soda consumption (p=.596). The mean pretest score for soda consumption was 2.80 (SD= 1.07) and the mean posttest score was 2.85 (SD=1.05). To examine possible gender differences from pretest to posttest, Wilcoxon rank-sum tests were performed. There were no significant differences between males and females in pretest-to-posttest changes in mean scores for fruit (p= .786), vegetable (p= .271) and soda.
Table 2. Comparison of Pretest and Posttest Scores for Food Intake, Physical Activity, Sedentary Behavior and Knowledge using Wilcoxon Signed-Rank Test

<table>
<thead>
<tr>
<th></th>
<th>Pretest Mean (SD)</th>
<th>Posttest Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Intake: Fruit Consumption</strong>&lt;sub&gt;1&lt;/sub&gt;</td>
<td>2.70 (1.03)</td>
<td>2.94 (.91)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td><strong>Food Intake: Vegetable Consumption</strong>&lt;sub&gt;2&lt;/sub&gt;</td>
<td>2.34 (1.09)</td>
<td>2.55 (1.07)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td><strong>Food Intake: Soda Consumption</strong>&lt;sub&gt;3&lt;/sub&gt;</td>
<td>2.80 (1.07)</td>
<td>2.85 (1.05)</td>
<td>.596</td>
</tr>
<tr>
<td><strong>Physical Activity</strong>&lt;sub&gt;4&lt;/sub&gt;</td>
<td>2.85 (1.06)</td>
<td>3.13 (.90)</td>
<td>.006</td>
</tr>
<tr>
<td><strong>Sedentary Behaviors</strong>&lt;sub&gt;5&lt;/sub&gt;</td>
<td>2.19 (.83)</td>
<td>2.30 (.80)</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Knowledge</strong>&lt;sub&gt;6&lt;/sub&gt;</td>
<td>.63 (.25)</td>
<td>.76 (.24)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

1. Fruit Consumption (Q1); 2. Vegetable Consumption (Q2); 3. Soda Consumption (Q3); 4. Physical Activity (Q5); 5. Sedentary Behavior (Q6); Knowledge (Q13-Q17)

consumption (p=.923) (See Table 3). Wilcoxon rank-sum tests were also conducted to examine differences in fruit, vegetable and soda consumption, physical activity and sedentary behavior between “unhealthy weight” children (children with a BMI of underweight, overweight or obese) and “healthy weight” children. There were no significant differences between the two groups in all the variables. (see Table 4).

**Pretest to Posttest Analysis of Physical Activity and Sedentary Behavior**

Significant changes were observed in physical activity from pretest to posttest in the entire sample (p ≤ .01); however, there were no significant changes observed in sedentary behavior (p=1.00) (see Table 2). The mean pretest score for physical activity was 2.85 (SD=1.06) and the mean posttest score for physical activity was 3.13 (SD=.90). The mean pretest score for sedentary behavior was 2.19 (SD=.83) and the mean posttest score was 2.30 (SD=.80). Wilcoxon rank-sum tests were conducted to find if there were any differences in
Table 3. Analysis By Gender of Pretest to Posttest Change Scores for Food Intake, Physical Activity, Sedentary Behavior and Knowledge using Wilcoxon Rank-Sum Test

<table>
<thead>
<tr>
<th></th>
<th>Males Change Score Mean (SD)</th>
<th>Females Change Score Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Intake:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit Consumption₁</td>
<td>.20 (.99)</td>
<td>.28 (.96)</td>
<td>.786</td>
</tr>
<tr>
<td>Vegetable Consumption₂</td>
<td>.32 (1.07)</td>
<td>.09 (1.04)</td>
<td>.271</td>
</tr>
<tr>
<td>Soda Consumption₃</td>
<td>.06 (.86)</td>
<td>.04 (.78)</td>
<td>.923</td>
</tr>
<tr>
<td><strong>Physical Activity₄</strong></td>
<td>.09 (1.25)</td>
<td>.35 (.95)</td>
<td>.114</td>
</tr>
<tr>
<td><strong>Sedentary Behavior₅</strong></td>
<td>.11 (1.02)</td>
<td>.09 (.72)</td>
<td>.899</td>
</tr>
<tr>
<td><strong>Knowledge₆</strong></td>
<td>.16 (.28)</td>
<td>.12 (.25)</td>
<td>.546</td>
</tr>
</tbody>
</table>

1. Fruit Consumption (Q1); 2. Vegetable Consumption (Q2); 3. Soda Consumption (Q3); 4. Physical Activity (Q5); 5. Sedentary Behavior (Q6); Knowledge (Q13-Q17)

Pretest-to-posttest change scores between males and females. There were no significant differences between males and females for physical activity (p=.114) or sedentary behavior (p=.899) (see Table 3). No significant differences were observed in the pretest-to-posttest change scores of “unhealthy weight” and “healthy weight” children for physical activity (p=.434) and sedentary behavior (p=.896) (see Table 4).

**Pretest to Posttest Analysis of Knowledge**

A Wilcoxon signed-rank test was conducted to assess changes in knowledge in the entire sample. Significant changes in knowledge were observed (p<.001) (see Table 2). The mean pretest knowledge score was .63 (SD=.25); the mean posttest knowledge score was .76 (SD=.24). A higher score indicated a higher number of questions answered correctly. To examine differences between genders, a Wilcoxon rank-sum test was conducted. No significant differences were observed between males and females in pretest-to-posttest knowledge change scores (p=.546) (see Table 3). No significant differences were observed
Table 4. Analysis by ‘Healthy Weight’ and ‘Unhealthy Weight’ of Pretest-to-Posttest Change Scores for Food Intake, Physical Activity, Sedentary Behavior and Knowledge Using Wilcoxon Rank-Sumtest

<table>
<thead>
<tr>
<th></th>
<th>Healthy Weight Score Mean (SD)</th>
<th>Unhealthy Weight Score Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Intake: Fruit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption&lt;sub&gt;1&lt;/sub&gt;</td>
<td>.28 (1.05)</td>
<td>.15 (.84)</td>
<td>.558</td>
</tr>
<tr>
<td><strong>Food Intake: Vegetable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption&lt;sub&gt;2&lt;/sub&gt;</td>
<td>.33 (1.00)</td>
<td>.04 (1.13)</td>
<td>.107</td>
</tr>
<tr>
<td><strong>Food Intake: Soda</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption&lt;sub&gt;3&lt;/sub&gt;</td>
<td>.04 (.72)</td>
<td>.11 (.85)</td>
<td>.742</td>
</tr>
<tr>
<td><strong>Physical Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.27 (1.12)</td>
<td>.07 (1.12)</td>
<td>.434</td>
</tr>
<tr>
<td><strong>Sedentary Behavior</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.12 (.97)</td>
<td>.09 (.76)</td>
<td>.896</td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.12 (.20)</td>
<td>.19 (.34)</td>
<td>.168</td>
</tr>
</tbody>
</table>

1. Fruit Consumption (Q1); 2. Vegetable Consumption (Q2); 3. Soda Consumption (Q3); 4. Physical Activity (Q5); 5. Sedentary Behavior (Q6); Knowledge (Q13-Q17)

between “unhealthy weight” and “healthy weight” children in pretest-to-posttest knowledge change scores (p=.168) (see Table 4).
CHAPTER 5

DISCUSSION AND CONCLUSIONS

This study focused on the changes in nutrition, physical activity, sedentary behavior and knowledge of fifth grade students in two low-income, predominantly Hispanic/Latino elementary schools. The study addressed the following questions: (1) did the children in the TODAY project increase fruit and vegetable consumption (2) decrease soda consumption, (3) increase frequency of physical activity (4) decrease frequency of sedentary behavior and (5) increase knowledge of nutrition and physical activity concepts. The questions were answered through the use of a pretest and posttest self-administered student questionnaire. The results of this study are consistent with previously published studies of school-based interventions. The TODAY study adds to the current literature of school-based interventions that focuses on obesity prevention studies. As the rise in overweight and obesity, particularly among the minority low-income pediatric population, takes place it is essential to create and implement effective prevention programs in schools. This final chapter will draw conclusions about the impact of this school-based intervention, analyze the limitations of the study and provide recommendations for future programs that could potentially reduce the prevalence of childhood overweight, obesity and diabetes.

NUTRITION

Healthy weight management and lower BMI measures have been associated with increased fruit and vegetable consumption (Lin & Morrison, 2003; McCrory et al., 1999; Rolls, Ello-Martin, & Tohill, 2004). Several school-based intervention studies have shown effective and successful ways to change nutrition habits in children by increasing fruit and vegetable consumption, increasing fiber and decreasing total energy and fat intake (Caballero et al., 2003; Harrell et al., 2005; Speigel & Foulk, 2006; Trevino et al., 2004; Wiecha et al., 2004). For instance, the Bienestar study demonstrated increases in dietary fiber (p=.009) (Trevino et al., 2004). Significant reductions in percent of energy from fat were observed in the Pathways study, which was conducted over the course of 3 years, from 3rd to
5th grade. At follow-up the mean total of kilocalories/day (kcal/d) was 1892 compared to 2157 at baseline (Caballero et al., 2003). Changes in total fat consumption were observed, at follow-up total fat accounted for 31.1% compared to 33.6% at baseline (Caballero et al., 2003). Significant changes in diet and knowledge were observed in the Pathways study (Caballero et al., 2003). Pre-to-post changes in diet were demonstrated in a fifth grade sample in rural Mississippi (Harrell et al., 2005). No significant changes in fruit consumption were detected; however, there were significant decreases in soft-drink consumption among the intervention group (Harrell et al., 2005). Various methods of data collection, such as questionnaires, teacher collected data and observations and calculations of food left on trays, have been used for tracking the dietary changes that occurred in participants of the school based interventions (Caballero et al., 2003; Spiegal & Foulk, 2006).

The child-reported scores for the nutrition variables showed a significant increase in consumption of fruits and vegetables among children who participated in the TODAY project. The classroom component of the TODAY project heavily emphasized fruit and vegetable consumption and provided practical instruction to students on how to consume the recommended amounts of daily fruits and vegetables. The classroom lessons included interactive activities which allowed the students to participate in the process of learning methods to increase fruit and vegetable consumption and then teaching and reinforcing the information to their peers. The results of this study are consistent with several other school-based studies that targeted overweight and obesity by increasing fruit and vegetable consumption (Gortmaker et al., 1999a, 1999b, Spiegal & Foulk, 2006). Spiegal and Foulk were able to observe notable increase in fruits and vegetables as they sought to reduce overweight prevalence through a multidisciplinary school-based intervention. The Planet Health study also observed increased fruit and vegetable consumption in the intervention group compared to the control group (Gortmaker et al., 1999a). In the Planet Health study, the intervention group ate 0.32 (p=.003) more servings of fruits and vegetables a day compared to the control group (Gortmaker et al., 1999a). One school-based intervention that effectively increased health knowledge of cardiovascular risk factors, also observed decreases in the amount of soft-drink consumed among school children in rural Mississippi (Harrell et al., 2005). However, in the TODAY project there were no significant changes in soda consumption.
PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR

The benefits of physical activity include: lower levels of depression (Jerstad, Boutelle, Ness, & Stice, 2010) higher attendance levels at school (Datar & Sturm, 2006), and reduces the risk of heart disease (Morris et al., 1953), risk of stroke, (Evenson et al., 1999) and diabetes and high blood pressure (Field, Diego, & Sanders, 2001; Spiegel & Foulk, 2006). Physical activity is also directly related to body weight and BMI (Spiegel & Foulk, 2006). The literature presents evidence of school-based interventions increasing levels of physical activity among school children (Coleman et al., 2005; Luepker et al., 1996; Spiegel & Foulk, 2006) as well as decreasing sedentary behavior (Gortmaker et al., 1999a).

Increases in physical activity were demonstrated in the NEEMA Project (Shaw-Perry et al., 2007). Reduction in sedentary behavior among school children has also been observed (Salmon et al., 2005). Among a sample of 58 African-American participants in fourth grade, physical activity was measured by a 20-meter shuttle run test (20-MST). The laps ran for the 20-MST increased from 16.40 (SD=9.98) at baseline to 23.73 (SD=14.79) at follow-up (Shaw-Perry et al., 2007).

The children in the TODAY project showed significant increases in physical activity. Physical activity and sedentary behavior were heavily addressed in the classroom lesson intervention and were also addressed by professional athlete, Ladanian Tomlinson at the school-wide assembly. The students were able to brainstorm ideas on how to decrease their sedentary behavior and instead do physical activity. Students were given pedometers to increase their “steps” and tracked their steps over the course of the intervention. To further emphasize doing sixty minutes of physical activity and the associated health benefits, the students taught their peers the concepts from the health lessons. Studies that have shown significant changes in physical activity include NEEMA (Shaw-Perry et al., 2007) and Bienestar (Trevino et al., 2004). The physical activity measured in the NEEMA project, showed a positive preliminary impact, measured by increases in the number of fitness laps (Shaw-Perry et al., 2007). Fitness scores of the intervention group significantly increased and decreased in the control group in the Bienestar study (Trevino et al., 2004). Planet Health, Switch Play, Switch Off-Get Active are examples of studies that have targeted sedentary behavior in school intervention programs (Harrison et al., 2006; Salmon et al., 2005; Wiecha et al., 2004) and have documented significant reductions in sedentary behavior such as screen
time. In the ‘Switch Off-Get Active’ study, participants in the intervention group increased physical activity levels and reduction in screen time (Harrison et al., 2006). Evidence suggests that school-based intereventions have been effective in decreasing sedentary behavior, yet sedentary behavior in the children involved in the TODAY project was not significantly reduced.

**Knowledge**

Consistent with previously published studies on health knowledge (Caballero et al., 2003; Harrell et al., 2005; Jan et al., 2009), the children in the TODAY project demonstrated an increase in health knowledge. Both Pathways and Shape it Up were able to demonstrate significant increases in health knowledge (Caballero et al., 2003; Jan et al., 2009). Pathway demonstrated increases in health knowledge, the average percentage of correctly answered questions increased significantly from 48% (SD=12%) to 60% (SD= 14%) in the intervention school (Harrell et al., 2005). Shape It Up, a school-based education program reported higher levels of knowledge among a convenience sample of 6,421 students (Jan et al., 2009).

The TODAY intervention utilized various methods of teaching the health messages. The methods involved interactive activities such as taste testing, mathematical concepts and having the children teach the health concepts that they learned from the instructors and work book to their peers. The TODAY project utilized five 30-minute lessons in the intervention. The literature presents various ways of increasing health knowledge in the school setting. Shape it up: a school-based education program that promoted healthy eating and exercise, demonstrated higher levels of knowledge in children (Jan et al., 2009). The intervention for Shape it Up included an interactive workshop, activity book, family guide, poster, website and educational field days. In the same way, a 16-week school based intervention among 205 fifth-grade students in rural Mississippi was effective in increasing health knowledge of cardiovascular risk factors (Harrell et al., 2005). Planet Health integrated 32 overweight prevention lessons over the course of three years and observed increased knowledge of curriculum-related lessons in boys and girls (Wiecha et al., 2004). The dose and time of lessons taught in school-based interventions varied; however, all were found to be effective in increasing health knowledge among children.
STUDY LIMITATIONS

The results of this study are limited due to several limitations. The study did not have a control group to compare the effects of the intervention to. Since the TODAY project was a sample based program; initiated by community collaboration, it was not possible to exclude students from receiving the intervention at the school sites. The lack of a control or comparison group may have introduced maturation or history bias. Maturation bias is when participants could have shown pretest-to-posttest differences due to growing older, wiser or stronger (McKenzie, Neiger, & Thackeray, 2009). History bias takes place when an event occurs between the pretest and posttest that is not associated with the health promotion program (McKenzie, Neiger, & Thackeray, 2009). The study design was a non-experimental pre to post test design, so the results of the study are of limited significance. Observed changes could be attributed to the program or to another event or collaborative targeting overweight and obesity in the community. Further limitations of the study include the sample size. A convenience sample was utilized and all students in the 5th grade cohort were accessed to participate in the study. The sample size is a reflection of all 5th grade students who completed a pre-post test survey at the two elementary schools. Statistical power of the study would have been greater had there been a larger sample size. The student survey was self-administered and required students to recall their activities over the past week, this could have introduced recall bias to the study. The majority of school-based interventions lasted longer than two weeks (Caballero et al., 2003, Harrell et al., 2005, Speigel & Foulk, 2006; Trevino et al., 2004; Wiecha et al., 2004), with the exception of Shape it Up, which was a one-day intervention (Jan et al., 2009). The length of the intervention was another limitation of the TODAY study. The classroom intervention took place over the course of a two-week period, a longer time frame between the pretest and posttest may have resulted in greater changes in physical activity, nutrition and knowledge.

RECOMMENDATIONS FOR FUTURE INTERVENTIONS

Culturally sensitive and appropriate nutrition and physical activity lessons should be developed in order to create effective interventions in reaching high-risk populations. Cultural sensitive lessons may integrate lessons in Spanish and use characters, images and role models that represent the culture. For instance, the Pathways school-based intervention
integrated an American-Indian character to support healthy habits in the children (Caballero et al., 2003). Lessons that address healthy lifestyles should be integrated into the school curriculum and taught by the teachers at the two school sites where the intervention took place. Although, this program evaluation showed successful results, the teachers at the sites have more contact and influence with the children in their classroom. Furthermore, teachers and students can both benefit when teachers act as role-models of healthy living. Special focus should be given to school-based interventions that can be sustained long-term, as well as initiate changes in the environment and involve families and communities in making these changes. Furthermore, long-term changes in the prevalence of overweight and obesity could be tracked by the schools or community partners. School-based interventions that involve the community can be effective in reducing the overweight and obesity prevalence in disadvantaged areas and schools (Hoelscher et al., 2010).

Although the results of the TODAY evaluation demonstrated results consistent with previous school based interventions, it lacked a theoretical framework to guide the intervention components. Theory-based interventions are needed for school-based interventions in order to more effectively assess the impact of the intervention in the schools and among the participants. Constructs of specific theories should be targeted from the beginning of the intervention. The TODAY Project lacked a specific theoretical framework and thus lacked the foundation for using specific constructs to target nutrition, physical activity, sedentary behavior and knowledge. The Social-ecological model (Sallis & Owen, 2002) is a theoretical model that can be used to improve the implementation of the TODAY project at the two school sites, by specifically focusing on the integration of the school environment, community and outside agencies and organizations in the intervention. School-based obesity prevention programs also need to have strong theoretical underpinnings and report formative research and process evaluation (Gittelsohn & Kumar, 2007). In the Planet Health study the theoretical frameworks used were behavioral choice and social cognitive theory. Like many other school-based interventions, theoretical frameworks were used in designing the intervention (Jan et al., 2009; Trevino et al., 2008).

Furthermore, future studies of school-based interventions must also utilize randomized control trials. This program evaluation of the TODAY project, evaluated the effectiveness of a existing school-based intervention that was initiated by the public health
community in Escondido, California. The primary goal of the program was to reduce overweight, obesity and type II diabetes in school children by the utilization of a BMI and glucose screening along with educational lessons and assembly. A randomized control trial and the use of a control or comparison group, would have been more effective in assessing the cause and effect impact of the intervention as well as minimize study biases that were introduced in this study. More research is needed to further examine the most effective way to decrease overweight and obesity prevalence in the school through school-based prevention programs. The current literature shows that interventions have been successful in making changes in diet, physical activity and health knowledge (Caballero et al., 2003; Coleman et al., 2005; Gortmaker et al., 1999a; Harrell et al., 2005; Jan et al., 2009; Spiegel & Foulk, 2006). Yet, there still is a lack of evidence that demonstrates a long-term reduction in overweight and obesity prevalence attributed to school-based interventions (Gonzalez-Suarez, Worley, Grimmer-Somers, & Dones, 2009). Sustainable interventions that track long term dietary, physical activity and anthropometric changes attributed to the intervention are needed to assess the long term impact on overweight and obesity prevalence in children.

**Conclusions**

Reducing the proportion of children and adolescents who are overweight and obese is one of the national objectives of Healthy People 2010 (Office of Disease Prevention and Health Promotion, 2010). In order to reach this national objective, it is imperative to research and evaluate overweight and obesity prevention methods for all age-levels, especially younger children. The school environment, which has been identified as a location to implement prevention measures for children, still faces challenges in financing and sustaining health programs. This current program evaluation, in spite of its study limitations, demonstrated results consistent with existing literature. In this study, the impact of the TODAY project on the children was assessed using pretest to posttest self-reported measures with 1 cohort over a 15 day period. Results suggest that, at least initially, self-reported changes in nutrition, physical activity, and knowledge can be achieved through a school-based intervention. Specifically, this study adds to the current literature by providing evidence of changes accomplished and the initial impact of a school based intervention in a predominantly low-income, Hispanic/Latino elementary school. Cost-effective and efficient
programs are needed to thwart the overweight and obesity epidemic, especially among minority and low-income populations; where the rates are elevated compared to the general population. By testing school-based interventions and community programs that targets risks associated with overweight and obesity rates throughout the nation can potentially be decreased
REFERENCES


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Program Survey

What is your racial/ethnic background? Circle one answer below.

1. White Caucasian
2. Latino/Hispanic (For example: Mexican American)
3. Black/African American
4. Asian (For example: Vietnamese, Chinese, Filipino)
5. Native Hawaiian or Pacific Islander
6. American Indian or Native American

Please circle the best answer to the question below:

Food Intake

Q1. In a typical day, how many servings of fruit do you eat?
0 1 2 3 4 or more

Examples of one serving size of fruit:
1 medium piece of fresh fruit (1 medium apple)
½ cup of fruit salad
⅛ cup of raisins, apricots, apple or grapefruit
* Do NOT count fruit punch, lemonade, Gatorade, Sunny Delight or fruit drink

Q2. In a typical day, how many servings of vegetables do you eat?
0 1 2 3 4 or more

Examples of one serving size of vegetable:
1 medium carrot or other fresh vegetable
1 small bowl of green salad
½ cup of fresh or cooked vegetables
* Do NOT count French fries, onion rings or potato chips.

Q3. In a typical day, how many sodas do you drink? A soda is a 12 ounce can of Coke, Pepsi, Sprite, etc.
0 1 2 3 4 or more
Physical Activity

Q4. In a typical day, how many hours per day do you usually spend watching TV, playing video games, surfing the internet and instant messaging?

0  1  2 to 3  4 to 5  6 or more hours

Q5. How many days a week in the past week did you play actively or do physical activity for 60 minutes or more?

0 days  1 day  2 or 3 days  almost every day  every day

Q6. How many days in the past week did one of your parents encourage you to do physical activity?

0 days  1 day  2 or 3 days  almost every day  every day

Q7. How many days in the past week did one of your parents do physical activity with you?

0 days  1 day  2 or 3 days  almost every day  every day

Q8. How many days in the past week did one of your parents take you to a place to do physical activity?

0 days  1 day  2 or 3 days  almost every day  every day
Beliefs

Q9. The food that I eat and drink now are healthy.

Yes, all of the time  Yes, sometimes  No

Q10. I believe that I can get healthy food at home.

Yes, all of the time  Yes, sometimes  No

Q11. I believe that I can get healthy food at school.

Yes, all of the time  Yes, sometimes  No

Q12. I believe that I’m a healthy weight

Yes  No  I do not know

Knowledge

Q13. One whole fruit (like an apple) is equal to:

2 cups  4 cups  1 cup  3 cups

Q14. According to the nutrition label on the right, how many grams of saturated fat are there?

5 grams  22 grams  40 grams  10 grams

Q15. According to the nutrition label on the right, how many calories are in one serving?
Q16. How much **time** is recommended for watching television, videos or DVD’s a day?

3 hours no more than 1 to 2 hours more than 2 hours

Q17. Toppings like butter, salad dressing and cheese can be high in fat:

0. False 1. True

Q18. Do you participate in the running club at school?

Yes No

*Thank you for your participation in the survey!*
APPENDIX B

RESULTS LETTER
School Diabetes Screening Program Results

Thank you for having your child participate in the Diabetes Screening program offered by the Escondido Union School District Project 21 TODAY Program. Your child’s screening results are listed below.

BMI: _____ Height: _________Weight: _________ Waist Measurement: __________

Your child’s results fell within the range of:  □ Underweight < 5%
□ Normal: 5% – 84%  □ Overweight: 85% - 94%  □ Obese 95% and above

**BMI is a measurement tool to determine a healthy height/weight proportion. It is only a screening tool and can be affected by an individual’s body type such as being muscular.**

Glucose Level: __________ (Normal Results 70 - 100)  ________ Not Tested

□ Your child’s results all fall in the normal range. Please keep this as a part of your child’s health records. You may also want to share this with your family doctor.

Your Child Needs Follow-Up

□ Based on your child’s screening results; we recommend you contact your family doctor to discuss the screening results. You will be contacted by the project case management team to provide you with resources and information for follow-up with either the school nurse or your family doctor.

These results are not intended for the purpose of giving you any diagnosis. If you have any questions, please contact Irma Cortez at Neighborhood Health Care at (760) 520-8323 or the Escondido Union School District Nurse, Lisa Elliot at ??.
If “Your Child Needs Follow-Up”, please complete this section below. Return to your school nurse or the health clerk.

☐ My child was not seen for medical follow-up.

☐ My child was seen by ____________________ for medical follow-up on ________.

          Doctor or Clinic      Date

The results of the doctor visit were

__________________________________________________________.

☐ I need further assistance with: ☐ a medical provider, ☐ insurance, ☐ nutrition education,

☐ area resources; please contact me at __________________________.

          Phone

Comments: ______________________________________________________________

Child’s Name ________________________ Parent’s Name ________________________