

**A Public Response to Childhood Obesity:
Evaluating the Fresh Fruit and Vegetable Program in
Texas Schools**

by

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An Applied Research Project
(Political Science 5397)
Submitted to the Department of Political Science
Texas State University
In Partial Fulfillment for the Requirements for the Degree of
Masters of Public Administration
Fall 2007

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ABSTRACT

The increasing prevalence of childhood obesity has introduced new challenges to public health policy makers. The Fresh Fruit and Vegetable Program (FFVP) is a policy response to this issue. This study assessed the FFVP, a federal intervention program designed to increase consumption of fresh fruits and vegetables among school-aged children. Elementary, middle, and high schools in Texas that participate in the FFVP were matched with schools that did not participate in the 2005-2006 and 2006-2007 school years. Difficulties in measuring consumption were encountered. Due to problems experienced in measuring actual fruit and vegetable consumption, spending on fruits and vegetables by the schools was used as a weak proxy for consumption. Differences were found in the 2006-2007 school year between the FFVP grant schools, and the non-FFVP grant schools. Challenges to program evaluation in this context were developed.

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CHAPTER 1. INTRODUCTION

Introduction

Since the mid-1990s, public health scholars and practitioners have kept a close eye on childhood obesity. They have observed a steady increase in the number and proportion of obese children over the last two decades. It is now reaching epidemic proportions (Hardy, Harrell, and Bell 2004, 376). Poor diets, sedentary lifestyles, food marketing influences, and a lack of education contribute to children's excessive and rapid weight gain, yet not until recently have aggressive measures been taken to counter the dangerous increase in childhood obesity across the nation (Story and Orleans 2006; Mulvihill and Quigley 2003).

With the increased prevalence¹ of childhood obesity in the United States comes a larger and more reliable body of research and knowledge which has shed light on causes and reliable measures to better control childhood obesity. Improving children's diets at schools is a reliable way to control and reduce childhood obesity. Providing healthy foods and environments at the school level has demonstrated positive results, and has proven effective in controlling childhood obesity.²

More work is needed to promote and encourage healthy food choices on a regular and ongoing basis. Providing healthy foods on a daily and regular basis at the schools is one strategy to change children's eating habits and perceptions of foods.

¹ Hardy, Harrell, and Bell 2004; Flegan, Ogden, and Carroll 2004; Strauss and Pollack 2001; Eisenmann et al. 2005; Finkelstein et al., 2003; Spiegel and Foulk 2006

² For other Texas State University, Applied Research Projects that deal with education issues see: Doehrman (2007); Sallee (2005); Waugh (2004); Jones (2004); Palacios (2003); Neal (2002); Musfeldt (2002); Perez (2000); Williams (1998); Mohajer (1992); and Corley (1992)

Childhood obesity is an epidemic that has raised concerns among school health officials, public health officials, and the medical community. It is also a challenge for various levels of government, public health agencies, and healthcare organizations (Mulvihill and Quigley 2003). Attention remains to be concentrated on this epidemic, and concern over childhood obesity continues to increase, especially in the medical community. While the obesity problem further worsens, it is highlighted as the “health time bomb” and is a growing challenge for various levels of government and public health agencies (Mulvihill and Quigley 2003, 13).

Forty-two percent of Texas fourth graders, 39% of Texas eighth graders, and 36% of Texas eleventh graders are overweight or at risk of becoming overweight. Furthermore, 70% of overweight children will become overweight or obese adults.³ As these affected children enter adulthood, their overall health quality will be undermined further and burden the healthcare system.

In 2001, of the \$67.1 billion spent on healthcare for adults, \$4.2 billion was directly attributable to obesity. In Texas alone, total costs attributed to obesity are conservatively estimated at \$9.1 billion, with other estimates as high as \$14 billion. These estimates include direct healthcare costs (\$4.2 billion) and indirect costs associated with lost productivity due to mortality and morbidity (\$6.3 billion) (McCuster et al. 2005).

In the United States today, there are approximately 9 million overweight children, of which a disproportionate number are African Americans, Hispanics, Native Americans, and low-income youth (Story and Orleans 2006). These same groups each

³ March 2007 report from the Texas Comptroller of Public Accounts
<http://www.window.state.tx.us/specialrpt/obesitycost/96-1245costscalories.pdf>

have a tendency to obesity because of low physical activity levels, poor dietary behavior patterns, and a genetic disposition to obesity (Hardy, Harrell, and Bell, 2004). Childhood obesity “has reached epidemic proportions, affecting 10 percent to 15 percent of the children in the United States” (Hardy et al. 2004, 376).

An urgency to reverse the trend of childhood obesity exists because these children will grow into adulthood with a strong predisposition to obesity, and then hand down the obese genes and poor habits to their children. At present, roughly 8% of children between the ages of four and five in the United States are considered obese (Deckelbaum and Williams 2001). More demands on the public healthcare system and the financing of healthcare in general can be expected if the childhood obesity issue is not addressed head on.

One important reason childhood obesity continues to increase is because the dietary intake and food consumption patterns of school-age children encourage obesity and poor health. Much of the behavior is due to the types of foods that are served and available in school cafeterias. In order to reverse the trend of childhood obesity, school-age children must adopt food consumption behaviors that reduce their risks for obesity and develop healthy eating habits that can be maintained into adulthood.

The Fresh Fruit and Vegetable Program

The Fresh Fruit and Vegetable Program (FFVP) provides school-age children with free fruits and vegetables throughout the school day, and is an effective way to introduce and encourage fresh fruits and vegetables as healthy snack options. Authorized by Congress in 2002 as a pilot program, the FFVP pilot provided funds for 207 schools to purchase fresh fruits and vegetables in four states and at an Indian Tribal Organization

location during the 2002-2003. The success of the FFVP pilot resulted in increased funding to expand the program to more states and schools. Texas initiated its FFVP in 2005.

The purpose of the FFVP is to increase fruit and fresh vegetable consumption in schools. Four goals of the FFVP are: (1) to create healthier school environments by providing healthier food choices; (2) expand the variety of fruits and vegetables available to children; (3) increase children's fruit and vegetable consumption; and (4) make a positive difference in children's diets to impact their present and future health. ⁴

The U.S. Department of Agriculture's USDA Food and Nutrition Service (FNS) administers the FFVP at the national level. In each participating state, the FFVP is administered by the state agency that administers the National School Lunch Program. In Texas that agency is the Texas Department of Agriculture.

Research Purpose

The purpose of this research is to evaluate the impact of the FFVP on fruit and vegetable consumption in Texas schools for the 2005-2006 and 2006-2007 school years. The measure for this evaluation is indirect and imperfect. In order to evaluate the FFVP, aggregated data from the Texas Department of Agriculture and data from forty-two Texas schools were examined and compared to determine if the FFVP influences expenditures on fruits and vegetables.

This research is important for two reasons. First, there is no current assessment of the FFVP in Texas schools, the data and information gathered from this research should

⁴ Texas Department of Agriculture. 2006. Program Handbook. Fresh Fruit and Vegetable Program Operational Handbook for School. Texas Fresh Fruit and Vegetable Program: Making the Best Decisions for Introducing Fruits and Vegetables to Students

provide needed information on the impact of the FFVP on school expenditures on fruits and vegetables and the amount of plate waste in the twenty-one participating Texas schools. Second, if it is shown that expenditures on fruits and vegetables increased and plate waste decreased, an indirect inference can be drawn about increased fruit and vegetable consumption and participation in the FFVP. This research may serve as a catalyst for additional research and FFVP improvement.

Chapter Overviews

Chapter 2 presents a review of the literature on childhood obesity. Several issues are explored, as are previous school-based intervention studies. Policy related disconnects are explored as they relate to availability and access to food products at schools.

Chapter 3 discusses the setting of this research by developing the conceptual framework. This includes a brief informal evaluation of the FFVP in Texas and an introduction to the working hypotheses. The methodology chapter (4), operationalizes the hypotheses and discusses the Texas Department of Agriculture's data used to assess the effectiveness of the FFVP in Texas. Chapter 5 explains the results and the statistical procedure. The results are summarized in tabular form and interpreted. Chapter 6 summarizes the results, offers suggestions for future research, and presents the conclusions. This chapter also communicates how this study provides an opportunity to fill research gaps, as the only other existing FFVP assessment was conducted in Mississippi during 2004-2005 school year.

CHAPTER TWO. LITERATURE REVIEW

Purpose

Chapter 2 presents a review of the literature on childhood obesity. The following areas are explored: (1) issues in childhood obesity; (2) previous school-based intervention studies designed to increase students' consumption of fruits and vegetables; and (3) the policy disconnects as they relate to food product availability and access at the school level. This chapter seeks to highlight the serious nature of childhood obesity and explain the need for programs designed to bring the epidemic under control.

Background

Childhood obesity is not unique to the United States. The epidemic of childhood obesity is a serious health issues in many countries, such as the United Kingdom, Australia, Sweden, Norway, and Japan. These and other countries recognize the significance of addressing childhood obesity. What is surprising is the alarming rate at which the childhood obesity epidemic is growing throughout developed and developing nations alike. In 2001, the number of obese children under age five had reached 22 million (Deckelbaum and Williams 2001).⁵

This literature review examines the obesity issue from the perspectives of public health and economics, explores a few areas from the broader perspective, and describes policy responses to the issue. Since the FFVP is the subject of evaluation, this literature review also develops a framework to evaluate the program.

⁵ For other Texas State University Applied Research Projects dealing with the problem of obesity and fitness see Oaks (2005), Hood (2005) and Rose (1996).

What is Obesity?

What exactly is obesity? At its most basic definition, obesity is abnormal or excessive fat accumulation that may impair health (World Health Organization 2006). For children and adolescents, ages two to nineteen years old, obesity is universally defined and accepted as a “sex specific Body Mass Index (BMI) \geq 95th percentile of BMI-for-age.”⁶ Another near-obese condition is described as “at risk for overweight...defined as a BMI \geq 85th percentile but less than the 95th percentile” (Flegan et al. 2004, 145). The definition for obesity was derived by using survey data from Brazil, the United Kingdom, Hong Kong, the Netherlands, and the United States (Hardy et al. 2004).

What causes obesity? The factors that contribute to obesity are numerous and complex, and include poor diet and low levels of physical activity (Story and Orleans 2006). In addition, exercise habits, racial and ethnic backgrounds, community conditions, and societal and behavioral patterns have dramatically changed food marketing methods aimed at children and contribute to their obesity problems. Fundamentally, obesity occurs when an individual’s intake of calories or energy exceeds his expenditure of those calories or energies (Mulvihill and Quigley 2003).⁷

High-sugar Drinks

One of the main risk factors for obesity in school-age children is the consumption of large or excessive quantities of sugar-sweetened drinks. Sweetened drinks have a

⁶ Body Mass Index (BMI) is a measure of weight scaled according to height, and is used to estimate body fat quantity. BMI is calculated by taking one's body weight and dividing it by the square of one's height.

⁷ This alone, however, does not account for corresponding links to causes of obesity such as behavior, environment, and social and genetic factors.

twofold effect in aiding in obesity because they increase the daily energy intake, and are directly associated with lower consumption levels of foods that have higher nutritional value. Vital nutrients such as calcium, phosphorus, magnesium, vitamin A, folate, and riboflavin found in nutritious foods are foregone in sugar-sweetened drinks (Mrdjenovic and Levitsky 2003). Protein, calcium, phosphorus, magnesium, zinc, and vitamin A are essential nutrients for a growing child. When the intake of these nutrients is suppressed, the child's body is deprived of nutrients necessary for healthy and normal growth. The main culprit is soda pop; however, fruit juices such as orange juice are also considered sweetened drinks. In addition, it is interesting to note that many of these drinks are marketed as being healthy choices or alternatives to soda pop. Therein lies another danger, because the actual amount of fruit juice consumed increases with the justification that the beverage is not soda pop and is therefore healthier (Mrdjenovic and Levitsky 2003).

Substituting healthier drink options with high-sugar drinks affects normal growth, and the excessive consumption of high-sugar drinks, including 100% fruit juice, is associated with a child's "failure to thrive, short stature, and obesity" (Rampersaud, Bailey and Kauwell 2003, 97). A study conducted by Cornell University illustrated the relationship between sugar-sweetened drink consumption and daily intake of milk. On days when the child subjects consumed more than three 16-ounce glasses of sweetened drinks, they drank significantly less milk. Lower milk consumption also occurred when the children drank large amounts of fruit juice (Mrdjenovic and Levitsky 2003, 607).

The Cornell study findings reinforced what the medical and nutritional communities had perhaps known all along; that children with the greatest weight gain

were the ones who consumed the most sweetened drinks (Mrdjenovic and Levitsky 2003, 608). Furthermore, it demonstrated that, when offered a choice between milk and sweetened drinks, children by a large measure chose sweetened drinks over milk (Mrdjenovic and Levitsky 2003, 609).

Biology of Obesity

Obesity has complex biological and pathological underpinnings (Trayhurn 2005). There are five factors that relate to the biology of obesity: adipocyte development, genetics, endocrine changes, control of appetite, and intrauterine environment. In order to assess obesity and make recommendations to reduce obesity, it is important to view the problem of childhood obesity from the context of the biology of obesity. Furthermore, to drive policies that are effective, it is essential that obesity not be viewed exclusively as a dietary matter. Even though diet is a significant variable in obesity, other variables must be assessed in order to understand childhood obesity comprehensively.⁸

Adipocyte Development

Adipocyte (naturally occurring fat cells) development is a completely normal biological process, and as a normal function increase in size during infancy. In non-obese children, adipocyte development ceases around the time the child reaches two years of age. When adipocyte development does not cease and continues until adolescence, an abnormal increase in the elements composing fat cells occurs at a greater rate, thereby increasing risk for the onset of obesity. There is a genetic cause for this and does not limit a child's ability to loose weight (Styne and Schoenfeld-Warden 2003).

⁸ A comprehensive picture of obesity factors includes not just diet, but also behavior, environment, and social and genetic factors as well.

Genetics

There are clear indications that point to genetic causes of obesity. The likelihood of a child becoming obese increases five times if either parent is obese. Furthermore, there are thirty-nine genes that are associated with BMI, body fat, and other obesity-related phenotypes. Studies show that 40% of obesity is caused by heredity (Styne and Schoenfeld-Warden 2003).

Endocrine Changes

The endocrine system is the system of hormones and glands that transfer information and instructions through the body's cells. Changes in endocrine levels have an impact on the risk of obesity. As obesity sets in, the secretion levels of growth hormones decrease (Styne and Schoenfeld-Warden 2003). When growth hormone levels decrease, the body cannot perform the functions necessary for proper development, thus increasing the risks of not being able to metabolize vital nutrients and rendering the body more susceptible to obesity.

Control of Appetite

Control of the appetite is more complex than what may be seen on the surface. The central nervous system has the ability to ensure adequate energy intake by providing redundancy and mechanisms that regulate the appetite and feeding behavior. This is accomplished through the ventromedial hypothalamus. If the ventromedial hypothalamus is damaged by trauma or a brain tumor, the body's natural ability to properly regulate the appetite fails, thus leading to obesity (Styne and Schoenfeld-Warden 2003).

Intrauterine Environment

The intrauterine environment plays a role in a child's susceptibility to obesity. How the pregnant mother's own biology functions, and how she treats herself, can affect the child's future susceptibility to obesity. For example, if the mother of an infant has diabetes, that infant's likelihood of obesity increases. What is more interesting is that mothers who starved themselves during the first six months of pregnancy, then developed better eating habits and quality nutritional intake, birthed infants of normal weight who then had an increased tendency to obesity twenty years after their birth (Styne and Schoenfeld-Warden 2003).

Breast-feeding and environment can impact a child's weight. Starting in infancy and continuing until a child can be fed solid foods, breast-feeding is an effective way to reduce the likelihood that a child will be obese. After infancy, an environment that encourages the consumption of empty calories and inactivity is linked to increased likelihood of childhood obesity. Increases in television watching and computer usage are associated with reduced overall decrease in physical activity levels thus contributing to childhood obesity. Furthermore, studies show that the programs and commercials that children view encourage increased consumption of high-calorie, low fiber foods (Styne and Schoenfeld-Warden 2003).

Prevalence of Childhood Obesity

Since the early 1960s, various studies have documented childhood obesity by evaluating diet, physical activity, and anthropometric measures. Between 1963 and 1974, the prevalence of childhood obesity held at a fair constant of about 4% in children six to

eleven, and 5.5% for children ages twelve to nineteen. By the year 2000 the levels of obesity in both age groups reached 15% (Hardy et al. 2004).

Recent studies that have documented increases in childhood obesity include the Bogalusa Heart Study, the National Growth and Health Study, the Child and Adolescent Trial for Cardiovascular Health, and the Pathways Study. Collectively the studies illustrate the dangerous reality of the dramatically increasing prevalence of obesity.

Bogalusa Heart Study

In the Bogalusa Heart Study, more than 14,000 people living in Bogalusa, Louisiana were examined in 1974 and 1994 for cardiovascular risk factors. Roughly 80% of the individuals examined were children. The study investigators documented the doubling of childhood obesity prevalence between 1974 and 1994. The annual increase in obesity was 50% higher in 1994 than the change between 1973 and 1982 (Hardy, Harrell, and Bell 2004).

National Growth and Health Study

Over a ten-year period, investigators from the National Growth and Health Study studied 2,379 girls between the ages of nine and ten who lived in Virginia, California, Ohio, and Washington, D.C. They measured body composition and risk factors for cardiovascular disease. The results demonstrated that black girls had significantly higher blood pressure, BMI, and skin-fold measurements than their white counterparts. The study also revealed that 30.6% of the black girls were obese versus 22.4% rate of the white girls. Finally, over the ten-year period the prevalence of obesity for black girls doubled (Hardy et al. 2004).

Child and Adolescent Trial for Cardiovascular Health

The Child and Adolescent Trial for Cardiovascular Health study evaluated the effectiveness of home-versus school-based education programs aimed at reducing cardiovascular risk factors in elementary schools. This study examined 4,019 elementary school children in a multicenter, randomized clinical trial. The investigators reported that the prevalence of obesity in boys was greater than 28%, and for girls was close to 30%. A follow-up study after two and one-half years revealed the obesity prevalence for both boys and girls had increased to more than 34% and 30%, respectively. The study also revealed that 38% of blacks were obese and 25% of whites were obese (Hardy et al. 2004).

Pathways Study

In the Pathways Study, researchers studied Native American tribes in South Dakota, Arizona, and New Mexico. The study focused on the personal, behavioral, and environmental aspects of health, physical activity, and nutrition in elementary school children from seven tribes living on reservations. The findings revealed a mean percentage body fat composition of 35.6% for boys and 38.8% for girls. Body fat composition greater than 30% is considered obese (Hardy et al. 2004).

Since these four studies encompassed much of the United States and the increases in obesity and body fat composition of the subjects were significant, it can be concluded that the prevalence of childhood obesity has been rapidly increasing since 1963, and that there are differences across ethnic groups and between sexes. Furthermore, each study consistently found the highest incidence of overweight among African American girls (Freedman et al. 2000; Morrison et al. 1999), Hispanic boys and girls (Lacar et al. 2000;

Mokdad et al. 2003), and Native American boys and girls (Broussard et al. 1995; Eisenmann et al. 2000; Freedman et al. 1997).

A study conducted by the National Center for Health Statistics (part of the Centers for Disease Control and Prevention) sheds light on the obesity issue as it relates to Hispanics. The results of the study clearly indicate an increase in the prevalence of obesity among Mexican American children: more than 20% have BMIs in the obese range, and more than 40% have BMIs categorized as at-risk of obesity (Flegan et al. 2004).

A startling statistic from another longitudinal study (1986 and 1998) demonstrated a sharp increase in the prevalence of obesity among African Americans and Hispanic Americans. By 1998, the African American and Hispanic populations experienced a 120% increase in the prevalence of obesity, and an increase of more than 50% among whites. Almost 22% of African Americans and 21.8% of Hispanics were obese, while only 12.3% of their white counterparts were considered obese (Strauss and Pollack 2001).

To further illustrate the increase, between 2001 and 2002, of the children between the ages of six and nineteen, 31.5% were at risk of obesity and 16.5% were already obese. In previous years (1999 to 2000), 29.9% of the children were at risk of obesity and 15% were already obese (Hedley et al. 2004).

Risks Associated with Obesity

Relationship between adolescent diet and adult obesity

That the manifestations of health-related risks associated with obesity and poor fitness habits do not appear until adulthood has been a long-standing assumption. There are, however, disturbing indications that the prevalence of type 2 diabetes and metabolic

syndrome are increasing in adolescents (Eisenmann et al. 2005). Research conducted by the Department of Health and Human Performance, at Iowa State University indicates that obesity in adolescent years tracks into adulthood. Along with obesity, cardiovascular disease risk factors also track into adulthood (Eisenmann et al. 2005). Results indicate that adolescent obesity is a strong predictor of adverse health issues in adulthood, and that adolescent obesity may actually be a predictor of much higher risks of obesity in adulthood (Eisenmann et al. 2005).

The results of this study demonstrate the value of examining BMI, waist circumference, body fat percentage, total cholesterol, and blood pressure. Each measurement showed a significant increase from adolescent years into adulthood (Eisenmann et al. 2005). The study examined adolescent cardio-respiratory fitness and body fat measurements. The results revealed a correlation in each measurement between body fat ratios of adolescence leading into increased body fat ratios in adulthood (Eisenmann et al. 2005). In a similar study conducted with Japanese subjects, about one-third of obese children would grow up to be obese adults (Deckelbaum and Williams 2001).

The Aerobics Center Longitudinal Study

The Aerobics Center Longitudinal Study examined the relationship between fitness and body fat during adolescence and cardiovascular disease risk factors in adulthood. A cardio-respiratory fitness criterion was used to examine the relationship, which was determined by a time-test exercise on a treadmill. The participants walked eighty-eight meters per minute at no elevation. After the first minute, the elevation was increased to 2%, and then increased another 1% per minute thereafter for twenty-five

minutes. Only a few participants were able to continue beyond twenty-five minutes. Elevation remained constant and speed was increased each minute by 5.4 meters per minute (Eisenmann et al. 2005).

Adolescents (mean age of 15.8 years) who were observed to sustain treadmill time to twenty-five minutes or more were measured for BMI, waist circumference, and percentage of body fat in adulthood (mean age of 26.6).⁹ Their measurements were significantly lower than the measurements of adolescents who could not sustain treadmill time of twenty-five minutes or more (Eisenmann et al. 2005, 49-50). The results indicate a correlation between adolescent fitness and lower rates of obesity in adulthood. Furthermore, participants categorized as high fat in adolescence showed “consistently lower treadmill time and higher fatness in adulthood than those in the low fat categories. Adolescent BMI and percent body fat were significantly lower in the high category of fitness in adulthood, indicating that high adolescent BMI percent body fat values correspond to significantly lower adult treadmill time” (Eisenmann et al. 2005, 50).

The study clearly indicated that “cardio-respiratory fitness and body fat indicators track from adolescence into adulthood,” and “adolescent cardio-respiratory fitness is related to adult body fatness” (Eisenmann et al. 2005, 50).

Health risk factors in childhood obesity

Chronic conditions typically afflicting adults are becoming increasingly more common in adolescents, particularly among obese adolescents. The public health concern is that the rise in childhood obesity is causing serious chronic diseases, such as type 2 diabetes, hypertension, high cholesterol, heart disease, stroke, certain cancers,

⁹ For the purposes of the Aerobics Center Longitudinal Study, the length of follow-up was controlled at a mean of eleven years.

arthritis, and depression to become increasingly common among children (Spiegel and Foulk 2006). Diabetes is the most common as its prevalence has increased along with the increased prevalence of obesity (Flegan et al. 2004). “Until recently, the most common form of diabetes diagnosed in children and adolescents was type 1. The incidence of type-2 diabetes (formerly termed adult-onset diabetes) is rapidly increasing in younger populations, especially among adolescents and minorities” (Hardy et al. 2004, 380).

The factor with the highest likelihood of contributing to type-2 diabetes in children is increased weight gain. When cardiovascular rate was examined in autopsies of children, evidence of fatty tissue was found in the aortas of 50 percent of children as young as two years, and increased to 85% by ages twenty-one to thirty-nine (Hardy et al. 2004). Among young Native Americans, approximately 30% of new cases of diabetes between the ages of ten and twenty are type-2 diabetes (Hardy et al. 2004). Another study conducted by the Cooper Institute found that 90% of diabetes cases are a result of physical inactivity, which causes the onset of insulin resistance (LaMonte et al. 2005). Hypertension is also on the rise in children. A 2000 meta-analysis that examined data from eight large studies of more than 47,000 children found that children with higher BMI had a higher incidence of hypertension (Hardy et al. 2004).

Psychological and physiological impacts of childhood obesity

Along with chronic health effects, obesity brings psychological and physiological impacts. Some children who are obese experience depression and suicidal thoughts, and have attempted suicide. Lower academic test scores among the severely obese have been documented, and many experience extreme dieting, skipping of meals, excessive television viewing, social isolation, and rejection by peers. Furthermore, these

characteristics can influence higher poverty rates and lower marriage rates; over the long term, once children become adults, they face disparate treatment in various settings (DSHS-AFH, BSS-R&PHA, June 2004).

Physiological side-effects and impairments are no longer problems found in adults alone. Such effects have encroached into childhood as a result of childhood obesity. Problems include softer bones resulting in bow-legged conditions; neurological problems such as pseudo-tumor cerebri, which is a false brain tumor; pulmonary problems such as severe asthma; sleeping disorders; gastroenterological problems such as gallstones and high deposits of fat in the liver; and endocrine problems that lead to over-production of male hormones and abnormal menstrual cycles in females (DSHS-AFH, BSS-R&PHA, July 2004).

Economics of Childhood Obesity

The financial burden of obesity

Drawing attention to the severity of obesity is important because it is a public policy issue with far-reaching implications and few easy answers. A priority must be given to examining the nexus between childhood obesity and long-term financial consequences. If policies cannot be developed to slow and reduce the prevalence of childhood obesity, future financial burdens will be extraordinarily high, difficult to contain and control, and even more difficult to manage.

A study using data from the 1996 Medical Expenditure Panel Survey (MEPS) and the 1997 National Health Interview Survey (NHIS) showed that the annual medical costs incurred by obese adults are 36% higher than for adults of normal weight (Finkelstein et al. 2003, 219). Another study that incorporated an epidemiological approach to estimate

costs found that obesity-related spending was 5.7% of all U.S. national health spending, which translates to \$53.6 billion (Finkelstein et al. 2003).

Using data from the above-mentioned studies, Finkelstein (2003) found that across all insurance categories the combined prevalence of overweight and obesity was directly linked to approximately 54% of spending, and was the largest for those enrolled in the Medicare program. Finkelstein (2003) also found that Medicaid carries the heaviest financial burden attributed to obesity-related claims, accounting for the highest percentage of Medicaid spending, and is close to 10% higher than other insurance categories (Finkelstein et al. 2003).

For an individual, the “average increase in annual medical spending associated with obesity is 37.4% (\$732.00)” (Finkelstein et al. 2003, 222). In 1998, a MEPS¹⁰ calculation of the total spending in each category found the following: out-of-pocket, \$3.8 billion; private, \$9.5 billion; Medicaid, \$2.7 billion; and Medicare, \$10.8 billion, which combined totals \$26.8 billion in costs associated with obesity (Finkelstein et al. 2003).

Based upon national medical spending data, the direct healthcare costs for obesity in Texas totaled over \$5 billion. In 2001, the population of Texas adults was over 15.3 million, and 24% were obese. Of the \$67.1 billion spent on healthcare for adults, \$4.2 billion was directly attributable to obesity. In Texas alone, total estimated costs attributed to obesity on the low end were \$9.1 billion, with estimates as high as \$14 billion. This includes direct healthcare costs (\$4.2 billion) and indirect costs associated with lost productivity due to mortality and morbidity (\$6.3 billion) (McCuster et al.

¹⁰ Initiated in 1996, the MEPS is a collection of U.S. data on specific health services used, frequency of use, cost of these services, and payment method. MEPS also collects health insurance coverage information.

2005). The number of hospital admissions attributed to obesity exceeded 94,000, with one-third related to coronary heart disease, 15% for congestive heart failure, and 13% for stroke (McCuster et al. 2005).

School Environment

Children spend a significant portion of their day in school. Generally they eat one meal, sometimes two meals while at school. The eating habits encouraged in many schools cultivate conditions that lead to severe weight gain and increased prevalence of childhood obesity. For several years, private competitive vendors have been providing poor-quality and low-nutrient foods in schools. When unregulated, the types of food products provided tend to be of poor nutritional value, and high in sugar and fat content (Kubik et al. 2003).

The school environment is one of the most powerful influences on school-age children's eating habits and behaviors. Ninety percent of schools offer an a la carte lunch program as well as school stores, snack bars, and vending machines. Very few of these food venues offer students low-fat, healthy food products (Kubik et al. 2003).

As determined by the U.S. Department of Agriculture, the lunches that are offered through the National School Lunch Program (NSLP) are required to meet certain nutritional guidelines, whereas competitive food vendors are not subject to these requirements. Within the school environment, policy makers have legitimate authority to make changes in expenditure patterns and to regulate the types of food products allowed on school campuses and in school cafeterias.¹¹ Hence, the nutritional value of food

¹¹ A more healthy and nutritious food environment is clearly recognized. According to nutrition objectives set forth in Healthy People 2010 a priority must be given to "increase the proportion of children and adolescents aged 6 to 19 years whose intake of meals and snacks at school

offered through the NSLP is higher than the nutritional value of foods from competitive sources, which are also much higher in calorie and fat content (French et al. 2002).

Implementing effective policies and nutrition programs can be difficult because of inconsistent priorities among senior-level school administrators and school principals. These inconsistencies can make support from senior-level school administrators weak. Among the principals surveyed, even though most believed it was important to provide a healthful food environment, only one-third of their schools had some sort of nutritional policy. Less than one-third had policies addressing the types of food and drink that were available in vending machines, at school stores, or at school functions (French et al. 2002).

A survey of 336 Minnesota school principals' attitudes about food and school nutrition demonstrates this point. Five questions were asked, and the results are as follows. Asked if they believe it is somewhat or very important to have a district or school-wide food and nutrition policy for the high school, 65% believed so; asked if they thought it was very important for the school to provide an environment to encourage healthful food choices, 52% thought so; asked if only healthful food choices should be provided to students at school, 64% believed so; whereas 36% of the principals believed that both healthful and less healthful food choices should be provided and students should be allowed to choose. Finally, when asked if food service should or should not be financially supported by general funds, 49% of the principals reported that they should not be supported general funds (French et al. 2002).

contribute to good overall dietary quality" (French et al. 2002, 1785). Unfortunately, the corresponding high priority has not been given to school nutritional policies.

Costs and Access to Healthier Foods

Eating healthy food may not be an option for some children, as low socioeconomic status can make access to healthier food financially unrealistic. This disparity is especially acute in lower income school districts where inexpensive food choices are widely available, and students and parents alike want to get the most out their limited budget (Drewnowski and Darmon 2005).¹²

According to Drewnowski and Darmon (2005), congressional districts with lower income levels have the highest levels of obesity. Furthermore, the risk for the onset of type-2 diabetes and rates of obesity are linked to poverty, and a strong correlation exists between families who live in poverty and obesity. Drewnowski and Darmon (2005) concluded that a link exists between the food environment and the increasing prevalence of obesity.

Poor-quality and low-nutrient foods are widely available, and are very low in cost. These foods tend to be far more affordable than leaner meats, whole grains, and fresh fruits and vegetables. Low-income families are more likely to choose and purchase energy-dense foods that contain high amounts of refined grains (Drewnowski and Darmon 2005).

In a 2004 editorial in the British medical and scientific journal *The Lancet*, the author¹³ acknowledged that efforts to stem the tide of obesity will fail so long as meals

¹² A perceived value helps influence purchasing decisions. But “getting the most out of limited resources” in this context does not necessarily carry the meaning of nutritional value and long-term health benefits.

¹³ The author of this article (*The Lancet* 363:9406), “Who Pays in the Obesity War?” is anonymous.

including foods such as grilled chicken, broccoli, and fresh fruits cost more and are less convenient than unhealthy food options.

State and District Policies

Federally subsidized school meal programs provide breakfast and lunch to more than 50% of school-age children in the United States (Wechsler et al. 2001).

Unfortunately, along with these school meal programs, many students consume poor-quality foods from vending machines, a la carte sales, snack bars, or concession stands.

State and district policies that address school food service programs and cafeteria environments can be shaped to promote and encourage healthier eating habits. Along with state and district policy changes, schools are uniquely positioned to encourage and promote healthier diets and improved nutrient intake. Many public health practitioners have identified school food service programs and the overall school nutritional environment as central to successful dietary interventions (Wechsler et al. 2001).

Unfortunately, state- and district-level policies seldom support a healthy school nutrition environment (Wechsler et al. 2001). Further, there is very little regulation of competitive foods and their sales at the federal and state levels. In addition, state and district policies dealing with the availability of fruits and vegetables in schools are limited. Many states and roughly half of the districts do not require schools to offer students a choice of two or more fruits and vegetables, and do not have established policies addressing the quality of food products sold outside the school lunch program. Furthermore, very few states and districts even recommend that fruits and vegetables be offered in the school environment.

Public health strategies to address obesity

The FFVP is one example of an array of strategies used by public health officials to improve the public's food choices, change the public's eating patterns, and modify the food environment.¹⁴ Central to this effort is a strategy that improves consumer access¹⁵ to healthier foods, such as fresh fruits and vegetables. Two programs designed to improve such access and address the issue of disparities are the U.S. Department of Agriculture's (USDA) FFVP for schools, and the USDA Senior Farmers' Market program. Both programs target limited-resource groups (Drewnowski and Darmon 2005).

The FFVP provides all of the children in participating schools with a variety of free fresh fruits and vegetables throughout the school day, and effectively and creatively introduces fresh fruits and vegetables as healthy snack options. The FFVP has four goals: (1) create healthier school environments by providing healthier food choices; (2) expand the variety of fruits and vegetables children experience; (3) increase children's fruit and vegetable consumption; and (4) make a difference in children's diets to impact their present and future health.

¹⁴ The school environment in the context of this research refers to various physical elements that are built or placed in close proximity to children in schools. Examples of this include a la carte stands, vending machines, soda machines, school stores, and even bake sales. The underlying characteristic of the school environment is its ability to trigger a desire to eat. Environments can influence eating choices.

¹⁵ Access in the context of this research addresses both financial and physical consumer barriers to healthier foods. Fresh fruits and vegetables tend to be both more expensive than unhealthy options, and are also not as likely to be available in lower-income areas (Drewnowski and Darmon 2005).

The FFVP targets school-age children by encouraging them to develop healthy eating habits. This is accomplished through the participating schools' providing a controlled setting where the environment can be influenced.

The next strategy involves efforts to remove low-cost, low-nutrient, and poor-quality foods from the consumer's array of choices. This strategy is achieved by restricting the sale of foods high in fat and sugars, placing marketing restrictions on soft drinks, and taxing low-nutrient, poor-quality foods in order to discourage sales (Drewnowski and Darmon 2005).¹⁶

The final strategy involves legal options such as lawsuits against food manufacturers and restaurants. These lawsuits claim that defendants in the food manufacturing and restaurant industries play significant roles in promoting obesity through deceptive and enticing marketing techniques that encourage overeating (Drewnowski and Darmon 2005).

Price Reduction Intervention

In the past few years, more and more students have been purchasing and consuming foods that are classified as "competitive." Food products that are not included in the school lunch program are classified as competitive, and include various a la carte foods and food products from vending machines.¹⁷ Of the foods purchased by students at school, competitive foods make up a large and increasing share of the food choices and purchases. Relative food prices are manipulated to make healthy foods more attractive to

¹⁶ In his 2005 Applied Research Project, Brion Oaks points out that, generally speaking, consumers are aware of nutritional issues, yet make choices based upon costs and benefits.

¹⁷ School lunch programs, primarily the National School Lunch Program and the School Breakfast Program, are eligible for reimbursement. Because competitive foods contain a high percentage of fat, they therefore fall outside the National School Lunch Program's criteria for nutrition and dietary needs, and are not eligible for reimbursement.

the consumer, with the anticipation that these price manipulations will decrease demand for competitive foods and increase the demand for healthier food choices (French 2005).

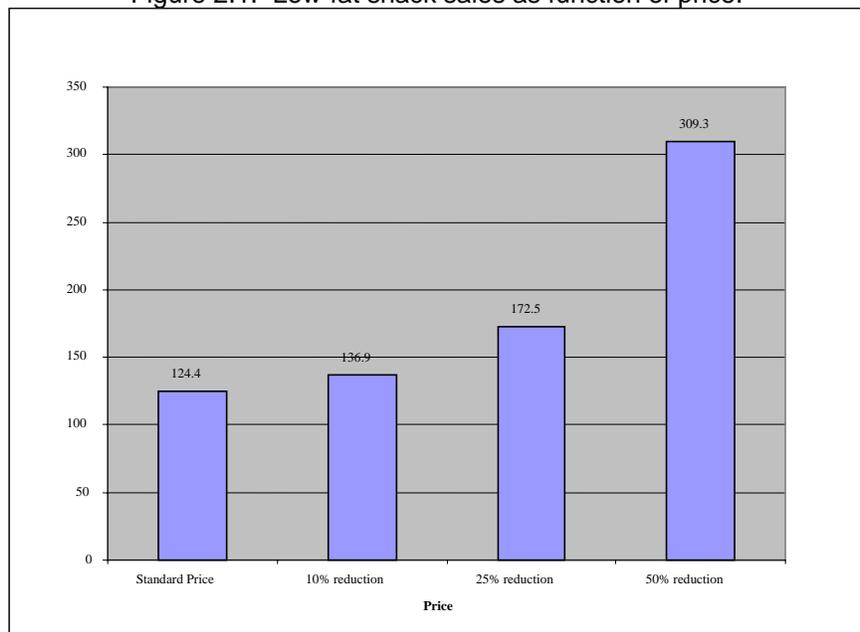
As part of an evaluation of price-reduction intervention strategies, French (2005) examined various strategies in twelve workplaces and twelve secondary schools in Minnesota. All of the vending machines were stocked with low-fat food and snacks and then the prices of those products were reduced 10%, 25%, and 50% compared with the snacks higher in fat.

According to French's (2005) study, a feasible strategy to discourage high-fat food purchases and encourage low-fat food purchases is for schools to apply small price increases to high-fat foods as well as small price reductions to low-fat foods. A 2005 school-based intervention, Trying Alternative Cafeteria Options in Schools (TACOS), was designed to increase low-fat food sales in secondary school cafeterias by increasing their availability and decreasing the prices, while simultaneously increasing the prices of competitive a la carte foods. After one year, sales of the low-fat foods had increased by 10%; in the second year, sales of low-fat foods increased 33.6% (French 2005) (see figure 2.1).

To illustrate the results of the study, figure 2.1 shows that small price reductions for low-fat snacks increased the sales of those products by 9%, 39%, and 93%, respectively. Following the 25% and 50% price reductions, the overall volume of snack sales experienced a significant increase, and there was no significant difference in average monthly profits for vending machines when accounting for the price-reduction

conditions (French 2005).¹⁸ This study demonstrates that consumers may be more encouraged to select healthier, low-fat vending machine snacks when the prices of those choices are reduced, even by small amounts, without a negative impact on the sales volume or the profitability of the vending machines.

Figure 2.1. Low-fat snack sales as function of price.



(French 2005)

Although further research into the effects of various price increase and decrease strategies upon low-fat food consumption is needed, preliminary evidence suggests school-based environmental interventions designed to increase low-fat food availability can increase low-fat food sales among adolescents. Unfortunately, despite the results of TACOS, there could be a consensus among scholars that when it comes to how environmental factors influence and affect children’s eating behavior, or the feasibility

¹⁸ The study involved vending machines in workplaces and secondary school sites. However, the results of this study could lead to an understanding of purchasing behaviors that could be applied to elementary school environments as well, and may have similar positive results (French 2005).

and efficacy of food environment improvement policies, little is known (Story and Orleans 2006). However, results of school-based interventions (such as restrictive strategies designed to promote and increase students' fruit and vegetable consumption) have been positive, as have environmental interventions, which are interventions that employ such tactics as lower prices and increased availability of healthy food options.¹⁹

Intervention Studies

Table 2.1 provides an overview of the intervention studies referenced in this research. The two categories include; Price Reduction Intervention (PRI), and Dietary Behavior Intervention (DBI).

Table 2.1. School study matrix			
STUDY NAME / TYPE / YEAR	SETTING	SUBJECTS	FINDINGS
Fruits and Vegetables Make the Mark; PRI (2000-'03)	Norway	1,950 Sixth and Seventh grade students.	Positive results. Students who received free fruit for the school year increased their consumption of fruits and vegetables, and sustained the increased consumption level over three years after free fruit was initially provided (Bere et al. 2007). Intake increases of fruits and vegetables observed, and the no-cost alternative influenced a decrease in the intake of high-sugar and -fat snacks.
5-a-Day Power Plus; PRI (2000)	St. Paul, MN	4,763 multiethnic Fourth and Fifth graders	Students chose significantly more fruits and vegetables than students who did not participate in the program (Story et al. 2000). This type of food intervention programs in urban schools with a multiethnic student population is feasible and effective.

¹⁹ Bere et al., 2007; Story et al., 2000; Perry et al, 2004; Reynolds et al., 2000; Perry et al., 2004; Spiegel and Foulk, 2006; Kubik at al., 2003; Centers for Disease Control, 2006; Hendy and Williams, 2005

			Indicates that this intervention can be accepted among the students whose previous diets were high in foods with added sugars and fats; "could significantly increase fruit and vegetable consumption among fourth and fifth-grade students" (Perry et al 2004).
High-5 Project; PRI (2000)	Alabama	1,698 Fourth graders in twenty-eight elementary schools	<p>Children receiving the free or low-cost fruits and vegetables consumed significantly more servings of fruits and vegetables combined than children paying full regular prices for fruits and vegetables (Reynolds et al. 2000).</p> <p>Along with their increased consumption of fruits and vegetables, the children's intake of fiber, folate, B carotene, and vitamin C was significant because of the increased consumption.</p> <p>Effectively improved the diet and eating behaviors among African American and low-income children and increased the fruit and vegetable intake among the students and the parents as well, and shows promising long-term effects in dietary behavioral changes that could also lead to reduced cancer risks and prevalence (Reynolds et al. 2000).</p>
Cafeteria Power Plus; PRI (2000)	Minneapolis-St. Paul, MN	1,668 students in twenty-six elementary schools	<p>"Students significantly increased their total fruit intake. Outcomes suggest that multi-component interventions are more powerful than cafeteria programs alone with this age group" (Perry et al. 2004, p. 65).</p> <p>Fruit and vegetable availability and appeal increased, students were encouraged to choose and eat more fruits and vegetables. What is essential is that during the two school years, students were provided more opportunities to eat fruits and vegetables, and as a result students consumed significantly higher amounts of fruits and vegetables (Perry et al. 2004).</p> <p>Environmental change interventions in elementary school cafeterias can have a significant effect on children's consumption of fruits and vegetables. Additionally, verbal encouragement by food service staff has a positive influence on children's intake of fruits and vegetables.</p>

Wellness, Academics, and You (WAY); PRI (2004)	Delaware, Florida, Kansas, North Carolina	1,013 Fourth and Fifth grade students	<p>Significant increases in fruit and vegetable consumption among the children who were offered these foods for free or reduced price. Along with the children's increased fruit and vegetable intake, academic performance improved as well.</p> <p>WAY indicates that school-based interventions involving increased availability of fruits and vegetables contribute to increased consumption of fruits and vegetables, reducing the prevalence of overweight and obesity in school-age children, and improving academic performance (Spiegel and Foulk 2006).</p>
Vending Machines Kubik et al.; DBI (2003)	St. Paul-Minneapolis, MN	598 Seventh grade students in sixteen schools	<p>Availability of a la carte foods had an inverse relationship with the consumption of fruits and vegetables, and had a positive relationship with the overall consumption of foods high in fat and sugars.</p> <p>The negative relationship was evident between high consumption of vending machine food products and low consumption of fruits. There was, however, a positive relationship between serving fried potatoes and the overall consumption of fruits and vegetables (Kubik et al. 2003).</p>
a la Carte Food Harnack et al.; DBI (2000)	St. Paul-Minneapolis, MN	Nineteen junior high and senior high schools	<p>Ninety percent of schools offered items such as fruit and fruits snacks, snacks, and non-dairy drinks, 70% offered a bread or cereal category food, 60% offered some sort of entrée, and 45% a vegetable item.</p> <p>a la carte food items accounted for 23.7% of items in the snacks category, non-dairy drink items accounted for 16.1%, dessert items accounted for 12.7%, entrees accounted for 11.9%.²⁰</p> <p>With 149 items sold, the snack category had the highest sales, and comprises food products sold from vending machines. The highest volume of sales of a la carte products includes the</p>

²⁰ A concern about the a la carte food items is the fat content, with only 48% of the food items meeting the FDA dietary fat criteria, and less than 10% of the food items in the cookie and entrée categories meeting the fat criteria (Harnack et al. 2000).

			<p>nondairy drink, dessert, entree, and cookie categories.</p> <p>On average, schools reported \$620 of revenue per day from the sales of a la carte foods, and that 34% of the students purchased at least one a la carte food item (Harnack et al. 2000).²¹ The a la carte food items accounted for 23.7% of items in the snack category, non-dairy items accounted for 16.1%, dessert items accounted for 12.7%, entrees accounted for 11.9%.</p>
Mississippi FFVP Pilot; DBI (2004)	Mississippi	660 Fifth, Eighth, and Tenth grade students	<p>Students' fruit and vegetable varieties consumed increased significantly. Overall consumption of fruits increased significantly among the Eighth grade students (0.34 serving per day), and among the Tenth grade students (0.61 serving per day) (Centers for Disease Control 2006).</p> <p>The variety of fruits and vegetables eaten in each grade level increased, and the program increased positive attitudes among Eighth grade students, which included improved willingness to try new types of fruits, and their preferences for fruit (Centers for Disease Control 2006).</p>
Kids Choice; DBI (2005)	Pennsylvania	346 First, Second, and Fourth grade students	<p>Increased fruit and vegetable consumption. Providing token reinforcement to students is effective in getting students to consume greater quantities of fruits and vegetables. The results were consistent across grade levels (Hendy and Williams 2005).</p>

PRI = Price Reduction Intervention
DBI = Dietary Behavior Intervention

Results from eight of these nine intervention studies indicate a trend toward increased fruit and vegetable consumption among the school-age children, which suggests that price reduction and dietary behavior interventions are effective strategies

²¹ Food items in the vegetable category include french fries, which had the highest volume of sales over any other item in the vegetable category. Foods in the entrée category include hamburgers and pizza, and were the highest of all foods in the entrée category.

for schools. The exception is the Harnack et al. a la Carte Food study. This study examined nine a la carte food categories, the number of items in each category that were sold, prices, and the percentage of these items that met the U.S. Food and Drug Administration's (FDA) fat criteria.²²

Plate Waste

The studies described above yield promising signs that school-based cafeteria interventions can increase fruit and vegetable consumption among school-age children. Nevertheless, an ongoing challenge exists to accurately measure and determine the actual fruit and vegetable consumption among school-age children (Adams et al. 2005). The fact that a piece of fruit or selection of vegetables was taken, does not necessarily mean that it was consumed.

In order to address this measurement problem, scholars use *plate waste* to help account for the amount of edible food taken and the actual amount of food consumed. Plate waste is defined as “the quantity of edible portions of food served through the USDA school nutrition programs...that students discard each year” (Buzby and Guthrie 2002, 1). Although there is no standard for plate waste, 12% is the nearest estimate (Buzby and Guthrie 2002).

Despite the lack of a universal standard for plate waste, scholars and practitioners use common measurement methods. Plate waste is measured in three ways: physical measurements (direct measurement), visual estimates, and food consumption as recalled by children (Buzby and Guthrie 2002).

²² The FDA dietary low-fat criteria of 3 grams of fat or fewer per serving for non-entrees, and 3 grams or fewer per 100 grams for entrees.

Physical measurements involve the weight of edible food prior to consumption, and the (second) weight of leftovers after the children have finished eating. Other studies measure plate waste as an aggregate across all children (Buzby and Guthrie 2002).²³

Visual estimates involve trained observers who make judgments of leftover proportions that remain on the lunch tray. Child recall involves a request to the children to rate the amounts of their own discarded food (Buzby and Guthrie 2002).

Two recent plate waste studies designed to better and more accurately measure school-age children's fruit and vegetable consumption resulted in findings that call for further research in this area. Waste is expected from children and school lunches; however, it is reported that fruits and vegetables are wasted more than any other items in a school cafeteria (Marlette et al. 2005).

Table 2.2 outlines an overview of the two plate waste studies referenced in this research. They include the 2005 San Diego County, California plate waste study and the 2002 Frankfort, Kentucky plate waste study.

²³ Regardless of actual procedure used, plate waste calculations are based upon percentage of unconsumed food. Percent waste = (edible waste weight / weight of mean serving size of edible food) * 100 ((Buzby and Guthrie 2002).

Table 2.2. School plate waste study matrix			
STUDY NAME / YEAR	SETTING	SUBJECTS	FINDINGS
2005 San Diego County, CA	San Diego County, CA	Four elementary schools	<p>The schools' student profile largely non-white, Hispanic, and almost all of the students were from low-income families, which qualified them for lunch subsidies.</p> <p>There was no significant difference found in the students' fruit and vegetable consumption. There was, however, an interesting finding, which showed a significant difference in the students' fruit and vegetable consumption in the schools with a variety of fruits and vegetables, which indicates that as fruit and vegetable variety increases, consumption increases (Adams et al. 2005).</p>
2002 Frankfort, KY	Frankfort, KY	369 (spring) 374 (fall) Sixth grade students	<p>During the 2002 spring semester (369 students), and repeated in the 2002 fall semester (374 new students). Before students were allowed to purchase competitive food items, they were required to purchase the lunch provided by the school.</p> <p>The students who purchased competitive food items along with the school lunch had a significantly higher rate of plate waste than students who did not purchase competitive food products. The purchase of competitive foods had a significant effect on the amount of plate waste of fruits, grains, meats, and mixed dishes (Marlette et al. 2005).²⁴</p>

The USDA issued a report containing very similar findings to the Frankfort, Kentucky study. The rate of plate waste by school children was 40% for cooked vegetables, 30% for salads, and 20% for fruits (Marlette et al. 2005).

²⁴ "Students who purchased competitive food items with lunch had significantly higher waste of fruits (52% vs. 36% respectively), grain products (26% vs. 14%, respectively), meats (25% vs. 16%, respectively), and mixed dishes (30% vs. 18%, respectively)" (Marlette et al. 2005, 1779).

2005 San Diego County, California plate waste study

The San Diego County plate waste study (Adams et al. 2005) examined four elementary schools in San Diego County, California. The schools' student profile was largely non-white, Hispanic, and almost all of the students qualified for lunch subsidies.

Students' plate waste of fruits and vegetables was compared between two schools with salad bars and two schools without salad bars. For the non-salad bar school, the study focused on pre-portioned plates. Students at salad bar schools were allowed to place fruit and vegetable choices directly onto their plates, and could choose any items and amounts they desired. Next, their fruit and vegetable selections were measured to the nearest gram. After the students finished their lunches, any fruits and vegetables remaining on their plates were scraped off onto a separate plate for an individual second measurement to determine consumption. The weight of the leftover fruits and vegetables was subtracted from the weight prior to consumption (Adams et al. 2005).

Adams et al. (2005) found no significant difference in the students' fruit and vegetable consumption between the salad bar and non-salad bar schools. There was, however, a surprising finding: In the schools with a greater variety of fruits and vegetables, the students' fruit and vegetable consumption was significantly higher (versus schools with less variety). This finding indicates that as fruit and vegetable variety increases, consumption of fruits and vegetables increases (Adams et al. 2005). Table 2.3, below, shows the results from the 288 students who were observed.

Table 2.3. Fruit and vegetable consumption measured by grams and percentages					
Serving type	# of students	Items served	Items taken	Items consumed (g)	Items consumed (%)
Pre-portioned school 1	76	5	96	49	51
Pre-portioned school 2	65	5	96	38	40
Salad bar school 1	70	4	117	36	31
Salad bar school 2	77	7	107	61	57

(Adams et al. 2005)

2002 Frankfort, Kentucky plate waste study

The 2002 Frankfort, Kentucky study examined plate waste among sixth-grade students during the 2002 spring semester (369 students) and the 2002 fall semester (374 new students). Before students were allowed to purchase competitive foods items, they were required to purchase the lunch provided by the school.

The results showed that the students who purchased competitive food items along with the school lunch had a significantly higher rate of plate waste than students who did not purchase competitive food products. The purchase of competitive foods had a significant effect on the amount of plate waste of fruits, grains, meats, and mixed dishes (Marlette et al. 2005).²⁵

²⁵ “Students who purchased competitive food items with lunch had significantly higher waste of fruits (52 percent vs. 36 percent respectively), grain products (26 percent vs. 14 percent, respectively), meats (25 percent vs. 16 percent, respectively), and mixed dishes (30 percent vs. 18 percent, respectively)” (Marlette et al. 2005, 1779).

In table 2.4, below, the food acceptance and waste rate for 743 sixth-grade students suggests that even when the students accepted the various fruits and vegetables, there was waste of those fruits and vegetables. Each particular food item corresponds with the number of students to whom food was offered, the percentage of students who accepted that item, and what the overall plate waste was for that particular food item.

Table 2.4. Acceptance and waste of offered school lunch items			
Food group item	# of students offered to	% students accepted	% average plate waste
Fruits			
Apple, fresh	656	23	62
Applesauce	105	37	23
Orange	481	8	54
Pears, sliced, canned	152	30	16
Frozen fruit juice bar	144	42	35
Vegetables			
Salad	446	28	26
Green beans	345	28	26
Potatoes (oven-heated)	216	68	33
Boiled potatoes	166	25	52
Mashed potatoes	156	70	19
Corn	191	49	34

(Marlette et al. 2005, 1780)

Conclusion

Childhood obesity is an epidemic. Much like many previous epidemics, the public health community responded, developed appropriate plans to deal with those

epidemics, and slowed or simply put an end to those epidemics. Short of encouraging and implementing feasible and sustainable measures to stem the increasing rate of childhood obesity, severe health risks and costs will continue to mount and thus become increasingly difficult to manage. The FFVP in Texas is an intervention designed to reduce childhood obesity. If successful, expansion into more Texas schools makes sense.

The following chapter discusses the setting of this research. It includes a brief informal evaluation of the FFVP as well as an introduction to the hypotheses that guide the subsequent evaluation.

CHAPTER 3 SETTING

Purpose

The purpose of this chapter is to discuss the FFVP and develop the working hypotheses used to evaluate the program's impact on fruit and vegetable consumption. This chapter also includes a general summary of an interview with Texas' FFVP program administrator.

The Fresh Fruit and Vegetable Program

The FFVP provides school-age children free fruits and vegetables throughout the school day. By targeting school-age children and encouraging them to develop healthy eating habits, participating schools provide a controlled setting where the environment can be influenced.

The USDA's Food and Nutrition Service (FNS) administers the FFVP at the national level, and at the state level the FFVP is administered by the Texas Department of Agriculture. Texas' FFVP has a dedicated program administrator who oversees and manages the program.²⁶

The success of the FFVP would be determined by an increased consumption of fruit and vegetable, and an decrease in the amount of plate waste. Previous intervention studies demonstrate success with their observations of increased consumption of fruits and vegetables and an adoption of healthier eating habits by students. The program's success in Texas is not yet fully documented.

²⁶ Fernando Becerra is Texas' FFVP program administrator, and works for the Texas Department of Agriculture. On June 27, 2007, a one-on-one interview was conducted for the purpose of gaining greater insight into the Texas FFVP.

Conceptual Framework

Two formal hypotheses form the conceptual framework. The first hypothesis is based upon previous studies examined the effect of price-reduction and dietary behavior interventions on school-age children's fruit and vegetable consumption. The research findings suggested that the respective interventions were effective in increasing school-age children's consumption of fruits and vegetables. If schools have adequate financial resources (FFVP funding), their expenditures on fruits and vegetables increase.

The second hypothesis is based upon two plate waste studies that evaluated how much food was wasted vis-à-vis how much food was initially taken. When fruits and vegetables are provided, the percentage of plate waste goes down. The research findings suggested that plate waste is less when adequate varieties of fruits and vegetables are available, and when the availability of competitive foods is restricted.

The first hypothesis - the FFVP will increase expenditures on fruits and vegetables in Texas schools - is central to the present research, and is tested by examining expenditure levels on fruits and vegetables at the program schools and comparison group schools. The second hypothesis - fruit and vegetable plate waste will be lower in FFVP grant schools - is tested by examining the amount of edible food waste that occurs in the program schools and the comparison group schools.²⁷

Table 3.1, below, summarizes the hypotheses and links each with their supporting literature.

²⁷ In order to get a clearer picture of actual consumption patterns, scholars have turned to plate waste.

Table 3.1: Hypotheses and Supporting Literature

<u>Hypothesis</u>	<u>Supporting Literature</u>
H1: The Fresh Fruit and Vegetable Program will increase expenditures on fruits and vegetables in Texas schools	Bere et al. 2007 Story et al. 2000 Reynolds et al. 2000 Perry et al. 2004 Spiegel and Foulk 2006 Kubik et al. 2003 Centers for Disease Control 2006 Hendy and Williams 2005
H2: Fruit and vegetable plate waste will be less in FFVP schools.	Buzby and Guthrie 2002 Marlette et al. 2005 Adams et al. 2005

The literature suggests that at schools where the availability and access to fruits and vegetables is increased and improved, school-age children will consume fruits and vegetables in larger quantities. The FFVP is the centerpiece to test the hypotheses.

This research employs an explanatory conceptual framework to evaluate the impact of the FFVP on expenditures on fruits and vegetables, and on plate waste in schools, by assessing the program in twenty-one FFVP grant schools in Texas. Furthermore, as an impact evaluation, the formal hypotheses provide the framework to assess how an outcome (expenditures, plate waste) is influenced by the treatment (FFVP). “Explanatory research and the formal hypothesis are the mainstay of social and policy science” (Shields and Tajalli 2006, 34). Shields and Tajalli (2006, 35) go on to say that, “from a public administration perspective, explanatory research is important because all impact program evaluations use formal hypotheses.”

Interview

Exploring and evaluating the data trends from the FFVP are important. Thus, the research incorporates a structured interview to help make sense of the trends that may not otherwise be as meaningful using only the data.. According to Babbie (2004), interviews are effective methods to gain insight into a larger group. He goes on to say that, “interviewing needs to be an integral part of the entire field research process” (Babbie 2004, 302).

The structured interview was conducted with Fernando Becerra, a policy program specialist and the FFVP Program Administrator. Mr. Becerra oversees and manages the FFVP, collects the data, and manages the data for the Texas FFVP grant schools,. He also submits the data to the USDA’s Food and Nutrition Service as required by the grant.

In a June 27, 2007, one-on-one interview, Fernando Becerra’s comments and perspective added valuable insight as someone who is close to the FFVP data, and one who also works closely with the Texas FFVP grant schools.²⁸ Responses to interview questions brought context to the Texas FFVP that the data alone are unable to do.

Mr. Becerra was quick to point out that the data are very telling, and that the FFVP grant schools have been able to increase spending on fruits and vegetables in large part because of the FFVP. A high-level analysis of the data shows that students are adopting healthier eating habits. Over the long term, this could translate into lower risks for obesity and increased overall health.

²⁸ Fernando Becerra adds valuable insight as someone who is close to the FFVP data and works closely with the FFVP grant schools. Responses to interview questions help bring context to the FFVP in Texas that the data alone is unable to do. Since Mr. Becerra has regular and ongoing communications with the FFVP grant schools, he has unique insight into what is “happening on the ground”. The full transcript of the interview is provided in Appendix A.

One of the strongest indicators of the success of the Texas FFVP is supply and demand. Because the demand for fruits and vegetables increased so rapidly, vending machines in some schools were removed.

Mr. Becerra also presented a realistic view of the weaknesses of the FFVP, why measuring plate waste can be problematic, and how much of the experienced success was attributable to the FFVP. His responses were objective and realistic.

Conclusion

This chapter discussed the setting of the research, presented the project's conceptual framework, developed the hypotheses linking childhood obesity reduction with the FFVP, and also included a general summary of the interview with Texas' FFVP program administrator. The next chapter operationalizes the hypotheses and discusses the data that were collected in order to test the hypotheses.

Program interventions are implied hypotheses. Because the measure for this study was indirect and imperfect, and based solely upon the data, one cannot know with certainty if the Texas FFVP intervention was a success.

CHAPTER 4. METHODOLOGY

Purpose

The purpose of this chapter is to explain how the FFVP was evaluated. The hypotheses are operationalized, and the comparison group and benchmarks are discussed. This chapter also discusses the data collected to test the hypotheses developed in chapter 3, and explains the design and statistical technique used to address the research questions. Using aggregated data to test the hypotheses, this study employs a quasi-experimental design that compares the treatment group (FFVP grant schools), and comparison group (non-FFVP grant schools).

Methodology

Quasi-experimental Design

The evaluation of the FFVP uses a quasi-experimental design that examined existing data – specifically, program records. The plate waste and expenditures for fruits and vegetables among FFVP grant schools in Texas were compared with comparable Texas schools that did not participate in the FFVP.

The research design selected for this study uses analysis of existing aggregated data from the Texas Department of Agriculture and twenty-one Texas schools. Non-FFVP schools were selected as a comparison group. The comparison group was selected so that it would approximate random assignment of subjects. There are three reports that each school participating in the FFVP must submit: these reports include forms, FND-106, FND-107, and FND-108. Form FND-108 provides financial information, and is the document used to collect the data.

According to Bingham and Felbinger (1999, 18), “the change in performance of the target group is measured against the performance of a comparison group.” The quasi-experimental method is used when randomization of comparison groups is not practical or not possible.

There are two advantages to using an analysis of existing aggregated data. First, the data are readily available from government sources and inexpensive. Second, the technique is unobtrusive and has no effect on the phenomena under study (Babbie 1995 as cited in Stone 2000).

Operationalization of the Hypotheses

The hypotheses are operationalized in table 4.1, below, and include the two dependent variables (the FFVP increases expenditures on fruits and vegetables in Texas schools, and the rate of fruit and vegetable plate waste is lower in FFVP grant schools), how each is defined, and their data source. The independent variable (The Texas FFVP), is defined, and then structured for the statistical analysis.

Table 4.1. Operationalization of the hypotheses			
Variables	Hypothesis	Definition	Data Source
<i>Dependent</i>			
Expenditures on fruits and vegetables	Hypothesis 1	Annual per capita spending on fruits and vegetables	FND-108. Required quarterly report sent from each FFVP grant school to the Texas Department of Agriculture, which details school-level spending on fruits and vegetables. Expenditure request form sent to comparable non-FFVP schools.
Percentage of plate waste	Hypothesis 2	Average annual percent of plate waste per student Benchmark of 12%	FND-107. Required quarterly report sent from each FFVP grant school to the Texas Department of Agriculture, which includes average plate waste per student for each school. 2005-2006, and 2006-2007. Waste request form sent to comparable non-FFVP schools as the FFVP schools, 2005-2006 and 2006-2007.
<i>Independent</i>			
Texas FFVP		(0, 1 variable) 0 = FFVP grant schools 1 = non-FFVP grant schools	FFVP grant schools (0) Texas Department of Agriculture Non-FFVP grant schools (1) Texas Education Agency

Independent Variable: Texas FFVP

This study included twenty-one Texas FFVP grant schools, and involves elementary, middle, and high schools.

Dependent Variables

H1: Expenditures on Fruits and Vegetables

Data on expenditure levels were collected from both groups for the 2005-2006 and 2006-2007 school years. These data are self-reported, and have the potential for

misreporting.²⁹ The difference in expenditures between the FFVP grant schools and non-FFVP grant schools measures the impact of the FFVP on fruit and vegetable expenditures.

Each of the participating FFVP schools is required to submit reports to the Texas Department of Agriculture. Those data are aggregated into a database, and organized by school. To obtain the data for the FFVP grant schools, a Public Information Act request was submitted to the agency. In order to collect the data for the non-participating FFVP schools, an information request form was sent to each school's food services director to complete and return.

Data on the FFVP schools were obtained from the Texas Department of Agriculture, Food and Nutrition Division records. Each FFVP grant school is required to report the actual dollars spent per quarter on fruits and vegetables (form FND-108).

H2: Percentage of Plate Waste

Data on plate waste were collected from both groups for the 2005-2006 and 2006-2007 school years. Plate waste is measured in terms of percentage of edible food remaining on the plate, and is averaged for each school. For the purposes of this research, 12% plate waste was set as the benchmark, and is not considered excessive (Buzby and Guthrie 2002). Form FND-107 is used by grant schools to report average plate waste in their quarterly reports to the Texas Department of Agriculture.

Plate Waste Benchmarks

A measure of plate waste is complicated to quantify, as all schools in Texas are not held to a common standard of plate waste, if it is measured at all. According to a

²⁹ Misreporting could be caused by a lack of understanding of the forms, not being trained in accurate data collection, the forms being a low priority, and competing priorities demanding attention.

report to Congress by Buzby and Guthrie (2002), a common benchmark measure of 12% does exist, and is measured by the percentage of edible food remaining on the plate when students have finished eating their lunch.

A 12% plate waste benchmark was used as the standard for comparison for this study. If a school's expenditures on fruits and vegetables increased, and plate waste was low, an indirect conclusion could be drawn that the students are actually eating the food. The same indirect principle could apply if plate waste was high, which could suggest that students are not actually eating the food.

The literature suggests that 12% plate waste is an appropriate benchmark (Buzby and Guthrie 2002). Plate waste above 12% would be considered high, and below 12% would be considered acceptable. As Buzbe and Guthrie (2002) point out, this benchmark was developed using plate waste measurements found at the consumer level, and meant to apply to the NSLP.

For this study, plate waste percentages for the treatment and control groups were above the 12% benchmark, and were only available for the 2005-06 school year. The average plate waste percentage for the FFVP schools was 20.71%, and ranged from as low as 2% to as high as 50%. The average plate waste percentage for the non-FFVP schools was 18.48%, and ranged from 2% to as 50%. This represents 8.71% and 6.48%, respectively, above the accepted benchmark.

Plate waste for the treatment group was reported for only one school year. Therefore, no reasonable conclusions can be drawn to determine if the FFVP affected plate waste levels, and it appears unlikely that alone it would affect plate waste levels.

The measure to evaluate the impact on fruit and vegetable consumption is indirect and imperfect, and is based upon expenditures and plate waste. An inference is made that if fruit and vegetable expenditures are high, and plate waste is low, then the FFVP increases fruit and vegetable consumption.

Summary of Data from Treatment and Comparison Groups

The raw data collected using the Public Information Request (treatment group) and Information Request Form (comparison group) are shown in table 4.2, below. Fruit and vegetable expenditures for the 2005-2006 and 2006-2007 school years are provided for each treatment and comparison group school. Also included in the table are each school’s plate waste percentages for the 2005-2006 school year, which is compared against the 12% benchmark.

Table 4.2. Raw data					
School	Type of School	Per capita exp. for 2005-2006	Per capita exp. for 2006-2007	Plate Waste	Plate Waste Benchmark
1	Treatment	\$7.58	\$58.40	25%	12%
2	Treatment	\$41.60	\$39.99	20%	12%
3	Treatment	\$6.89	\$46.41	50%	12%
4	Treatment	\$7.49	\$54.41	20%	12%
5	Treatment	\$25.21	\$28.77	20%	12%
6	Treatment	\$32.05	\$43.14	15%	12%
7	Treatment	\$17.51	\$40.53	35%	12%
8	Treatment	\$29.21	\$37.70	25%	12%
9	Treatment	\$41.28	\$28.61	25%	12%
10	Treatment	\$36.87	\$47.09	15%	12%
11	Treatment	\$5.25	\$44.14	15%	12%
12	Treatment	\$7.78	\$29.15	15%	12%
13	Treatment	\$12.04	\$41.29	5%	12%
14	Treatment	\$18.19	\$44.44	8%	12%
15	Treatment	\$15.06	\$43.37	40%	12%
16	Treatment	\$6.34	\$55.27	10%	12%
17	Treatment	\$21.70	\$35.56	2%	12%
18	Treatment	\$12.65	\$63.77	20%	12%
19	Treatment	\$25.93	\$36.45	5%	12%

20	Treatment	\$14.35	\$44.39	35%	12%
21	Treatment	\$9.45	\$47.42	30%	12%
22	Comparison	\$11.88	\$10.39	4%	12%
23	Comparison	\$25.75	\$25.00	18%	12%
24	Comparison	\$23.25	\$23.00	10%	12%
25	Comparison	\$5.82	\$8.82	50%	12%
26	Comparison	\$20.92	\$21.35	5%	12%
27	Comparison	\$48.80	\$49.95	25%	12%
28	Comparison	\$17.70	\$17.50	35%	12%
29	Comparison	\$29.50	\$29.64	35%	12%
30	Comparison	\$12.07	\$13.18	5%	12%
31	Comparison	\$6.97	\$8.46	38%	12%
32	Comparison	\$20.92	\$21.35	2%	12%
33	Comparison	\$10.49	\$10.40	4%	12%
34	Comparison	\$9.32	\$9.86	4%	12%
35	Comparison	\$12.00	\$9.00	20%	12%
36	Comparison	\$23.74	\$17.66	11%	12%
37	Comparison	\$26.29	\$26.83	25%	12%
38	Comparison	\$8.50	\$8.29	30%	12%
39	Comparison	\$24.79	\$26.66	20%	12%
40	Comparison	\$9.50	\$8.00	20%	12%
41	Comparison	\$16.94	\$10.14	10%	12%
42	Comparison	\$19.50	\$18.50	17%	12%

Constructing the Treatment and Control Groups

Treatment Group

The treatment group consisted of twenty-one FFVP grant schools in Texas. The selection of the FFVP grant schools was based upon solicitation and review of applications from interested schools, and upon established criteria in the law and guidance from the Food and Nutrition Service.

In order to gather the data available for the treatment group, a formal request under the Public Information Act (PIA) was made to the Texas Department of Agriculture. The three categories of information requested were, information on annual per capita spending per FFVP grant schools, annual average plate waste per FFVP grant school, and the number of students at the school.

Table 4.3 lists the treatment group schools, and each school’s respective school district and county. Of the twenty-five Texas schools that participate in the FFVP, four could not be included in this study because a comparable school could not be identified.

Table 4.3. Treatment group			
	Grant School Name	School District	County
T1	Bowie Elementary	Abilene	Taylor
T2	Canutillo Elementary	Canutillo	El Paso
T3	Como-Pickton School	Como-Pickton	Hopkins
T4	Lake Worth High School	Lake Worth	Tarrant
T5	Marfa Elementary	Marfa	Presido
T6	Miller Heights Elementary	Belton	Bell
T7	Morrill Elementary	Harlandale	Bexar
T8	Nixon-Smilely Elementary	Nixon-Smilely	Gonzales
T9	Nixon-Smilely High School	Nixon-Smilely	Gonzales
T10	Nixon-Smilely Middle	Nixon-Smilely	Gonzales
T11	Obadiah Knight Elementary	Dallas	Dallas
T12	Rangel All Girls High School	Dallas	Dallas
T13	Seven Hills Elementary	Northwest	Denton
T14	Splendora Middle School	Splendora	Montgomery
T15	Sundown Elementary	Katy	Harris
T16	Temple Elementary	Diboll	Angelina
T17	Valley View North Elem.	Valley View	Hidalgo
T18	West Texas Elementary	Plemons-Stinnett-Phillips	Hutchinson
T19	Westfield High School	Spring	Harris
T20	Wilma Magee Elementary	Calallen	Nueces
T21	Worsham Elementary	Aldine	Harris

Comparison Group

The Texas Education Agency (TEA) provided a database of comparable schools in Texas. The TEA Academic Excellence Indicator System’s database produces Comparable Improvement system directory reports. The comparable schools for this study were determined by six selection criteria:

- Percent economics
- Percent white
- Percent Hispanic

- Percent mobility
- Percent African-American
- Percent limited English Proficiency ³⁰

Comparable schools were not necessarily from the same school district or county as their respective corresponding treatment school. Table 4.4, below, lists the Texas schools selected as the comparison group for this study.

Table 4.4. Comparison group			
	Grant School Name	School District	County
C1	Long Elementary	Abilene	Taylor
C2	Worth Heights Elementary	Fort Worth	Tarrant
C3	Patton Springs School	Patton Springs	Dickens
C4	Scarborough High School	Houston	Harris
C5	Harry C. Withers Elementary	Dallas	Dallas
C6	Reilly Elementary	Austin	Travis
C7	Vestal Elementary	Harlandale	Bexar
C8	Joslin Elementary	Austin	Travis
C9	Del Valley High School	Del Valle	Travis
C10	Lincoln Middle School	San Angelo	Tom Green
C11	Leila P. Cowart Elementary	Dallas	Dallas
C12	Franklin Middle School	Abilene	Taylor
C13	Austin Elementary	Abilene	Taylor
C14	Hall Middle School	Weatherford	Parker
C15	Cedar Creek Elementary	Bastrop	Bastrop
C16	Sunset Valley Elementary	Austin	Travis
C17	Elodia R Chapa Elementary.	La Joya	Hidalgo
C18	Highland Park Elementary	Austin	Travis
C19	Eastern Hills High School	Fort Worth	Tarrant
C20	Bluebonnet Elementary	Bastrop	Bastrop
C21	George Clarke Elementary	Fort Worth	Tarrant

Table 4.5 shows the pairings for the treatment and comparison group schools. The pairing for the schools was determined by running TEA comparison reports for each

³⁰ These six selection criteria, provided by the Texas Department of Education's Academic Excellence Indicator System's database are available on the TEA website at: <http://www.tea.state.tx.us/perfreport/aeis/index.html>

treatment group school, which produced a list of comparable schools. The comparison schools were then selected based upon closest match to the treatment school.

Table 4.5. Treatment and comparison group pairings		
Treatment Group	Pair #	Comparison Group
Bowie Elementary	1	Long Elementary
Canutillo Elementary	2	Worth Heights Elementary
Como-Pickton School	3	Patton Springs School
Lake Worth High School	4	Scarborough High School
Marfa Elementary	5	Harry C. Withers Elementary
Miller Heights Elementary	6	Reilly Elementary
Morrill Elementary	7	Vestal Elementary
Nixon-Smiley Elementary	8	Joslin Elementary
Nixon-Smiley High School	9	Del Valley High School
Nixon-Smiley Middle	10	Lincoln Middle School
Obadiah Knight Elementary	11	Leila P. Cowart Elementary
Rangel All Girls High School	12	Franklin Middle School
Seven Hills Elementary	13	Austin Elementary
Splendor Middle School	14	Hall Middle School
Sundown Elementary	15	Cedar Creek Elementary
Temple Elementary	16	Sunset Valley Elementary
Valley View North Elem.	17	Elodia R Chapa Elementary.
West Texas Elementary	18	Highland Park Elementary
Westfield High School	19	Eastern Hills High School
Wilma Magee Elementary	20	Bluebonnet Elementary
Worsham Elementary	21	George Clarke Elementary
Note: A total of twenty-five schools in Texas participate in the FFVP. Of those twenty-five schools, four did not have a TEA corresponding school in the Academic Excellence Indicator System's database, comparable improvement report.		

Date Retrieval Issues

To gather data from the comparison group schools (non-FFVP schools), this study used an information request form accompanied by a cover letter from Dora Rivas, national officer for the School Nutrition Association and Division Manager of the Dallas Independent School District's (ISD) Food and Child Nutrition Services (appendix B). The information request form asked for concrete data based on records that have been maintained at corresponding non-FFVP grant schools.

Statistics

The study used a matched t -test to test for differences between the FFVP grant schools and the non-FFVP comparison schools. Comparison criteria include per capita expenditures on fruits and vegetables and the amount of plate waste.

To make the comparison, the same information requested from the treatment group schools was requested from the twenty-one comparison schools. Ms. Dora Rivas provided final approval to send the information request form with an accompanying cover letter that she signed. A copy of the material sent to the comparison schools is contained in appendix B.

Conclusions

This chapter discussed the methodology selected to evaluate the FFVP in Texas. Existing data were used from the treatment and comparison schools to test whether participation in the FFVP will increase expenditures on fruits and vegetables in Texas schools, and whether plate waste will be lower in FFVP schools. Using a paired-sample t -test, the treatment and comparison groups were compared and found to be equivalent. The next chapter describes the results of the three paired-sample t -tests.

CHAPTER 5. RESULTS

Purpose

This chapter tests the research hypotheses and assesses the FFVP. The study used a quasi-experimental design pairing treatment and comparison group schools. In order to test the hypotheses that the FFVP will increase expenditures on fruits and vegetables in Texas schools and that plate waste will be lower in FFVP schools, three separate paired-sample *t*-tests were performed. In addition, the FFVP schools were compared with standardized benchmarks.

Paired *t*-Test Results

Table 5.1 provides the results of the data analysis, which reveal that between the FFVP schools and non-FFVP schools in the 2005-2006 school year, there was no significant difference in fruit and vegetable expenditures, nor was there a significant difference in the percentage of plate waste. For the 2006-2007 school year, however, a significant difference was found between FFVP schools and non-FFVP schools in fruit and vegetable expenditures.

Table 5.1. Results of paired <i>t</i> -test statistical procedure		
Dependent Variable	Pair 1: FFVP and non-FFVP schools (2005-06)	Pair 2: FFVP and non-FFVP schools (2006-07)
<u>Expenditures on Fruits and Vegetables</u>		
Treatment group (FFVP) Comparison group (non-FFVP)	N=21 N=21	N=21 N=21
Mean		
FFVP grant schools	\$18.78	\$43.35
non-FFVP grant schools	\$18.32	\$17.71
Mean Difference	\$0.47	\$25.63
<i>t</i> value	.150	8.930
<i>p</i> value	.882	.000
	Pair 3: FFVP and non-FFVP schools (2006)	Benchmark of 12%
<u>Percentage of plate waste</u>		
Treatment group (FFVP) Comparison group (non-FFVP)	N=21 N=21	% Difference
Mean		
FFVP Grant Schools	20.71%	
non-FFVP Grant Schools	18.48%	
Mean Difference	2.24	
<i>t</i> value	.530	
<i>p</i> value	.602	

H1:

The FFVP will increase expenditures on fruits and vegetables in Texas schools

For FFVP schools the average fruit and vegetable expenditure per student for the 2005-2006 school year was \$18.78, and the average was \$18.32 for the non-FFVP schools. The difference of \$0.47 between the FFVP and non-FFVP schools is not considered significant.

For the 2006-2007 school year the average fruit and vegetable expenditure per student for the FFVP schools was \$43.35, and was \$17.71 for the non-FFVP schools. The difference of \$25.63 between the FFVP and non-FFVP schools is significant, and suggests that with adequate funding, expenditures on fruits and vegetables will increase.

H2:

Fruit and vegetable plate waste will be lower in FFVP schools

The average percentage of plate waste per student for the 2005-2006 reporting year for the FFVP schools was 20.71%, and was 18.48% for the non-FFVP schools. A difference of 2.24% between the FFVP and non-FFVP schools is not significant difference. The Texas Department of Agriculture collected plate waste data only for 2006. Not surprisingly, based solely upon plate waste percentages, it is difficult to draw a concrete conclusion about the effects of the FFVP on plate waste levels. It is notable, however, that the percentage of plate waste at FFVP and non-FFVP schools is almost identical, suggesting that the average percentage of plate waste per student is around 20% throughout Texas.

In essence, neither the 2005-2006 fruit and vegetable expenditures nor the plate waste percentages differed significantly between the FFVP schools and non-FFVP

schools. Regarding expenditures alone, it appears that one year provided sufficient time for the FFVP to change spending levels in the program schools.

Unfortunately, since there was no measure of plate waste for the 2006-2007 reporting year, it would be premature to draw conclusions about the effects of the FFVP on plate waste levels, and to connect actual consumption levels.

The average plate waste for the treatment group schools was 21%, and included an average variance from the 12% benchmark of + 9%. The average plate waste for the comparison group schools was 18%, and included an average variance from the benchmark of + 6%.

Conclusion

This chapter described the results of this quasi-experimental research study. Tests showed that there was no significant difference between FFVP and non-FFVP schools in expenditures or plate waste in 2006, but does show that there was a significant difference between the FFVP and non-FFVP schools in expenditures in 2007.

CHAPTER 6. SUMMARY AND CONCLUSION

Research Summary

The purpose of this research was to evaluate the impact of the FFVP on fruit and vegetable consumption in Texas schools. The measure for this evaluation was indirect and imperfect. Chapter 1 introduced the research topic, and chapter 2 provided a review of the literature, which included a comprehensive overview of the obesity issue.

Chapter 3 discussed the setting of the research, and developed the project's conceptual framework. Two hypotheses were developed. Childhood obesity is linked to diet. Increased consumption of fruits and vegetables is linked to healthy weights among children. Hence, the FFVP should be one strategy in the larger policy goal of healthy children (including healthy weight). The chapter also included a general summary of a one-on-one interview with Texas' FFVP program administrator. The interview attempted to bring perspective and context to the overall FFVP picture in Texas that might otherwise be missed by using only data.

Chapter 4 described the research methodology for this study, and included a discussion of the quasi-experimental design, the operationalization of the hypotheses, and the methodology developed to address the research question. The independent and dependent variables, data from the treatment and comparison groups, the composition of the treatment and control groups, data retrieval issues, and statistics were discussed. In order to describe the research methodology, analyses of existing data on expenditures (treatment and comparison groups) and plate waste (treatment group) were used, and self-reported plate waste estimates were requested using a standardized form (comparison

group). A paired *t*-test was performed to compare the treatment group and the comparison group.

Chapter 5 detailed the results of the statistical analysis. The results showed that for 2006, there was no significant difference between the treatment group and control group in fruit and vegetable expenditures or plate waste. The results also showed that for 2007, there was a significant difference between the treatment group and control group in fruit and vegetable expenditures.

This chapter, chapter 6, summarizes the conclusions drawn from the results presented in chapter 5, and makes suggestions for future research. This chapter also communicates how this study provides an opportunity to fill gaps in the existing research, as the only other published FFVP assessment was conducted in Mississippi in the 2004-2005 school year.

Limitations

This research had three primary limitations. First, because neither plate waste nor expenditure data measure the actual consumption of fruits and vegetables, it is impossible to draw conclusions about children's actual fruit and vegetable intake. A loose connection can be made between increased consumption of fruits and vegetables and decreased obesity rates; however, in this research, that link is imperfect and indirect, and should be noted.

Second, measurement presented a limitation. Amongst the schools used in the control group, there was no consistency in how fruit and vegetable expenditures are measured, nor was there consistency in how plate waste is measured. For the purposes of this research, this inconsistency within the control group renders any finding suspect.

Third, inventory waste occurs prior to service, but no data are available. In speaking with the food service manager for the Weatherford ISD, this researcher learned that food waste other than plate waste must be examined. Some fruits and vegetables are discarded because they go bad before they can be served to the children. A school can spend money on fruit and vegetables, yet never serve the food because it spoils.

Although not necessarily a limitation for the research, it must be noted that some schools were able to provide data on expenditures to the penny, whereas others were unable to provide similar data to the nearest dollar. This disparity is due to the variations between the schools in their record keeping and information technology systems used to specify financial figures.

Suggestions for Future Research

This study was unable to draw concrete and accurate conclusions about the level of actual fruit and vegetable consumption. An alternative research design could be developed to decrease indirect and imperfect conclusions and provide for greater accuracy in determining actual consumption levels. All future studies should be able to consistently measure fruit and vegetable expenditures and plate waste. Unfortunately, this study erroneously assumed that all schools use similar techniques in calculating fruit and vegetable expenditures, and to measure plate waste.

Since determining levels of obesity and ultimately reducing obesity is a shared vision and goal, a new approach might be more effective. Developing the treatment and control groups based on school level (elementary, middle, or high school) and fruit and vegetable expenditures, and then comparing the BMI of the children in each group, could provide a clearer picture of whether a school's level of expenditure on fruits and

vegetables affects children's BMI. Vending machine policies should be consistent across schools. The treatment group must have fruit and vegetable expenditures of no less than 55% of total food purchases, whereas the control group would have fruit and vegetable expenditures of 55% or less of total food purchases. Each semester for at least two consecutive years, the BMI of the children in each group should be calculated.

A study that looks at school food budgets on fruits and vegetables and BMI rates could reduce some of the problematic reporting issues of this particular study. It could be hypothesized that schools that spend a greater percentage of their overall food budget on fruits and vegetables would have students with healthy BMI levels.

Suggestions for Policy Makers

The findings of this research are inconclusive. This, however, should not discourage policy makers from developing policies that encourage increased spending on healthier food products, fruits and vegetables in particular. The FFVP is a viable option for increasing fruit and vegetable consumption in school-age children in Texas, and for reducing the prevalence of obesity. This research effort, along with overwhelming support from the literature, suggests this claim warrants attention.

The literature suggests four policy strategies to provide healthier foods at Texas schools. They are as follows:

1. Allocate budget dollars for expanding the FFVP to more Texas schools.
2. Encourage partnerships between local growers and school districts to provide fresh produce to schools.
3. Provide a creative array of incentives for schools that spend a larger percentage of their food budget on fruits and vegetables.

4. Limit or restrict vending machines in schools.

An important component of the overall obesity reduction plan is to consider long-term costs. As the population in Texas continues to grow with an aggressive trajectory, with the Hispanic population contributing a significant percentage of this increase, a real threat to containing and/or controlling Medicaid costs looms ominously over the coming decade. The number of obese children filing Medicaid claims for ailments directly attributed to their obesity continues to rise. This forecast holds as the Texas population grows and the prevalence of childhood obesity increases.

In conclusion, the FFVP should be expanded to more schools in Texas, as the program shows promising signs of success in reducing the prevalence of childhood obesity.

APPENDIX A. INTERVIEW TRANSCRIPT

Interview with Fernando Becerra, FFVP Program Manager for Texas

Q: Looking at the data the FFVP grant schools returned, what does it tell you about the program in terms of overall success?

The data is telling, however, the data alone will not sufficiently provide a good picture of how successful the FFVP has been. Starting with the data, we do see that the FFVP grant schools are in fact able to increase their spending on fruits and vegetables. The critical component to the actual success of the FFVP is children's adoption of healthier eating, which translates into lower risks of obesity.

One of the strongest indicators of the success of the FFVP in Texas can be seen through witnessing supply and demand in action. Of the 25 FFVP grant schools, four had their vending machines removed because the demand for the fruits and vegetables were so high that it dropped demand for products in vending machines. Literally, the children in these four schools preferred the selections of fresh produce far more than they did the selections of vending machines snacks.

Central Elementary School students created an entire recipe book of healthy meals and snacks. The publication is quite remarkable considering these were children at the elementary age-level who conducted the research, made the meals based upon their recipes, wrote, edited, and created a bound color publication of about 75 pages. One of the most innovative approaches is at Miller Heights Elementary School. The students, under the leadership of Reba Baker, Child Nutrition Director, have a vegetable garden that they themselves maintain. From compost making, planting, maintaining, and harvesting, the students develop unique insight into healthy diets. Not only do the

students maintain the garden, the school cafeteria uses the produce grown in that very garden in the food served to the students during lunch.

At Splendora Elementary School, two innovative approaches are being used. Students are offered freshly made juices using fruits and vegetables that are directly in front of them. The students are offered a choice of what type of juice drink they want, and the preparer simply takes the student's produce options and makes the juice drink right there in front of the student.

Next some of the students at Splendora take it upon themselves to create weekly "FFVP Buzz" flyers. Each week a different fruit, vegetable, or herb is highlighted and provides interesting and useful information about that week's produce or herb, and distributed to the students during lunch. Information such as history, vitamins and minerals, health benefits, and even its commercial influence is included.

Q: What about the program in terms of weaknesses and areas of opportunity or improvement?

The primary weakness should not be viewed as a weakness at the school level. What the primary concern and where there is opportunity is with funding levels. Because a finite amount of dollars are allocated to participating states, a limited number of schools are ultimately chosen to participate in each of the states that do receive funding. In Texas, over 300 schools submitted grant applications for a chance to be one of the 25 FFVP grant schools.

Q: Measuring plate waste can be problematic. Were recommendations provided to the FFVP grant schools to create a standard measurement technique for plate waste? Unfortunately no recommendations were made.

Q: Previous studies on plate waste indicate that 12 percent plate waste is normal.

What are tactics or strategies the FFVP grant schools have used to work towards keeping plate waste at or below 12 percent?

One strategy being used in some schools is to use the fruits and vegetables themselves in the math and science classes, with structured and guided classroom instruction. The students receive instruction with the very produce they will later consume. This has shown some degree of success, but may not be the most effective strategy to use. A certain amount of plate waste is inevitable. The challenge food service directors have is how best to manage and control excessive plate waste.

Q: Plate waste ideally should be as low as possible. What would be a reasonable plate waste benchmark that schools can use to gauge if students' fruit and vegetable consumption is enough?

Mr. Becerra did not have a response for this.

Q: When looking at the data as a whole (reimbursement figures and plate waste), can a reasonable conclusion be drawn that the students at the students at FFVP grant schools are increasing their consumption of fruits and vegetables?

There is no doubt that the students' consumption of fruits and vegetables at the FFVP grant schools is high. The data received from the participating schools, along with ongoing and regular communications with the various food service directors provides a very clear picture of increased fruit and vegetable consumption, and adoption of better and healthier diets.

Q: How much of this success (students' increased consumption of fruits and vegetables and adopting healthier diets and eating habits) do you think is attributable to the FFVP?

This depends on the school district. Some FFVP grant schools had a head start and were already providing high levels of fruits and vegetables. On the other hand, many schools simply did not have adequate funding to purchase sufficient quantities of fruits and vegetables, and therefore increased consumption of fruits and vegetables and adoption of healthier diets and eating habits is due in large part by the FFVP.

The FFVP grant requires each school receiving funds to be creative with how fruits and vegetables are served. What happened is that food service directors were equipped financially to purchase more fruits and vegetables for their respective schools, and to initiate effective strategies that encourage consumption.

Q: What is it about the FFVP that makes it so successful?

The FFVP allows food service directors to do what they have always wanted to do in the first place, which is to provide healthy meals for their students. Schools with limited financial resources, apart from FFVP grant funding, have little choice but to let their dollar go as far as it possibly can. The FFVP bridges the gap between what the food service directors want to do, which is provide healthy meals, and what they are financially able to do.

Q: You and I both would agree that the FFVP, short-term, could be an effective way change children's diet and eating behaviors. Speaking to the long-term, can you talk to how the FFVP would affect obesity rates?

Developing healthy eating habits is critical in reducing childhood obesity; it is as simple as that. Students must develop good eating habits that will carry over into adulthood, and the FFVP has been instrumental in helping children adopt much healthier eating habits. The FFVP is also helping the students make life applications to what they are learning at the schools. In some of the schools reports are coming back that parents are making significant dietary changes at home as well. This is important because the goal is to have consistency in the diet and for it not to be healthy only at school. One food service director commented that, “this is an effort to address the issue of obesity in our children. A program like this (FFVP) is a step in the right direction. We are constantly being told that there is a fire. This program is the water.”

APPENDIX B. REQUESTS FOR DATA

Letter accompanying Information Request Form

Dear fellow Texas School Nutrition professionals:

Your assistance is needed in gathering information related to increasing funding for expansion of the Fresh Fruit and Vegetable Program (FFVP) to more Texas schools. As you are aware, Texas currently has 25 FFVP grant schools. Providing an assessment of the program underway could provide the needed information that could help justify additional resources.

I am encouraging you to assist graduate student Tommy Boukhris from Texas State University who is working on an applied research project for his Masters of Public Administration/Public Affairs degree. His project attempts to gather more information to support funding for the FFVP program. Please assist by completing the enclosed survey and returning it no later than Monday, June 4, 2007. If you have any questions regarding this project, please feel free to contact Tommy Boukhris at (512) 891-0879, or at (512) 458-7111, ext. 2780. He can also be reached via the following email address: tommy.boukhris@txstate.edu. I believe your help is important, and I think it will make a difference for our K-12 students throughout Texas.

Respectfully,

Dora Rivas
 Division Manager
 Food and Child Nutrition Services

Information Request Form

Name of ISD and School				
	Average annual spending on fruits and vegetables for school (dollars)	Average Daily Participation	Average spent per student based on Average Daily Participation	Average annual plate waste per student (percentage)
Year				
2005-2006				
2006-2007				

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