SCREENING FOR ACANTHOSIS NIGRICANS: ANALYZING THE CORRELATION BETWEEN SOCIO-ECONOMICS AND ACANTHOSIS NIGRICANS

THESIS

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TABLE OF CONTENTS

TABLE OF CONTENTS, CONTINUED

LIST OF TABLES

Page

LIST OF TABLES, CONTINUED

Page

LIST OF FIGURES

Page

ABSTRACT

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Contemporary research pertaining to the prevalence rate of schoolchildren with a skin pigmentation condition called acanthosis nigricans demonstrates that causal factors, such as ethnicity and obesity, can make children more at-risk for obtaining this condition which results from hyperinsulinemia. Currently, states, such as Texas, require school nurses to screen certain schoolchildren for skin markers on the nape of the neck and other skin fold locations so these children may be referred to a primary care physician for appropriate diagnosis and treatment.

While research work is abundant in assessing genetic and ethnic causal relationships among known populations experiencing this skin condition, no research exists that measures the correlation of socio-economics among the population of children with acanthosis nigricans. Socio-economics can influence an individual's lifestyle and behavior and it can play a role in effecting a person's diet, nutrition, and overall health status putting children more at-risk in obtaining acanthosis nigricans. The purpose of this thesis is to determine if a correlation exists between socio-economic factors and schoolchildren with acanthosis nigricans. The thesis factors out aspects, such as ethnicity, in the causal relationship in order to determine if children of a lower socio-economic status may be more at-risk in obtaining acanthosis nigricans than children of a higher socio-economic status. The thesis purports this position by first analyzing contemporary research on acanthosis nigricans to defend the position that research is absent with relation to the thesis' hypothesis. The thesis sets forth its analysis by relying upon primary data resulting from a case-control study involving schoolchildren and their parents in both urban and rural populations of Texas and utilizes secondary data sources for cross-comparison of its primary data measuring socio-economic status. The conclusion of this research and analysis demonstrates that correlations exist between socio-economic factors and the prevalence of acanthosis nigricans, and this data supports the notion that children of lower socio-economic status could be more at-risk of obtaining acanthosis nigricans than those children of higher socio-economic status in lieu of the socio-economic factors effecting their overall health status.

CHAPTER I

INTRODUCTION TO THE STUDY

Scientific research can provide useful analysis of an issue using data to yield one position or another. The validity of the scientific research depends greatly on the sample size of a study population, the methodology employed to analyze the study population, and the manner in which the investigation controls for factors that directly or indirectly attribute to the condition under analysis. When studying the effects of disease or health conditions upon a population, it is important to control for any causal factors in order to best assess the correlated relationships of those aspects under study. Epidemiology studies the distribution and factors effecting this distribution of a particular disease in a given population (Gordis, 2000). The basic premise for epidemiological surveillance is rooted in the notion that each individual has certain characteristics, which influence their predisposition towards or against obtaining a certain illness or condition.

In lieu of this basic aspect of epidemiology, research tends to focus on the individual specific traits that are easy to measure, or on aspects of a population that are consistent with national uniform standards for measuring criteria within a given ethnic population. For example, the Centers for Disease Control and Prevention utilize standards for assessing anthropometrics and calculating the body mass index (BMI) for

children (Centers for Disease Control and Prevention, 2005). Using standards to measure and assess aspects of a general population helps identify and select groups of individuals, or cohorts, that can further studies based on the similarities or dissimilarities of the study subject's traits in comparison to the total population. Using these techniques scientists can analyze variations in particular attributes of study subjects and their cohort populations to determine their correlative relationship to obtaining a certain condition, like a disease.

Examples in the way scientists study particular nuances among cohort populations include measuring observable variations in asthma care by race and ethnicity among Medicaid children (Shields, Comstock, & Wiess, 2004), and understanding the association of acanthosis nigricans with hyperinsulinemia compared with other factors associated with the risk for obtaining Type 2 Diabetes among Cherokee Indians (Stoddart, Blevins, Lee, Wang, & Blackett, 2002). The numerous ways in which scientists and observers can approach their analysis to study a certain condition creates great variation in the types of investigations conducted on populations. One of the most popular areas of interest by the global scientific community involves studying health-related conditions, specifically obesity.

The Problem and Its Importance

Obesity is a growing global problem. In 1997, the World Health Organization declared obesity as the greatest threat facing humankind with the problem spreading throughout many populations of the European countries, United States, United Kingdom,

and Asia. In 2000, the United Kingdom recorded obesity-related deaths equaled the approximate number of deaths attributed to lung cancer (Speakman, 2003). In China, childhood obesity is reaching alarming proportions reaching nearly 28 percent of the population (Cheng, 2004). Obesity-related expenditures in the United States for 2000 calculated by the Centers for Disease Control and Prevention total $117 billion (Witt, 2003) compared to £500 million (approximately $962,449,086 in U.S. dollars) in the United Kingdom (Speakman, 2003). Obese people are at-risk of developing high blood pressure, coronary heart disease, diabetes, and some forms of cancer (Kopelman, 2000). Domestically, obesity is growing at an alarming rate, particularly among young people. In the United States, around 9 million adolescents and children are obese or overweight (Witt, 2004). According to data gathered and analyzed by the U.S. Centers for Disease Control and Prevention's National Center for Health Statistics, this translates into nearly 15 percent of adolescents and children between ages 6 and 19 who are obese or overweight (Centers for Disease Control and Prevention, 2004). The American Heart Association reported in 2004 that 10 percent of the U.S. children between ages 2 and 5 are overweight (American Heart Association, 2004). Obesity prevalence is notable among ethnic populations and is most prominent in African American children (Speakman, 2003) and Hispanic children (Mei, Scanlon, Grummer-Strawn, Freedman, et al., 1998).

Several recent studies indicate that low-income Hispanic children are the cohort most at-risk of becoming obese (Mei, et al., 1998) (Ogden, Flegal, Carroll & Johnson, 2002). The trend in this ethnic population as well as others is troubling since overweight-ness in children and adolescents increases their probability of obesity in adulthood (Guo,

Wei, Chumlea, & Roche, 2002) (Dietz, 1997) (Dietz, 1998) (Melgar-Quinonez & Kaiser, 2004). This data reveals a troubling trend among the Hispanic population and warrants further research into the factors attributing to the increasing prevalence of obesity and associated conditions.

Lifestyle and behavior have a direct impact on health status. The correlation between the increasing prevalence of obesity and obesity-related conditions warrants surveillance, particularly in lieu of trends among ethnic populations. One health-related condition with a high correlative incidence rate to obesity is diabetes mellitus. Diabetes mellitus occurs as either insulin-dependent diabetes mellitus (type 1 diabetes), or it occurs as non-insulin dependent diabetes mellitus (type 2 diabetes). Type 1 diabetes accounts for 10 to 15 percent of all cases of diabetes mellitus (Berkow & Fletcher, 1992), and it is characterized by hyperglycemia and a propensity for diabetic ketoacidosis. Type 1 diabetes is not associated with obesity and results from genetic conditioning (Berkow & Fletcher, 1992), and it usually occurs in children and adolescents. Type 2 diabetes on the other hand is associated with obesity and is characterized clinically by hyperglycemia that is not associated with a propensity to develop diabetic ketoacidosis. Type 2 diabetes occurs in people over 30 years of age and can occur in children and adolescents. However, recent research demonstrates an alarming increase in Hispanic children developing type 2 diabetes (Neufeld, Raffel, Landon, Chen., & Vadheim, 1998). While obese children are susceptible to developing type 2 diabetes, systemic, compensatory conditions associated with type 2 diabetes occur which provide a manner for detecting the early onset of the disease.

Acanthosis nigricans (AN) is a cutaneous marker associated with systemic disorders such as hyperinsulinemia, insulin resistance, and obesity. AN is clinically characterized by dark, coarse thick skin (Stoddart, et al., 2002), and feels like velvet when touched. While there is not a consensus on the cause of the dark coloration (Stoddart, et al., 2002), it is agreed that AN is associated with type 2 diabetes, hyperinsulinemia, insulin resistance, and obesity (Stoddart, et al., 2002)(Mukhtar, Cleverley, Voorhees, & McGrath, 2001)(Hirschler, Aranda, Oneto, Gonzalez, & Jadzinsky, 2002)(Stuart, Gilkison, Smith, Bosma, Keenan, & Nagamani, 1998). Additionally, research supports ethnicity as a determinant for AN prevalence for people with hyperinsulinemia (Stuart, Gilkison, Smith, et al., 1998). These research findings and the noticeable increase in the incidence rate for type 2 diabetes in children, particularly Hispanic-Americans, associated with the increasing incidence rate for obesity is forcing many state governments to evaluate implementing screening programs to identify at-risk children with the disease.

In Texas, for example, the legislature passed a law authorizing the University of Texas-Pan American to develop and implement a program aimed at screening certain schoolchildren for acanthosis nigricans. While this state initiative uses AN as the screening marker, scientists at the Centers for Disease Control and Prevention currently oppose using AN as sole screening factor for predicting type 2 diabetes on the grounds that there is not sufficient evidence to support the correlation that children with AN have type 2 diabetes (Centers for Disease Control and Prevention's website, 2004). Research is abundant associating obesity and AN and associating AN with ethnicity (Stuart, Gilkison, Smith, et al., 1998) (Stoddart, et al., 2002) (Ramachandran, Snehalatha,

Satyavani, Sivasankari, & Viswanathan, 2003). However, there is no investigative research assessing the correlation between socio-economics and AN prevalence.

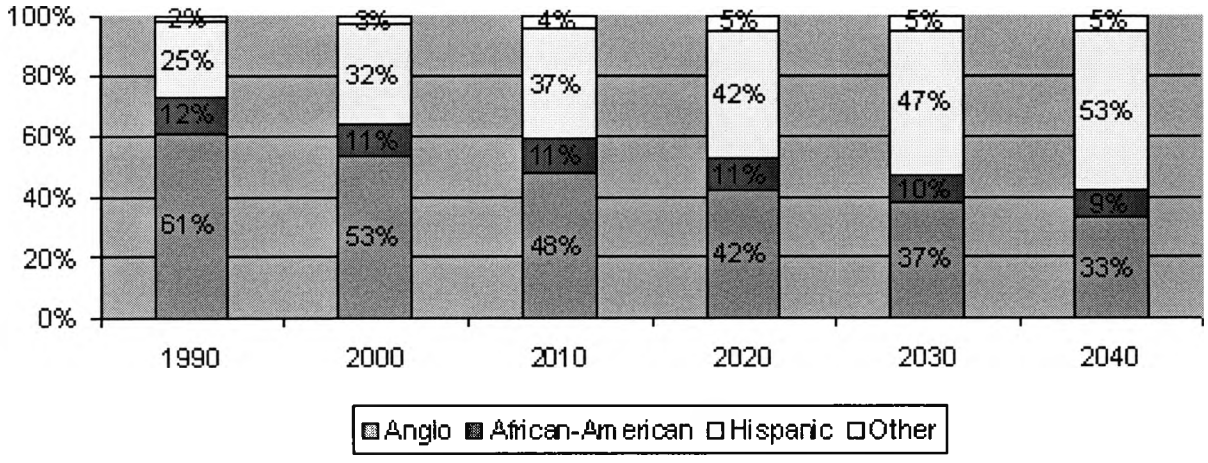
Hypothesis and Experimental Design

In lieu of the unavailable research associated with studying the correlation between AN and socio-economics, this thesis seeks to measure whether a correlation exists. The thesis establishes the hypothesis that a strong correlation exists between children of lower socio-economic status and AN prevalence. Lifestyle factors and ethnicity factors can influence the predisposition for AN prevalence, and therefore this thesis controls for these variables and their effect modification. Additionally, the thesis obtains primary data using survey instruments for collecting data representative of socio-economic factors related to nutrition, lifestyle, access to health care, and income, and compares this data to secondary data related to socio-economic information, when available. The secondary socio-economic data originates from the school district's use of student household income level eligibility criteria for the Texas Free and Reduced School Lunch Program. The data collected for this research project includes sample populations from both urban and rural Texas. The study subjects include schoolchildren in grades 3, 4, and 5, and their parent(s), or guardian(s). The statistical methods employed for analysis involves use of bivariate analysis and matched pair analysis using anthropometric criteria, ethnicity, and gender for matching variables. Case subjects include schoolchildren screened positive for AN. Control subjects include schoolchildren without AN.

How Hypothesis and Design Relate to the Problem

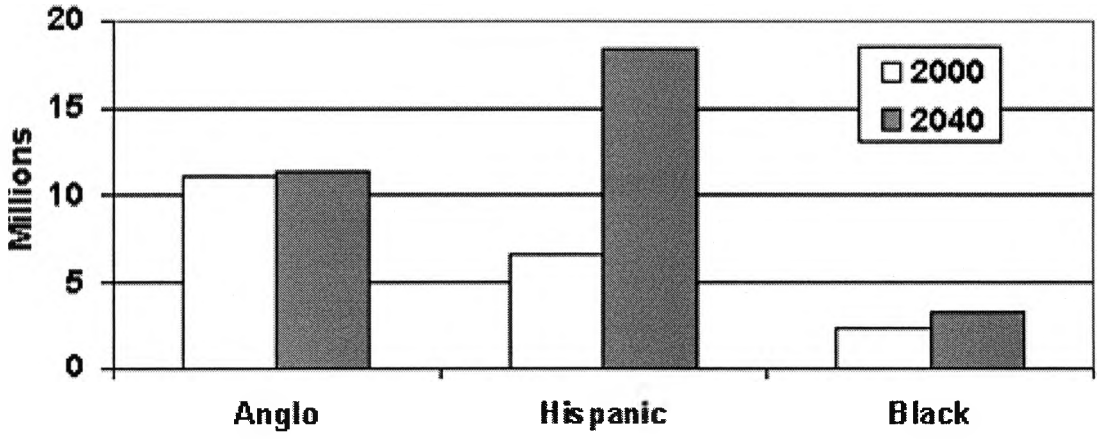
The investigation to measure the correlation between socio-economics and prevalence is a novel approach to further address ethnic trends associated with type 2 diabetes and obesity. Texas has a growing Hispanic population comprising 32 percent of the total population in 2000 (U.S. Census Bureau, 2005) and this population is expected to increase to 37 percent by 2010 (Texas Health & Human Services Commission, 2002). Figure 1 below depicts the projected proportions for race and ethnicity for Anglos, African Americans, and Hispanics, and demonstrates the increasing proportion of the Hispanic population over the next decades. Figure 2 depicts these population trends in millions.

Figure 1 Proportion of Texas' Population by Race & Ethnicity



Source: Texas Health & Human Services Commission, 2002.

Figure 2 Projected Texas Population Trends in Millions 2000 to 2040



Source: Texas Health & Human Services Commission, 2002.

In 2000, the Hispanic population of Texas accounted for 53 percent of the state's poverty population, 57 percent of the uninsured, and 50 percent of the total Medicaid population (Texas Health & Human Services Commission, 2002). The current and

future effect of the Hispanic population on state government resources is great. With the increasing prevalence of obesity and type 2 diabetes among certain ethnic populations, government-sponsored programs will need to effectively identify all of the aspects attributing to these burgeoning problems. Socio-economic factors may possess correlative relationships to obesity and type 2 diabetes and this aspect needs further analysis if lawmakers intend to maximize state investments to fund public health programs. It is therefore the goal that the research resulting from this thesis' investigative study will help yield a better understanding of the importance of socio-economics on childhood acanthosis nigricans and its association with obesity.

Theoretical Implications of the Hypothesis' Study

The results from this thesis' investigation may have long-term advantages for public policy makers and epidemiological surveillance. If a correlation is observed through the analysis of this thesis' investigation, then major changes need to be made in the manner in which public schools address the nutritional programs of the reduced and free lunch program and the method for screening at-risk schoolchildren for obesity-related conditions. The correlative data from the thesis' investigation may yield the importance of socio-economic relationships upon prevalence, and this data may help heighten the need for revamping the state's screening program. In addition to promoting further policy changes to the state's AN screening program, the thesis may support the need for more efforts to help invoke a cultural revolution on the manner in which parents become more responsible for their children's lifestyles and behavior. The data may also demonstrate that prevention through enhanced screening programs, such as in Medicaid and public education, can yield substantial savings if the state better directs its

investments to address the problem. For example, a child on Medicaid screened as having AN can improve their health status through increased physical activity and better nutrition. If an obese child on Medicaid with AN improves their health status prior to adolescence, then future Medicaid expenditures are offset and averted as a result of this screening and treatment since it is less expensive to care for a child without a chronic condition, such as health problems resulting from childhood obesity. Additionally, government and community programs aimed at addressing the importance of socio-economics on the health status of children can help invoke a paradigm shift in the way parents view the effects of the lifestyle on their children's overall health. Junk food, which is high in fat and hydrogenated oils, is generally less expensive than healthier foods. By making the public more aware of the role socio-economics plays on obesity and diabetes, school districts may deter allowing snack food vendors to sell their products in the school cafeteria. These examples are simply a few of the long-term desired outcomes that may be gained by demonstrating a correlative relationship between AN and socio-economics.

How Hypothesis Relates to Previous Work

While contemporary research relating to AN documents ethnic trends and genetic predisposition (Stuart, Gilkison, Smith, et al., 1998) (Stoddart, et al., 2002) (Ramachandran, et al., 2003), research is absent on demonstrating a measurable correlation between socio-economic factors and AN prevalence. In one study describing the onset features of pediatric type 2 diabetes among Hispanic people the investigation notes the sample population comprised mainly of uninsured and working poor Hispanic

families (Neufeld et al., 1998). The findings from international research suggest a trend of higher prevalence of type 2 diabetes occurring in children living in developing countries (Ramachandran, et al., 2003). Contemporary research findings on obesity and AN mainly focus on the influence of biological factors and effects of parenting factors on diet (Melgar-Quinonez & Kaiser, 2004) (Benton, 2004), and these studies do not focus specifically on the correlative relationship between AN prevalence and socio-economic factors. Therefore the analysis of this thesis' hypothesis is complimentary to contemporary research and is intended to augment further comprehensive investigations studying the correlation between socio-economics and prevalence.

How Hypothesis Approach will Address Problem

Through the analysis of socio-economic factors relating to health status and obesity, the thesis intends to heighten awareness of the importance of these variables in schoolchildren developing AN. While a correlation between socio-economics status does not necessitate a causal relationship associated with developing AN, it is the goal of this thesis to demonstrate the importance of controlling for socio-economic factors effecting childhood obesity so that government programs can be modified to improve the approach and effectiveness for obesity surveillance and treatment. By improving the existing AN and obesity-related screening programs, it is hoped that the prevalence rate for obesity and AN will reduce and the overall health status of Texas schoolchildren will improve and, as a positive consequence, help reduce the public's burden for funding the potential long-terms costs associated with caring for people with these chronic conditions.

CHAPTER II

BACKGROUND AND CONTEMPORARY RESEARCH

Description of Acanthosis Nigricans

Obesity generally precedes non-insulin dependent diabetes mellitus (Stuart, Gilkison, Keenan, & Nagamani, 1997), which is associated with a skin condition known as acanthosis nigricans. Many contemporary studies related to childhood obesity and diabetes involves studying the prevalence of acanthosis nigricans (AN); a condition characterized by a dark and thick keratin layer of the skin predominantly found on the neck and axillae. AN can appear prior to the onset of glucose intolerance (Gilkison, & Stuart, 1992), and the skin trait is often associated with hyperinsulinemia (Burke, Hale, Hazuda, and Stern, 1999) (Stoddart, et al., 2002) (Gilkison, & Stuart, 1992) (Saltmarsh, 2001) (Mukhtar, Cleverly, Voorhees, & McGrath, 2001). AN was first identified and described in 1889 (King-Tryce, Garza, & Ozias, 2002), and was only recently classified according to its degree of severity on a scale of zero to four (Burke, Hale, Hazuda, & Stern 1999). Physiologically, AN feels velvety to human touch and classification of severity is based according to the visible thickness of the pigmentation upon the person's neck (see Appendix E for the grading scale). The severity of AN degree is variable and may correspond to the degree of insulin resistance (Levine, N., 2002). In addition to the neck and axilla (armpit) areas, AN is found on the groin area and other physiological

locations where the skin folds or bends. Screening children for AN is a useful technique, because it is a marker for detecting hyperinsulinemia and insulin resistance (Stoddart, et al., 2002) (Stuart, Gilkison, Keenan, & Nagamani, 1997) (Gilksison & Stuart, 1992) (Richards, Cavallo, Meyer, Prince, et al., 1985) (Reiman, 2000).

Previous Research Strategies

In addition to research demonstrating a positive correlation between AN and hyperinsulinemia, further research has shown AN to be a risk-factor for non-insulin dependent diabetes mellitus, or type 2 diabetes (Stuart, Gilkison, Smith, Bosma, et al. 1998). In this research by Stuart et al., ethnicity was found to be a major determinant in whether AN will develop in individuals with hyperinsulinemia (1998). A study conducted by the Argentina Department of Nutrition and Diabetes of Buenos Aires Durand Hospital suggested the presence of AN showed a positive correlation with body mass index (Hirschler, Aranda, Oneto, Gonzalez, & Jadzinsky, 2002). Additional investigations have shown a strong correlation between AN and ethnicity (Stuart, et al., 1997) (Stoddart, et al., 2002) and a correlation between AN and heredity (Richards, et al., 1985). In one particular study of more than 1400 students in an unselected population, the prevalence of AN was 7 percent with 5.7 percent in Hispanic children, 5 percent in white children, and 13.3 percent in black children (Stuart, Pate, and Peters, 1989). An analysis of 34 predominantly obese black children in Dallas, Texas, reveals a prevalence rate of 74 percent, while Burke et al. demonstrates a prevalence of 41.1 percent with diabetes and 31.6 percent without diabetes (Burke et al., 1999). A study of 675 New Mexico middle schoolchildren revealed an estimated 8.9 percent prevalence of

hyperinsulinemia among all middle schoolchildren where 47 percent of these students were obese and had AN (Mukhtar, Cleverly, Voorhees, & McGrath, 2001).

Diabetes and obesity are growing at alarming rates in Texas, and the state seems to be facing conditions for the "perfect storm" (Texas Department of Health, 2002). The prevalence is particularly alarming first among Mexican Americans, then Native Americans, Blacks, and Anglo populations respectively. According to the Texas Department of Health, statewide diabetes prevalence rates for the year 2000 by ethnic and race classifications represent 5.7 percent for Non-Hispanic Whites, 9.0 percent for Non-Hispanic African Americans, 6.4 percent for Hispanics, and 7.8 percent among other groups (King-Tryce, Garza, and Ozias, 2002). The 1999-2000 results from the National Health and Nutrition Examination Survey (NHANES), which utilizes weight and height measurements to calculate the body mass index expressed as weight/height^2, demonstrates that an estimated 15 percent of children ages 6-19 years are overweight; this figure represents a 4 percent increase from 1988-1994 data obtained in a previous NHANES study (Centers for Disease Control and Prevention, 2004). The American Obesity Association, using 2002 NHANES data, also verifies the growth of the overweight and obesity problem in the prevalence rates of obese children (ages 6 to 11) with Mexican Americans at 23.7 percent, Blacks at 19.5 percent, and Whites at 11.8 percent, while obese prevalence in adolescents (ages 12 to 19) is 23.4 percent, 23.6 percent, and 12.7 percent per respective race in the United States (American Obesity Association, 2004). In a Rand analysis on obesity, moderately obese people experience a 20-30 percent higher annual average increase in health care costs than the costs for people with normal weight (RAND Corporation, 2004). The Centers for Disease Control

and Prevention estimate that roughly 13 percent of today's children and adolescents are seriously overweight, and the percentage of overweight children has more than doubled since the 1970s (Centers for Disease Control and Prevention, 2002).

Using 1999-2000 data, the Texas Department of Health shows children age 11 years had the highest prevalence rate for AN at 20 percent of 102,733 kids screened (King-Tryce, et al., 2002). The same state study also reveals that children 8-11 years had a prevalence rate of 14.7 percent, and children 12-15 years have a prevalence rate of 10.3 percent with acanthosis nigricans (King-Tryce, et al., 2002). While AN occurs on numerous places of the body, studies indicate that a majority of physical occurrences are found on the nape of the neck (Burke et al., 1999). Since the anatomical frequency is greater on the nape of the neck, the occurrence makes the physical location ideal for effectively screening children in a noninvasive manner (Saltmarsh, 2001) (Richards, et al., 1985) (Drobac, Brickman, Smith, & Binns, 2004).

Overview of Texas Screening Program

The Texas "Acanthosis Nigricans: The Education and Screening Project", or ANTES, is a program created from legislation, HB 2989, passed during the 2001 77th Texas legislative session. Over several subsequent legislative sessions, amendments made to the law require screening schoolchildren in public and private schools located in Texas Education Agency's Education Service Centers Regions 1, 2, 3, 4, 10, 11, 13, 15, 18, 19, and 20 for acanthosis nigricans (Texas Department of Health, 2003). The law appears in the Texas Health and Safety Code however the Texas-Mexico Border Health Coordination Office at the University of Texas Pan-American (UTPA) is responsible for

program enforcement. The law requires UTPA to create an executive council to develop and adopt rules for implementing the law. The law does not require certain grade levels be screened, but does require AN screening to occur in concert with hearing and vision screening or when spinal screening is performed (Texas Health & Safety Code, 2004). The UTPA requires school nurses to screen schoolchildren's height, weight, blood pressure, gender, race/ethnicity, and AN gradient for the purpose of detecting and intervening at-risk children from developing type 2 diabetes. The rules enforcing the ANTES program require nurses to examine schoolchildren for AN during routine hearing and vision screenings in the third grade and during scoliosis screening performed in the fifth and eighth grades, or sixth and ninth grades (Acanthosis Nigricans: The Education & Screening Program, n.d).

CDC's Position for AN as a Screening Tool for Diabetes

The Centers for Disease Control and Prevention (CDC) argues that while AN may be a marker for high levels of insulin, or insulin resistance (a primary risk factor for type 2 diabetes and other conditions), the data is inconclusive to support screening for AN solely to predict diabetes (CDC, 2003). According to the CDC's "Statement on Screening Children for Acanthosis Nigricans in Schools and Communities," the CDC asserts the "relationship between AN and the development of type 2 diabetes is not known" (2003). The CDC does support screening children for AN for high levels of insulin, since 34 percent of those with AN are likely to have high insulin levels (2003). However, the agency's position is that while AN may be a marker for high insulin levels, it could not be used to predict diabetes (CDC, 2003).

The CDC's position is based on several scientific aspects of previous research on AN screening. First, the CDC states it is unaware of any systematic guidelines for the "clinical detection of AN." Since a clinical standard is absent in demonstrating the repeatability, reliability, and validity of AN screening, the CDC suggests healthcare providers should assess obesity, AN presence, and physical activity when evaluating adolescents for type 2 diabetes. In addition, the CDC believes there needs to be further evaluation of AN-related prevention (2003). Based on the lack of scientific data supporting a standardized protocol for AN screening for clinical and community settings and the lack of available evidence showing AN presence as a predictor for type 2 diabetes, the CDC scientists believe that "it is not ethical or cost-effective" to screen children for AN.

Continuity with Hypothesis and Thesis Strategy

The thesis presents an overview of how socio-economic factors may relate to AN prevalence. As previously noted, contemporary research demonstrates that factors such as heredity, ethnicity, and parenting may increase the risk of children becoming obese and developing acanthosis nigricans. The thesis methodology further identifies lifestyle, healthcare access, nutritional knowledge, eating habits, daily food intake, and behavioral habits as factors relative to socio-economics. By building upon contemporary literature and analysis of AN causation and frequency, the thesis focuses on specific factors that may impact children becoming overweight and obese and result in developing AN. The thesis will study whether correlations exist between measured socio-economic indicators and AN prevalence. By distinguishing the position of the CDC in lieu the Texas ANTES

program and additional AN research efforts to screen children for diabetes, this thesis presents arguments that explain why socio-economics and poor diet are important in assessing the correlative relationship to AN so that future government surveillance efforts may benefit from this investigation's findings.

This thesis will utilize both primary and secondary data sources. The primary data source will consist of a matched-pair analysis involving a control and study population in both rural and urban areas. Survey instruments are used to measure the participant's socio-economic status as well as query their diet, lifestyle, physical activity, and access to health care services. Secondary data will originate from the state agencies, participating independent school districts, and the ANTES program using previously collected data. Using data from state agencies, ANTES, and the independent school districts, the study population is matched based on AN prevalence, proportion of ethnicity, population size, access to available health services, socio-economics, and geography. The thesis addresses fall-out in the scientific study's survey implementation and data collection process and identifies certain assumptions relevant to the study. Through these methods to validate the thesis' hypothesis, the investigation intends to further interest among the scientific community in evaluating the role of socio-economics on AN prevalence.

CHAPTER III

PURPOSE AND RATIONALE FOR SOLVING THE PROBLEM

Restatement of the Problem

Obesity is growing in epidemic proportions. According to the Centers for Disease Control and Prevention (CDC), black and Hispanic adults have the highest prevalence of obesity (2004). Table 1 below depicts how prevalence rates for obesity among adult ethnic populations significantly increased for data collected between years 1988 to 1994 and 1999 to 2000. The percent in change between these two data samples are 9.7 percent for blacks, 6.0 percent for Mexican Americans, and 7.5 percent for whites (CDC, 2002).

Table 1 Increase in Overweight and Obesity Prevalence Among U.S. Adults by Racial/Ethnic Group.

	Overweight (BMI ≥ 25) Prevalence (%)		Obesity (BMI ≥ 30) Prevalence (%)	
Racial / Ethnic Group	1988 to 1994	1999 to 2000	1988 to 1994	1999 to 2000
Black (non-Hispanic)	62 5	69 6	30 2	39 9
Mexican American	67 4	73 4	28 4	34 4
White (non-Hispanic)	52 6	62 3	21 2	28 7

Source CDC, National Center for Health Statistics, National Health and Nutrition Examination Survey Flegal et al JAMA 2002, 288 1723-7 and IJO 1998,22 39-47 *Ages 20 and older for 1999 to 2000 and ages 20 to 74 for 1988 to 1994

A major concern related to this observable trend is the high prevalence rate among certain ethnic populations and the number of health-related conditions linked to obesity. In a study released in 2004, the CDC reported that 1999-2002 National Health and Nutrition Examination Survey data revealed Mexican-American children ages 6-11 were 22 percent more likely to be overweight than other ethnic groups. The same study revealed that Mexican-American children ages 6-11 were 20 percent more likely to be overweight than non-Hispanic black children, and 14 percent more likely to be overweight than non-Hispanic white children (CDC, 2004). The increase in obesity prevalence among ethnic populations is quite disturbing and this situation is only further complicated with at-risk factors resulting from high BMI values during childhood and adolescence.

According to a revised study by Guo entitled "Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence," male children at nine years of age with a body mass index (BMI) in the 95th percentile are 81 percent more likely to be overweight by adulthood (2002). Female children at nine years of age with a BMI in the 95th percentile are 79% more likely to be overweight by adulthood (Guo, Wu, Chumlea, & Roche, 2002). Table 2 depicts the probabilities for young males and females with BMI values at the 85th and 95th percentiles becoming overweight or obese at adulthood at age 35 years (Guo, et al., 2002).

Table 2	Probabalities of adult overweight (BMI ≥ 25) and adult obesity (BMI ≥ 30) at age 30 for young males and females with BMI levels at the 85th and 95th percentiles.							
	Overweight Probabilities					Obesity Probabilities		
BMI %	85th	85th	95th	95th	85th	85th	95th	95th
Age (years)	Males	Females	Males	Females	Males	Females	Males	Females
3	0.59	0.45	0.71	0.58	0.12	0.17	0.15	0.24
4	0.53	0.42	0.62	0.59	0.11	0.16	0.14	0.25
5	0.59	0.46	0.72	0.65	0.19	0.21	0.31	0.37
6	0.57	0.49	0.69	0.72	0.16	0.2	0.23	0.43
7	0.66	0.52	0.86	0.73	0.19	0.22	0.38	0.41
8	0.57	0.54	0.72	0.76	0.14	0.23	0.22	0.46
9	0.68	0.56	0.86	0.81	0.17	0.25	0.3	0.51
10	0.61	0.54	0.81	0.79	0.17	0.23	0.37	0.52
11	0.64	0.61	0.84	0.86	0.16	0.25	0.28	0.59
12	0.63	0.6	0.82	0.86	0.18	0.23	0.38	0.5
Source: Guo, S., Wu, W., Chumlea, W., & Roche, A. (September 2002). Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *American Journal of Clinical Nutrition*, 76(3), 653-658.								

Most alarming in Guo et al.'s risk analysis of childhood obesity is the high probabilities for both females and male in the 85th and 95th percentiles between 5 and 11 years of age of becoming obese adults at 35 years of age. Guo et al.'s data reveals the potential for children with high BMI levels to become obese or overweight and demonstrates the importance for society to determine not only an explanation for the rise in obesity prevalence but also methods to avert it.

According to the American Obesity Association, lack of physical activity, sedentary behavior, socio-economic status, eating habits, and the environment comprise the modifiable behaviors and lifestyle habits that contribute to obesity (2005). Studies show that behavior and lifestyle are contributing factors effecting obesity, and obesity-related problems can further compound the health conditions of children (Danielzik, Czerwinski-Mast, Langnase, Dilba, & Muller, 2004) (Melgar-Quinonez, & Kaiser, 2004). Obesity increases the risk of hypertension, coronary heart disease, and some types of cancer (Melgar, 2004) and attributes to kidney failure, strokes, and orthopedic

complications (Witt, 2003). Obesity-related conditions can include hyperinsulinemia, insulin resistance, and acanthosis nigricans (Stoddart, et al., 2002) (Stuart et al., 1998). In a study on the socio-demographic factors effecting diabetes among urban Hispanics, age-adjusted data revealed Hispanics were two-times higher to have diabetes than non-Hispanic whites (CDC, 2003), and this data demonstrates a proportionally alarming rate for certain ethnic populations and the need to increase screening among these populations.

Formal Statement of the Hypothesis

Longest identifies the determinants of health in populations and people as being determined by 1) individual behavior and their biology, 2) their physical environments, 3) socio-economic factors, and 3) the types of health services available for people to access (2002). Socio-economics influences one's lifestyle, such as eating habits and behavior, and deficiencies in these areas can compound the causal factors related to the diminishing health status of particular ethnic populations (Longest, 2002). Texas, like many states, is faced with a diverse ethnic population and great variability in its socio-economic situations and health status. For example, Texas is comprised of 254 counties of which 196 are rural, or over 76 percent (Office of Rural Community Affairs, 2002). Rural residents tend to have less access to available, local health services, and consequently a greater proportion of risk factors contributing to their health problems, like diabetes (Summers, 2003). In urban Texas, there are higher concentrations of populations of people with varying socio-economic trends that are further compounded by limited access to available health services, poor lifestyle, and ultimately insufficient nutrition.

Each of these factors attributes to an increase in the probability of health problems (Longest, 2002), and impact lifestyle decisions related to individual diets and socio-economics.

As discussed, states, such as Texas, are working to address the increasing prevalence of obesity and obesity-related health conditions by screening children in schools and providing educational outreach to communities. One main reason governments are developing screening programs is to avert increased overall state spending that may result from obesity-related conditions that become long-term chronic illnesses. While the Texas acanthosis nigricans screening program provides a mechanism for identifying children with acanthosis nigricans, the program is limited to certain geographic areas, mainly the Texas Rio Grande Valley. The program is also limited in its ability to obtain socio-economic information demonstrating correlative relationships to obesity. In lieu of the growing problem with obesity, the limitations in data collected in the state screening program, and the lack of available scientific research measuring socio-economic factors and acanthosis nigricans prevalence, this thesis establishes to collect and analyze data to measure whether a correlation exists. To accomplish this scientific investigation, the thesis establishes the hypothesis that a correlation does exist between socio-economics factors and the prevalence of acanthosis nigricans. The study additionally measures and analyzes the null hypothesis by asserting that a correlation does not exist between socio-economics and acanthosis prevalence.

The method of proving this hypothesis requires the identification of relevant factors associated with socio-economics. Through exhaustive research to qualify and substantiate the hypothesis' novel approach, the investigation identifies a number of

socio-economic factors to study. After identifying each socio-economic factor, the investigation further analyzes the socio-economic attributes by identifying and measuring the sub-hypotheses to their corresponding null sub-hypotheses. To prove the original hypothesis, that a correlation exists between socio-economics and acanthosis nigricans prevalence, each sub-hypothesis and its corresponding null is analyzed to measure the strength of their associated relationships.

The socio-economic indicators relevant to the investigation's study includes measuring the schoolchildren case and control subject's frequency and access to health care, knowledge of nutrition, dietary eating habits, lifestyle, and level of physical activity. In addition to these categories, the study measures additional factors relevant to the schoolchildren's socio-economic status by obtaining information related to the student's parent or guardian's occupation, marital status, annual household income, and source of health care. The first sub-hypothesis therefore states a correlation exists between the study population's access to healthcare and socio-economics. The second sub-hypothesis maintains a correlation exists between knowledge of nutrition and socio-economics. The third hypothesis asserts a correlation exists between dietary eating habits and socio-economic factors. The fourth sub-hypothesis supports a correlation exists between the student's lifestyle and their socio-economic status. The fifth sub-hypothesis in the investigation establishes a correlation exists between socio-economics and the student's level of physical activity.

In addition to these sub-hypotheses, the investigation seeks to include socio-economic factors relevant to the student's parent(s) or guardian's marital status, annual household income, occupation, and source of health care. The inclusion of the

parent/guardian factors introduce additional sub-hypotheses to analyze. These sub-hypotheses equally address socio-economic factors, which could attribute to acanthosis nigricans prevalence and therefore require measuring their correlative relationship. For example, the sixth sub-hypothesis asserts a correlation exists between the student's parent(s) or guardian's marital status and socio-economics. The seventh sub-hypothesis states a correlation is prevalent between socio-economics and annual household income. The eighth sub-hypothesis asserts a correlation exists between the student's parent(s) or guardian's occupation and socio-economic factors, and finally, the ninth sub-hypothesis establishes a correlation exists between the student's parent(s) or guardian's source of health care and socio-economics. Appendices B, C, and D are the original surveys used to obtain data for measuring these sub-hypotheses' correlative relationships with socio-economics and depict the survey elements and socio-economic variables employed. As with the methodology's original hypothesis necessitating the analysis of the null hypothesis, the investigation calculates the nulls for each sub-hypothesis. The first null sub-hypothesis states a correlation does not exist between the study's access to healthcare and socio-economics. Additionally, the second null hypothesis asserts a correlation is not present between knowledge of nutrition and socio-economic factors. The third null hypothesis states there is not correlative relationship between dietary eating habits and socio-economic factors. The fourth null sub-hypothesis asserts a correlation does not exist between the student's lifestyle and their socio-economic status. The fifth null sub-hypothesis in the investigation states a correlation is absent between socio-economics and the student's level of physical activity. The sixth null sub-hypothesis asserts a correlation does not exist between the student's parent(s) or guardian's marital status and socio-

economics. The seventh null sub-hypothesis asserts there is not a correlative relationship between socio-economics and annual household income. The eighth null sub-hypothesis states a correlation does not exist between the student's parent(s) or guardian's occupation and socio-economic factors. The final ninth null sub-hypothesis asserts there is no correlation between the student's parent(s) or guardian's source of health care and socio-economics.

Explanation and Definition of the Variables

The investigation utilizes anthropometric information previously collected by the participating school nurses in calculating the body mass index for each study subject. This secondary data provides useful variables for calculating statistics and matching the case subjects to control subjects. The statistical variables include additional information from the schools comprising a) data related to the child's parent(s) or guardian's socio-economic status; b) source of the student's health insurance, when available (example, Medicaid); the student's school grade; the student's body mass indices; and c) information indicating whether the student has the skin-pigmentation known as acanthosis nigricans or not. As previously discussed, the investigation's survey methodology includes a parent/guardian active consent form attached to a questionnaire. This questionnaire measures additional socio-economic variables of the parent/guardian by soliciting information pertinent to occupation, marital status, race & ethnicity, household annual income, health care source, and familial health conditions, such as acanthosis nigricans, diabetes, and high blood pressure (see Appendix D).

The socio-economic variables in the student questionnaire (Appendix B) include healthcare access, dietary eating habits, knowledge of nutrition, mental health, physical activity, and lifestyle. To obtain data related to these variables, the questionnaire solicits responses using the following frequency of questions:

a) nine questions relate to the frequency of accessing health care services and the locale for receiving the health care services;
b) nineteen questions concern the student's dietary eating habits;
c) seventeen questions pertain to the student's knowledge of nutrition;
d) one question measure their mental health;
e) five questions concern student physical activity; and,
f) four questions relate to the student's lifestyle.

These variables are categorical variables in that they include characteristics which are distinguishable by names (Veney, 2003). Each of these variables must vary in order to depict a measurable relationship; otherwise, these characteristics constitute constant characteristics without any measurable variability (Veney, 2003). As previously articulated, the investigation's data collection and statistical techniques rely on stratified sampling to achieve random distribution of the study sample populations. The technique of stratified sampling divides the total population into two or more strata, or groups with similar characteristics. Stratified sampling ensures that the case and control populations not only appropriately represent the total populations but these two population's exhibit characteristics closely related to the investigated condition (Veney, 2003). In the case of this investigation, the two strata are cases and controls. The case study group includes schoolchildren with acanthosis nigricans. The control study group comprises

schoolchildren without acanthosis nigricans. To prove the thesis' hypothesis that a correlation exists between acanthosis nigricans (AN) prevalence and socio-economics, the investigation first endeavors to prove the original null hypothesis that a correlation does not exist between AN prevalence and socio-economics.

Assumptions Made in the Study

Using the socio-economic variables of the student questionnaire and the parent/guardian survey, the investigation bases the primary hypothesis on the premise that each collected variable is useful in determining the correlative relationship between AN prevalence and socio-economics. The belief is children from families of lower socio-economic status have lifestyles, living habits, and dietary eating habits that increase the risk of obtaining acanthosis nigricans. Prior research indicates that Mexican-Americans of lower socio-economic status in California, for example, experience a higher prevalence of diabetes than other studied populations. In lieu of data indicating these ethnic trends and the effects of socio-economics on lifestyle and behavior effecting obesity and the correlative relationship between obesity and AN, it is believed that schoolchildren of lower socio-economic status and poorer diet may be more at-risk at getting the condition of AN. According to the CARDIA study for example, fast foods could increase the risk obesity and diabetes since fast food often comes in excessive portion sizes where single meals meet or exceed daily nutritional requirements (Pereira, Kartashov, Ebbeling, Van Horn, Slattery, Jacobs Jr., & Ludwig, 2005). According to Periera et al.'s fifteen-year investigation, the consumption of fast food has a strong correlation with weight gain and insulin resistance, which suggests that fast food

increases the risk of obesity and type 2 diabetes (2005). Generally fast foods are high in fat, sugar, salt, carbohydrates, hydrogenated oils, and other ingredients, and these types of food are generally less expensive to purchase. Children exposed to a diet high in fat who do not engage in physical activity are prone to weight gain. Equally important, research shows that certain ethnic populations may have genetic risk factors towards becoming obese and obtaining acanthosis nigricans (Stuart, et al., 1998). If a correlation is prominently measured between children of lower socio-economics and AN prevalence, then the data will depict this observable trend in the study population possessing AN versus the control population without AN. The survey instruments include survey elements, which obtain proportional values. As mentioned, these values are stratified, random samples that divide the populations into strata based on relational categorical variables in order to represent the general population.

The variables measuring dietary eating habits contain questions related to the study subject's daily consumption of meat, cheese, milk, vegetables, fruit juice, and fruit. The variables also include questions measuring the study subject's frequency of eating in the cafeteria, eating breakfast, and eat three regular meals. The study variables related to dietary eating habits also include measuring the number of times the study subject's consume foods high in sugar and fat such as French fries, fast food, snacks, sodas, and punch. These variables have relationships that relate to socio-economics. The objective of this hypothesis is to identify measurable differences between case and control study populations to support the assumption that a correlation exists between children of lower socio-economic status and the high prevalence rate of acanthosis nigricans.

Expectations for the Study's Results and Rationale for Hypothesis

The investigation hopes to achieve collecting sufficient data to measure a noticeable correlation between socio-economics and the prevalence of acanthosis nigricans (AN). By using the study variables related to socio-economics resulting from the primary data collection and using statistics to compare these variables and their relationships to the secondary data on socio-economic status and AN prevalence, the investigation believes the results will conclude that case subjects of lower socio-economics are more at-risk of obtaining AN. Support for this assertion emanates from the data's relation to the effects on the cases suffering from a poor lifestyle, inadequate dietary habits, insufficient physical activity, and lack of knowledge of nutrition. As a result, schoolchildren exposed to environments fostering these variables on populations similar to those of this study will be at-risk for AN. The findings resulting from this investigation coupled with the conclusive research from previous studies further supports a need for government policy to review current AN screening programs in order to ensure that these programs appropriately target the problem of obesity and obesity-related conditions, such as type 2 diabetes. While AN prevalence screening is an indicator for obesity-related conditions, it is not conclusive of type 2 diabetes (CDC, 2004). By demonstrating a correlative relationship between socio-economics and AN prevalence, future policy can better address the fundamental importance of effectuating conditions for favorable lifestyle on the upbringing of children and the impact socio-economics has on overall health status. While it is possible that the socio-economic variables are the result

of other effect modifiers, this investigation recognizes that a correlation does not necessitate causation, and this realization while measurable, requires additional attention if scientific research desires to specifically identify their correlative relationships and independent strengths in the future.

CHAPTER IV

STUDY METHOD

To accumulate the data necessary to analyze the relevance of socio-economics to the prevalence of acanthosis nigricans among schoolchildren, the research required obtaining primary data on the schoolchildren's lifestyle, nutrition, health status, and socio-economic status. Additionally, the research utilized secondary data sources that aided in the cross-comparison of the socio-economic data relevant to the primary data sources. To obtain permission for conducting the study, the research used an active consent form that included two survey instruments. The investigation obtained sample data from both urban and rural populations to measure correlations and cross comparisons between the sample data and research hypothesis. The data collection process involved developing a testing procedure that did not conflict with didactic objectives of the school that were critical to the student's educational involvement and performance. In the analysis of the type of data necessary to control for confounding variables and to control against particular biases, the statistical method employed the utilization of a matched pair case-control study.

Objectives and Criteria for Matched Pair Analysis

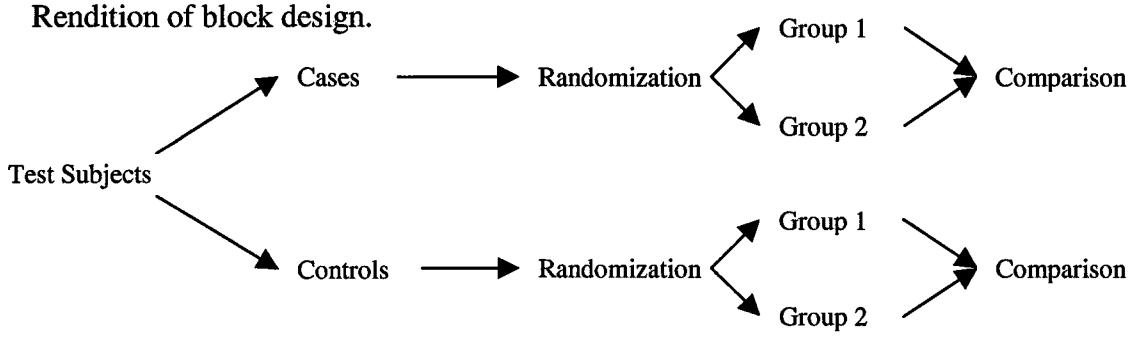
Matched pair analysis involves pairing a case sample to one or more sample control-based traits, or variables, identified to be similar between the two sample populations. The use of attributes or characteristics to pair the sample case population with a sample population may include variables such as gender, race, sex, income, height, weight, prevalence of condition, non-prevalence of condition, etc. By using matched pairs, the investigation can yield more accurate results than simple randomization (Moore, 2000). The degree to which the sample population's matched variables are similar, their difference as it relates to the condition may be attributable to an alternative variable. Additionally, if the case and control samples demonstrate a measurable degree of differences because of some exposure variable, which may suggest an association with the disease or condition under analysis, then the association cannot be explained in terms of case to control differences on the matched characteristics (Schlesselman, 1982).

Therefore, matching the case sample population to control sample population attributes, or characteristics, must occur during the early phase in which the samples are obtained in the investigation. Additionally the investigation must take into account the ratio of total number of case samples to control samples used during the investigation in order to govern against incomplete matching. The design of matched pair analysis therefore uses the method of comparing explanatory variables, called treatments, while using randomization and replication on experimental subjects in order to control for lurking variables or confounding factors (Moore, 2000). Randomization should not occur during the matching process, but rather within each of the matched pairs to help reduce the effect of variation among the cases and the controls. Additional statistical techniques

called "blocking" provide further techniques to control against unwanted influencing causal factors. It is preferable to form blocks based on those unavoidable factors of variability that may influence subjects under investigation (example, the cases and controls). By controlling for these unavoidable factors of variability the use of randomization will help control the effects of the remaining variation during the investigation and help provide an unbiased comparison of the case and control subjects (Moore, 2000). One method of grouping the samples according to equivalent variables is to match them according to similar variables; matched pairs are a common method of using block design. A block design, see Figure 3 below, outlines the process of bifurcating the study group into case and control samples for controlling the effects of outside variables by incorporating those variables into the experiment in order to reduce variability between study subjects.

Figure 3

Rendition of block design.



In randomizing, the experiment applies chance to assign the case and control population variables according to similarity. By combining the comparable attributes and

characteristics between the case and control sample population groups, randomization and comparison both help avoid bias in the course of the investigation, as well as avoid confounding and lurking variables.

One major concern in conducting a case-control study results from situations where cases and controls differ in their attributes outside of those targeted for the study. For if more cases than controls are found to be exposed, then the investigation may result with the question of whether the observed association is a result of factors other than the exposure being studied therefore causing the differences between the controls and the cases (Gordis, 2000). Take a situation where more case samples are exposed to a certain condition than control samples; the case samples are of a lower economic status, such as poverty and the control samples are of a higher economic status, such as affluence. In this scenario, it would be difficult to determine if the factor influencing the development of the condition is from exposure to the factor under study or an outside characteristic associated with the lower socio-economic status of being poor. To address this situation in matched pair analysis, it is important to ensure that the distribution of case samples to control samples, in terms of socio-economic status, is similar, so that any perceived difference in exposure will likely be the determining factor. Any absence or presence of the condition is not likely attributable to the difference in socio-economic status. As a means of avoiding this problematic situation, the design of the investigation should match the case sample populations and the control sample populations using characteristics that directly relate to the study's concern.

When conducting a matched pair analysis using a case sample population to a control sample population, the investigation's design can select controls based on the

proportion of controls with identical select characteristics to the proportion of cases with the same select characteristic. This type of matching is known as "group matching." An alternative form of matching utilizes the approach in which each individual case selected for the study is matched with a control, or multiple controls, based on similar attributes or select variables of concern. Matched pair analysis offers several benefits in conducting the study investigation.

Matching to Control for Bias

One of the primary benefits to employing a matched pair design is the removal of biased comparisons between cases and controls (Schlesselman, 1982). The elimination of biased comparisons is only possible if the investigational design accompanies an analysis that corresponds to the matched design. The determination to use matched pair analysis compared with the use of least squares regression involving unmatched sample data has been scrutinized in their ability to effectively remove biased comparisons. Schlesselman writes that contemporary observers have approached the "paradigm of comparative experiment" by demonstrating that in the regression method involving unmatched data some residual bias may persist "with an the analysis based on post-stratification" (1982). Equally, Schlesselman argues that since "exact matching" rarely occurs in actual practice, matched pair analysis may also only remove part of the bias. As such the extent that regression analysis is effective in removing biases depends on whether the relationship between exposure, condition, and the variables employed for adjustment have been accurately outlined in the investigation.

Matching Criteria and Problems with Overmatching

The criteria employed for a matched pair analysis involves using variables that while independent of exposure are risk factors for the condition. According to Moore, matched pair design utilizes the method of comparing treatments, randomization, and replication on several experimental subjects (2000). A variable for matching does not need to cause the condition but rather the variable's "risk-factor" may result from its association with other causal factors (Schlesselman, 1982). Therefore, it is important to match variables believed to be risk factors for the condition, or disease. Characteristics matched using variables other than those associated with being risk factors in either a deliberate or inadvertent manner results in overmatching (Gordis, 2000). Overmatching results in reducing the validity of the statistical integrity of an investigation, particularly a case-control study (Schlesselman, 1982).

Conducting the Study

The investigation involved using matched pair analysis to analyze primary data and secondary data among Texas' schoolchildren. The study, called "The Health & Wellness School Project" articulated that a surveillance system would help monitor student health and wellness in schoolchildren in order to monitor the impact of socio-economics on Texas' schoolchildren being obese and overweight. The study's purpose is to provide data that is representative of rural and urban Texas and to measure the correlation, if any, between socio-economics and acanthosis prevalence among schoolchildren. The research project first obtained formal approval from the Institutional Review Board (IRB) of Texas State University-San Marcos. The IRB reviewed and

authorized that the thesis research project conforms to federal and international standards governing the protection of human subjects during scientific research. Upon receiving approval from the IRB, the school districts were notified and their involvement solicited during the summer of 2004 using an informational packet outlining the project (see Appendix A). Authorization was obtained from the superintendents at two school districts. The test subjects, or cases, consisted of students having acanthosis nigricans (AN). School nurses participating in the Texas AN screening program were trained on identifying and grading AN and identified each positive AN case within their school district as required by the state program; this data set comprised the case population for the investigation. The control subjects included students who did not have the acanthosis nigricans condition. Survey instruments, consent forms, and instructional booklets for the school nurses, school district administrators, and student parents were developed and distributed in the fall semester of 2004. Approximately forty students from the 3rd, 4th, and 5th grades were invited to participate from selected schools. The schoolchildren were selected from these three school grades for a couple of reasons since these grades corresponded with state screening initiatives and puberty has not set in for most children within these age groups.

Study Methodology

The University of Texas Pan-American administers the state acanthosis nigricans screening program in certain elementary schools. Screening for AN involves only a visual check of the child's neck and can be conducted in conjunction with the school's vision, hearing and scoliosis screening exams. Since the school grades of the Texas

Acanthosis Nigricans: Education and Screening (ANTES) program correspond with some of the investigation's selected elementary grades, data obtained for the ANTES program provided secondary data on those schoolchildren positively identified with acanthosis nigricans. Additionally, many school nurses screen students in grades 3, 4, and 5 to obtain anthropometric data, such as student height and weight, which can be used to calculate the body mass index (see Appendix E for more information on the ANTES screening form). The Centers for Disease Control and Prevention (CDC) provides standards for calculating a child's body mass index (BMI) in comparison to the national averages for his/her height and weight in order to compare and classify the student. According to the CDC's Nutrition Examination Survey (NHANES I) data, children whose BMI falls within 19.6, age 10, to 30.5, age 17 fall within the 95th percentile for BMI (Neufeld, Raffel, Landon, et al., 1998). The secondary data set therefore included students with acanthosis nigricans, students without acanthosis nigricans, and the height, weight, gender, and ethnicity for all of the students in the investigation.

Secondary data also was obtained related to the student's socio-economic status by obtaining information from the schools on those children identified as economically disadvantage according to the Texas Department of Agriculture's national school lunch and child nutrition programs, such as the state's free and reduced school lunch program. According to the Texas Department of Agriculture (TDA), a student is considered economically disadvantaged based on family size and annual income (TDA, 2004). For example, in a family size of two with income less than $16,237, the children would be eligible of free lunch at their school. In a family size of two with income of less than $23,107, the children would be eligible for reduced lunch service at their school (TDA,

2004). The secondary data on the student's anatomical profile, such as height and weight, coupled with available socio-economic data aided in the validity of the investigation's primary data on socio-economics and in controlling for outside variables in the matched pair analysis.

Survey Instruments and Procedures

After receiving a letter of participation, or acknowledgement of participation, from both the urban and rural school districts, the participating school nurses sent home to each student in the 3rd, 4th, and 5th grades a parent/guardian consent form and survey. The parent/guardian consent form and survey was printed double-sided on yellow paper. The top-half of the front side of the parent/guardian consent form contained a brief overview of the project, purpose, and contact information to address any questions or concerns of the parent(s) or guardian(s). On the bottom-half of that page was an active, consent form requiring the parent(s) or guardian's signature for the student to participate in the "Health & Wellness School Project." The reverse side of the document contained a nine question parent/guardian survey that measured elements related to ethnicity, marital status, annual income, health care source, and family history of acanthosis nigricans, diabetes, and blood pressure (see Appendix D). Stapled to the front of the parent/guardian consent form and survey was a double-sided document on white paper that included a parent/guardian letter of participation in the project and a parent/guardian information sheet, which described the research project and relevant contact information. The parent/guardian consent form and survey were tested using several parents with children in similar grades to measure and test the validity of the survey instrument and to

measure how well the parent(s) or guardian(s) comprehend the consent verbiage and the purpose of the research program. The parent/guardian consent form and survey was also translated into Spanish for non-English speaking people (see Appendix D).

The consent forms and surveys were distributed during the 2004 fall semester. In the urban school district the distribution of the parent/guardian consent and survey form included 525 for the 3rd grade, 519 for the 4th grade, and 550 for the 5th grade. In the rural school district, approximately 500 parental consent/survey forms were distributed. Additional parental consent/survey forms were provided after the initial distribution resulted in low response rates among the case population group for both the rural and urban school districts. After distributing the parent/guardian consent forms and surveys, each school nurse was educated on collecting the parent/guardian documents, the procedures for matching the cases to controls, and administering the student questionnaires to both study populations.

In order to acquire additional variables pertinent in measuring noticeable socio-economic disparities in the study populations, a student health questionnaire was developed and administered that obtained data relevant to student access to health care, health literacy, health education, diet, physical lifestyle, and physical fitness. The purpose of the student questionnaire was to obtain cross-sectional data that when used in the matched pair analysis would provide data used to validate the study variables and to control for unwanted outside factors. Like the parent/guardian consent and survey form, the research methodology required translating the student questionnaire into Spanish for non-English speaking students whose native language is Mexican Spanish. The research questionnaire developed for the students relied upon the Flesch-Kincaid grade level

analysis methodology to validate the reading level suitable for 4th grade students. The nurses collected the parent/guardian consent and survey forms and tallied their responses onto a spreadsheet. Analysis of the data aided in matching the students based on the anthropometric variables and attributes of weight and height, as well as gender and ethnicity. The students screened positively for acanthosis nigricans comprised the case population while students without acanthosis nigricans represented the controls. Matching the case to controls consisted of closely matching students based on their similar attributes and variables. The investigation's optimal ratio for matching case to controls intended to achieve a 1:2 case to control ratio, or a 1:3 case to control ratio.

Once the case and control student selection occurred, each school nurse in both the rural and urban school districts notified each participating student's homeroom teacher about his/her involvement. Each school district designated a testing facility, and a scheduled time and date assigned for administering the student questionnaire. The student questionnaire involved the students personally consenting to their participation and acknowledgement that their information is confidential. The student questionnaire included questions phrased to obtain data related to the student's health, nutrition, wellness, diet, and physical activity (see Appendices B & C). The questionnaire consisted of 65 questions and required an hour to administer per test group. The questions and verbiage complied with a fourth grade reading level and the Flesch-Kincaid grade level analysis scored the questionnaire on a 4.2 grade level. To test the student questionnaire's validity and reliability, the investigation solicited the participation of several students in grades 3, 4, and 5. A student from each grade participated in the validity and reliability testing. The tabulation and administration of the "mock" testing

resulted in making modifications to several questions based on the answer selections being vague or confusing, and additionally revealed the need to have the students spaced accordingly to discourage student collaboration. A trained adult administered each testing episode of the student questionnaires.

Since there were Spanish-speaking students, administering the questionnaire required a Spanish translation and bi-lingual translators. To translate the English version into Spanish at a fourth grade reading level, the investigation sought the expertise of Texas State University's Modern Language Department to validate the questionnaire's semantics and colloquialisms to Mexican Spanish. Additionally, the Texas Workforce Commission (TWC) provided a Spanish-speaking translator who attended each testing and who administered the questionnaire in Spanish. The rural school district did not have any Spanish-speaking students; however, a TWC translator participated as a precaution. Additionally, the urban school district did not have any students out of the sample population that could not speak English either, but the TWC translator participated again as a precautionary measure. Participating students completed a questionnaire that assessed their self-reported knowledge of nutrition, health, wellness, access to health care, and physical activity, or exercise. All student information including names and identifying data remain confidential with their data. In each instance, the principal investigator administered and collected the student questionnaires. The investigation's administrator entered the results from each location's student questionnaire testing episode and compiled the data.

Description of Study Subjects

As discussed previously, the study subjects consist of schoolchildren in 3rd, 4th, and 5th grades. The case subjects include schoolchildren screened positive for acanthosis nigricans, a dark-skin pigmentation resulting from hyperinsulinemia. The control study subjects are schoolchildren who did not have acanthosis nigricans. Due to the ethnic prevalence of obesity and acanthosis nigricans, the case and control study subjects mainly include Hispanic and black ethnic population groups of both male and female ratios. As previously discussed, the study subjects agreed to participate in the investigation by obtaining written, active consent by the parent or guardian provided at the beginning of the semester.

Survey Issues, Matching Criteria, and Rationale

The development of the statistical survey instruments at a Flesch-Kincaid fourth grade reading level proved to be a time consuming endeavor. Equally daunting is the realization that it is impossible to obtain statistically valid socio-economic data from a child age nine, since a 4th grade student is unlikely to know the annual income of his/her parent(s) or guardian(s). An additional obstacle in collecting data from a young sample population is the reliability of the information. During the initial validity testing, two of the students asked questions related to the list of responses to one of the questions, and it was observed that the general discussion of the question could inadvertently bias the student's response and jeopardize his/her objectivity in selecting the most appropriate choice.

One major issue resulted from nurse compliance in acanthosis nigricans reporting. A critical observation made during the course of the investigation revealed that the nurse director of the urban school district would re-check each student in each grade since she had observed substantial variability in the accuracy of positive and negative screens previously conducted by her nursing staff. Consequently, this observable trend permeated throughout the investigation and adversely effected the inclusion of the 3rd and 4th grade students taking part in the case and control sample populations and resulted in only the 5th grade students being eligible for final testing with the student questionnaire.

An additional concern arose during the development of the survey language since the students reading level varied between grades 3, 4, and 5. To accomplish the task of drafting the survey instrument according to the appropriate reading level and to verify the reliability in the student comprehending each question, the investigation relied upon the analysis of the previous work by the School Physical Activity and Nutrition Project (SPAN). The SPAN research project involves the assessment of 4th grade school children and children in higher grades in surveying their nutrition and lifestyle habits. However, applying the Flesch-Kincaid grade level reading analysis to the SPAN survey revealed the survey instrument exceeded the 4th grade reading level and scored a 6.2 Flesch-Kincaid. This revelation posed a serious problem since the SPAN survey methodology and semantics seemed like a good instrument to emulate. The investigation reviewed additional survey instruments and finally developed an instrument independently, and scored it using the Flesch-Kincaid grade level reading analysis at a 4.2 grade level.

Additional observations made during the course of the research investigation revealed a need for employing a different strategy for distributing the parent/guardian

consent forms and surveys. In the research methodology, all of the requested copies of the parent/guardian consent and survey documentation were sent to the director of nursing for each participating school district. During the course of distributing these materials, over 500 parent/guardian consent forms and surveys were lost or misplaced requiring replacement copies in place of them. This occurrence required the research investigation to incur additional production costs.

For the rural school district, the case sample population did not meet a desired statistical population for analysis. As a result, the school nurses re-sent the parent/guardian consent and survey forms accompanied with a personal letter requesting their consideration to have their child participate. After several iterations to obtain parent and guardian consents, as well as personal phone calls, the research investigation received a few additional consent forms and surveys. The consent forms and survey results allowed matching the case samples to control samples 1:2 with one case to two controls.

The urban school district posed some challenges as well in obtaining the parent/guardian consent forms and surveys. Similar to the rural sample population, the urban sample population required repetitive attempts by the school nurses to obtain a satisfactory number of consent forms for cases. Unfortunately, this process exceeded the time allotted to administer the student questionnaire in the fall semester of 2004, and it required continuing the effort of obtaining parent/guardian consent forms and surveys immediately following the start of the 2005 spring semester. The expected proportions of case to controls in the urban school district did not meet the desired 1:2 case to control ratio. The total number of control samples matched on the four criteria of weight, height,

gender, and ethnicity did not permit 1:2 matched pair case to control ratio, since the control sample size was insufficient. While the 1:2 or 1:3 case to control ratio is optimal (Schlesselman, 1982), a ratio of 1:1 case to control is adequate for conducting a matched pair analysis. In addition to the ratio of case to controls, several case study subjects demonstrated characteristics, which proved difficult to match closely with a control subject. In one particular instance, a case subject demonstrated a weight of 264 pounds and a control subject with very similar characteristics of weight, height, gender, and ethnicity was unavailable. Since the case's variable for weight exceeded any normal range in the sample control population, the investigation employed matching variables used to control for ethnicity and gender. The rationale for employing this methodology is due to the study's goal of demonstrating that socio-economic patterns must be comparative among similar ethnic and cultural populations, and weight patterns are variable among general ethnic populations. While research shows a correlation between ethnicity and acanthosis nigricans (Stuart, C., Smith, C., et al., 1998) (Stoddart, M., et al., 2002) (Glasser, N. & Jones, K., 1998), contemporary research also shows a correlation between elevated levels of BMI, obesity, and acanthosis nigricans (Ramachandran, A., et al., 2003) (Chin, D., et al., 2002) (Hirschler, V., Aranda, C., et al., 2002). The desire to control for confounding and lurking factors, variables that influence the causation of the condition, related to socio-economics required the investigation to use ethnicity as a controlled variable for matching.

The criteria for matching proved critical in the overall research investigation, since prior research on obesity and ethnicity demonstrated noticeable correlations with acanthosis nigricans. Despite this valuable research on acanthosis nigricans, none of the

previous investigations surveyed their sample population in order to collect data elements specifically to measure the relationship between socio-economics and acanthosis nigricans prevalence. In lieu of this reality, the data elements comprising the survey instruments of this investigation needed to rely upon gathering socio-economic primary data that could be validated with secondary data for cross-comparison. Based on the state's school lunch program's eligibility criteria for "free" and "reduced" lunches, the validity of the student's socio-economic situation provided that the elimination of respondent biases was possible. When determining a manner in which to address fall-out and lack of response and to ensure a meaningful response rate, the investigation utilized a survey instrument that included both the parent/guardian consent form as well as a socio-economic survey. This type of survey instrument technique heightened the response rate since respondents who consented to their child taking part in the research project would be more inclined to answer honestly about their socio-economic status. Whether the consenting respondents acted in a utilitarian manner or out of a sense of duty to their society and family, it is unknown since the investigation did not measure these particular nuances affecting their motivation.

The statistical methods employed involved the use of basic bivariate analysis (example, frequency counts) to describe the distribution of responses to each data element for matching purposes and overall statistical computations. To determine correlations between case and control data, certain variables were controlled using chi-squared statistic analysis in order to compare the observed and expected amounts (Moore, 2000) and to determine whether these differences were statistically significant. Using the chi-squared analysis, the research methodology is capable of comparing the number of

sample proportions and related data element frequencies to the number of population proportions. Using this statistical analysis, the investigative research is able to show which factors, or attributes, contribute the most to the components of chi-squared (Moore, 2000), and whether a relationship is observable between factors. This form of statistics offers the advantage of applying this technique to the research investigation since it permits easy use of comparing multiple proportions.

The survey elements of the parent/guardian survey questioned the respondent on their occupation, marital status, race and ethnicity, household annual income, and health care source. The survey also solicited from the respondent information pertaining to familial acanthosis nigricans, diabetes, and high blood pressure. The rationale for including these types of socio-economic elements in the survey instrument was for cross-comparison with the state's subsidized school lunch data, as well as to obtain household income status on those respondents exceeding state eligibility for the free and reduced lunch program. The health care source data element on the survey provides pertinent information that is useful for cross correlation with socio-economics and in supporting policy changes. The data element related to ethnicity is useful as a comparative variable for several reasons. First, the data collected related to this factor showed trends in the proportion of respondents' ethnicity. The ethnicity data for parents and guardians is also helpful in revealing inter-racial trends and adopted children. Finally, the ethnicity data is valuable in providing a cross-comparative analysis to support previous documented ethnic trends related to health status and socio-economic status.

One important data element of the parent/guardian survey is measuring marital status. The data collected relating to the marital status of the respondents is helpful in

determining correlations between household incomes and health care source, since single parents or guardians are more likely to have a lower household income than a household with two working spouses. Additionally, a single parent or guardian household would be more likely to qualify for government assistance than a household with more household income. The student questionnaire required more data elements in order to conduct a matched pair chi-squared analysis.

In the student questionnaire, the survey instrument's elements consisted of obtaining data related to the student's health, nutrition, physical activity, mental health, lifestyle, dietary eating habits, and access to health care. The importance of acquiring this information is tied to the research methodology of analyzing the student's information in comparison to the proportion of the primary data sample population and any available secondary sample population data (example, anthropometric information).

Given the previous discussion, the methodology chosen involved the matched pair statistical technique using bivariate data analysis. Parent/guardian consent forms with socio-economic surveys were distributed to every student in the 3rd, 4th, and 5th grades. The sample case and control populations originated from the total number of returned parent/guardian consent forms. Incomplete forms were discarded. Criteria for matching case to control subjects included anthropometric indicators for height, weight, gender, and ethnicity. A student questionnaire administered to the case and control sample populations measured student socio-economic factors. The student questionnaire's data elements were tallied and inputted into a spreadsheet. Final analysis of each survey element demonstrated proportional outcomes and quantitative values using chi-square

statistics to measure the correlative strength between the socio-economic variables and AN prevalence with compelling results.

CHAPTER V

STUDY RESULTS

Evaluation and Interpretation of Data

The study's results provide a relevant perspective of certain observed socio-economic factors that exhibit a correlative relationship with acanthosis nigricans (AN). Specifically, upon measuring the categorical variables resulting from the student questionnaire and the parent/guardian surveys, the data reveals correlations between AN prevalence and household income level, frequency to health care, access to health care, dietary eating habits, knowledge of nutrition, and lifestyle. In addition, thorough analysis of the uncorrelated data reveals some startling similarities between schoolchildren with AN and schoolchildren without AN when compared to the same categorical variables of socio-economics.

Since chi-square tests statistical significance for bivariate tabular analysis (2x2 tables), any appropriately performed test of statistical significance provides the degree of confidence in accepting or rejecting the hypothesis or null hypothesis. In the analysis of this study, chi-square tests whether or not two different samples differ enough in a characteristic that the investigation can generalize from the study samples that the general populations from which these samples are drawn are also different in this characteristic. For example, the chi-square tests for the main null hypothesis and its related null sub-

hypothesis determine whether a characteristic (example, household income) is not a characteristic of AN prevalence. While chi-square analysis is a rough estimate of confidence this method helps accept less accurate data in the statistic compared to other parametric tests, example t-tests and analysis of variance. This limitation of chi-square analysis is also its strength since it is more forgiving in the type of data that it accepts for use in the statistical analysis.

Bivariate analysis is useful in determining the intersections and relationship (if any) between independent and dependent variables (example, categorical variables). An independent variable is the characteristic that the investigation's hypothesis helps explain the characteristic of AN prevalence. Employing bivariate analysis, the investigation seeks to explain:

1) Whether there is a relationship between AN prevalence and socio-economic characteristics;
2) The strength of the relationship (if any); and,
3) Whether the relationship is due to effect modification, or some outside intervening variable.

Since chi-square does not require the sample data to be normally distributed, it relies on the assumption that the variables are normally distributed within the population from which the sample subjects are gathered. This aspect to chi-square puts some requirements on its use. The requirements for using chi-square analysis state the sample subjects be randomly drawn from a general population and the data must be analyzed in frequencies and not percentages. The categories of the independent and dependent variables must be mutually exclusive, frequencies for a 2x2 table should be at least five,

and frequencies for a 2x3 table should be at least two. In lieu of these requirements, the investigation sought to obtain a sample size that is sufficient to employ chi-square analysis.

Discussion of the Data's Results

To analyze the investigation's data, the study considered the total respondents for the urban population of case and control subjects as an adequate sample size (n = 46) for employing chi-squared analysis. However, the rural sample size (n = 18) was insufficient for independent analysis using the chi-square total values and the chi-square distribution critical values with a $p < .05$ upper tail probability. The study calculated the total chi-square value for the urban sample populations, and combined the rural sample data with the urban sample data and re-calculated the total chi-square values by "adjusting" the bivariate tabular ratios. This adjustment involved removing data in cells where the frequency of these data cells did not meet the minimum frequency thresholds required for conducting chi-squared analysis. This resulted in the investigation employing the adjustment methodology. The adjustments made in conducting the secondary chi-squared analysis involved combining the rural and urban populations and reviewing the total chi-square value and rendering an assumption based on the relativity of this variable on AN prevalence. The resulting values of this test yield an understanding that certain correlations do exist between socio-economics and the presence of acanthosis nigricans.

The presence of these factors and aspects of this study stimulate further consideration for conducting more study with a larger sample population size for case and control study subjects. Consistency exists between both geographical samples and

exhibit moderate similarity in their categorical variables and frequencies. A comprehensive analysis of this area would require a large enough sample size to obtain a sufficient and adequate sampling of the general population with characteristics under investigation.

Explanation of the Data's Importance and Phenomena

Due to the observed variability during the distribution phase of the survey instruments and follow-up informational gathering for the parental/guardian consent and survey forms, the investigation's experience made findings that are helpful in understanding the prevalence of acanthosis nigricans and helping guide future research and policy in this area. As previously mentioned, the thesis' findings include observable correlations in certain socio-economic factors related to two specific cohorts: schoolchildren with acanthosis nigricans matched-up to schoolchildren without acanthosis nigricans. The matched criteria utilized factors such as gender, age, study condition prevalence, height, weight, and ethnicity in pairing case subjects to control subjects. These categorical variables are basic criteria for matching case and control samples, and this experimental design offers opportunity for replication.

While the goal of this study is to stimulate further interest in researching the correlation between socio-economics characteristics and AN prevalence, the data suggests that some of the control subjects exhibit similar responses to case subjects as observed in the responses to the survey elements measuring socio-economic factors. It is infeasible to analyze this data for statistical purposes with any substantive level of confidence since the data sample is too small. Based on this observation, the

uncorrelated data resulting from adjusting the chi-square total values may simply be the result of an insufficient sample size to represent the normal occurrence in the general population.

While the investigation's findings are limited, the study did reveal a number of pertinent correlations based on the analysis of the chi-square total values for both unadjusted and adjusted data samples. Of the fifty-five total questions measuring socio-economic characteristics, 10.9 percent of the survey questions demonstrate measurable unadjusted correlations. Table 3 below outlines this correlative interpretation in the data for both the case and control study subjects in the urban independent school district (ISD).

Table 3

Urban ISD Case & Control Student Questionnaire Results

Question	**Chi-Sq. Critical Value (p<.05)**	**Total Chi-Sq. Value**
10	9.49	10.50
24	3.84	4.96
40	7.81	8.00
52	7.81	8.09
56	5.99	7.25
65	5.99	14.8

Adjusting this data based on their categorical variables provide similar trends observed in the unadjusted socio-economic characteristics under investigation. Again, the observed, measurable trends in the adjusted data include socio-economic factors using the following categorical variables: healthcare access, dietary eating habits, lifestyle, and

knowledge of nutrition. Table 4 depicts the chi-square total values for these adjustments and the new correlations observed in both study subject populations.

Table 4

Adjusted Urban ISD Case & Control Student Questionnaire Results

Question	Chi-Sq. Critical Value (p<.05)	Total Chi-Sq. Value
10	3.84	8.33
16	3.84	5.06
24	3.84	3.94
25	3.84	5.04
40	5.99	6.01
52	7.81	8.09
56	5.99	7.25
65	5.99	14.8

After calculating the chi-square total values for the initial data, the investigation combined the study samples to increase the sample sizes for both case and control populations. After consolidating these sample populations and calculating the chi-square total values for the combined samples, the analysis reveals some new correlations and removes some previous ones as well. Table 5 below depicts these findings:

Table 5

Total Chi-Square Values - Combined (Rural + Urban) Case & Control Student Results

Question	Chi-Sq. Critical Value (p<.05)	Total Chi-Sq. Value
20	9.49	11.95
33	3.84	4.36
40	7.81	7.94
45	5.99	7.43
52	7.81	9.80

61	5.99	6.72
63	5.99	6.28
65	5.99	10.76

The investigation then calculated the statistic by adjusting the data based on chi-square frequency requirements, which eliminates data cells not meeting the bivariate tabular requirement. The results from this adjustment reveal an additional four correlations: two related to healthcare access, one related to dietary eating habits and one related to knowledge of nutrition. Table 6 outlines the correlations following the adjustment in calculating the chi-square total values.

Table 6
Adjusted Total Chi-Square Values - Combined Case & Control Student Results

Question	**Chi-Sq. Critical Value (p<.05)**	**Total Chi-Sq. Value**
10	7.81	8.33
16	5.99	7.60
17	5.99	6.02
20	9.49	11.95
33	3.84	4.36
40	7.81	7.94
45	5.99	7.43
52	7.81	9.80
56	3.84	4.73
61	5.99	6.72
63	3.84	5.72
65	5.99	10.76

Taking the combined adjusted chi-squared data and comparing it to the proportion of respondents' total frequencies, the investigation observes five categories with measured correlations. Table 7 below represents the proportion of the categorical variables and observed correlations in proportion to their representative categories related to socio-economic attributes.

Table 7
Proportion of Categorical Variables to Socio-Economic Survey Elements

Categorical Variable	**Question(s)**	**Proportion**
Healthcare access	10, 16, & 20	3:9:55
Dietary eating habits	17, 33, 40, & 56	4:19:55
Knowledge of nutrition	45, 61, 63 & 65	4:17:55
Lifestyle	52	1:4:55

The investigation conducted an analysis of the case and control samples with bivariate tabular analysis to calculate the chi-square total values using the household income data from the parent/guardian consent and survey forms for each case and control subject. Based on this data, household income shows a strong correlation with AN prevalence for both the combined school district household income data and the urban ISD data independently. The chi-square total value for the urban ISD case and control responses is 12.64 with a chi-square critical value of 12.59 where $p < .05$. The chi-square total value for the combined data for both school districts is 15.74 with a chi-square critical value of 12.59 where $p < .05$. The following tables (see Tables 8 & 9) depict the correlative data related to socio-economic factors and household income for both the urban ISD data samples and the combined ISD data samples.

Table 8

Chi-squared Total Value for the Urban ISD Case & Control Subjects' Data

Category	**Chi-Sq. Critical Value (p<.05)**	**Total Chi-Sq. Value**
Household Income	12.59	12.64

Table 9

Chi-squared Total Value for Combined ISD Case & Control Subjects' Data

Category	**Chi-Sq. Critical Value (p<.05)**	**Total Chi-Sq. Value**
Household Income	12.59	15.74

Tables 10 & 11 below depict the data pertaining to the frequencies of the parent/guardian consent and survey forms for the urban independent school district (ISD) for both the case and control study subjects.

Table 10

Household Income & AN Prevalence – Urban ISD Case & Control Results

Income Level	**AN**	**No AN**
≤ $9,000	5	0
$10,000-$19,999	4	4
$20,000-$29,999	3	5
$30,000-$39,999	5	6
$40,000-$49,999	1	1
≥ $50,000	3	7
No Answer	2	

Table 11

Household Income & AN Prevalence – Combined ISD Case & Control Results

Income Level	**AN**	**No AN**
≤ $9,000	6	2
$10,000-$19,999	6	4
$20,000-$29,999	4	9
$30,000-$39,999	6	6
$40,000-$49,999	1	1
≥ $50,000	3	9
No Answer	3	3

While the investigation seeks to measure observable correlations between socio-economic factors and acanthosis nigricans prevalence, further analysis of the study's data reveals additional information worth discussion. In tabulating the response frequencies of parent/guardian consent and survey forms, the graphical representation of the data visually reveals a normal curve in the clustered column chart depicting household income levels between the amounts of $10,000 to $19,999 and the $40,000 to $49,999 range. The urban ISD response rate for the parent/guardian consent and survey forms is 13.55 percent out of one thousand five hundred and eighty-seven students in the 3rd, 4th and 5th grades, while the rural ISD response rate for the parent/guardian consent and survey form is 20.6 percent out of five hundred enrolled elementary students. The following two figures (see Figures 4 & 5) portray this data for the urban independent school district (ISD) data sample and the rural ISD data sample.

Figure 4

Parent/Guardian with Child Enrolled in Urban ISD Responding to Survey Question "Does anyone in your family have a dark ring around their neck? A physician may or may not have diagnosed this as acanthosis nigricans."

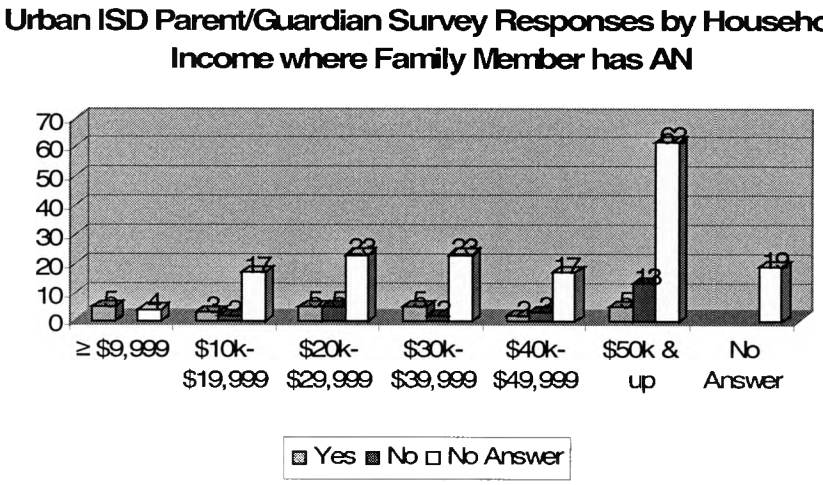
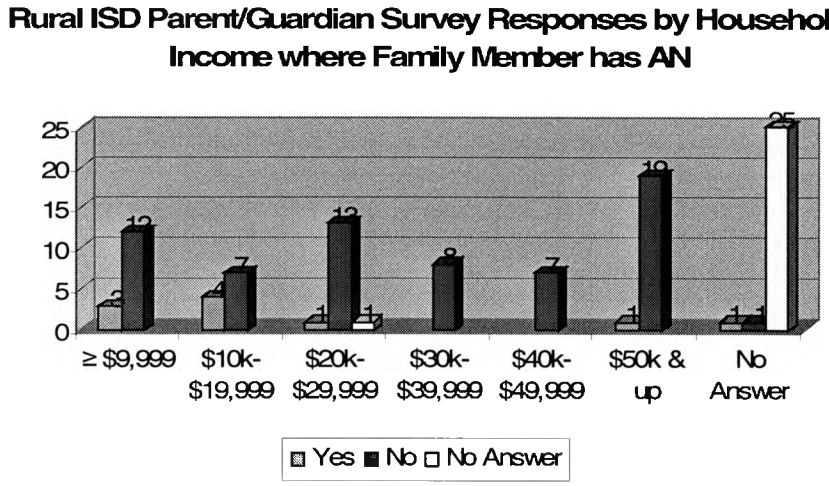


Figure 5

Parent/Guardian with Child Enrolled in Rural ISD Responding to Survey Question "Does anyone in your family have a dark ring around their neck? A physician may or may not have diagnosed this as acanthosis nigricans."



Assuming that factors affecting the study subjects' body mass index remain constant, the investigation's data is also helpful in depicting the probability of the case subjects in developing adult obesity. The data, when compared to Guo et al.'s tables characterizing the probability of a boy or girl developing adult obesity based on the child's body mass index level being at or above the 95th percentile, demonstrates that 82.6% of the urban ISD AN case subjects may become obese by adulthood (see Table 12 below). This data is disconcerting given Guo et al.'s calculated probabilities for a child developing obesity.

Table 12
BMI of the Urban Case Study Subjects Compared to Guo's Analysis
Determining the Probabilities for Adult Obesity with BMI Levels at or above the 95th Percentile.

Case Subject's Age & BMI			Obesity Probabilities 95th	95th
Age (yrs)	Males	Females	Males	Females
10	26.95	28.63	0.37	0.52
10	38.03	26.73	0.37	0.52
10	24.2	47.51	0.37	0.52
10	27.59	29.21	0.37	0.52
10	23.2	22.21	0.37	
11	29.47	22.84	0.28	
11	22.68	25.22		0.59
11	25.74	29.67	0.28	0.59
11	26.5	23.42	0.28	
11	27.21		0.28	
11	23.8		0.28	
12	26.02	32.89	0.38	0.5
12		34.38		0.5

The investigation was able to obtain additional secondary data pertaining to whether or not the case and control study subjects took part in the state's free and reduced lunch program regulated by the Texas Education Agency. To determine eligibility for free

meals under the Texas Education Agency (TEA) program to implement the National School Lunch and Child Nutrition Program, TEA uses four categories to define a student's economically disadvantaged status. These criteria include:

A. Students from a family with an annual income at or below the official poverty line

B. Students eligible for Temporary Assistance to Needy Families (TANF) or other public assistance

C. Students that received a Pell Grant or comparable state program of need-based financial assistance

D. Students eligible for programs assisted under Title II of the Job Training Partnership Act

E. Student eligible for benefits under the Food Stamp Act of 1977

Source: TEA (2005). *2004-2005 Economically Disadvantaged Students Report Criteria.* Retrieved on 3/17/05 from http://www.tea.state.tx.us/adhocrpt/abteco05.html

The Department of Health and Human Services (HHS) develops and updates the federal poverty guidelines. According to the HHS, the 2005 Poverty Guidelines state the following for persons per family unit residing in one of the 48 contiguous states, including the District of Columbia and excluding Hawaii and Alaska:

Persons in Family Unit	Income
1	$9,570
2	12,830
3	16,090
4	19,350
5	22,610
6	25,870
7	29,130
8	32,390

Source: *Federal Register*, Vol. 70, No. 33, February 18, 2005, pp. 8373-8375.

Based on these TEA criteria for determining student economically disadvantaged status and the federal poverty guidelines, the investigation obtained the economically disadvantaged status for each of the participating case and control subjects. These findings reveal that 83.3 percent of the rural ISD students classify under the economically disadvantaged status and 65.2 percent of the urban ISD student case and control study subjects classify under the economically disadvantaged status. Of the case subjects, those schoolchildren with acanthosis nigricans, 100 percent of the rural ISD case subjects are economically disadvantaged according to TEA, and 63.3 percent of the urban ISD case subjects are economically disadvantaged. This proportional data reveals that children with AN comprise a majority of the study subjects categorized as economically disadvantaged.

Synthesis and Conclusion of Study's Results and Findings

The findings from this thesis' investigation demonstrate observable correlations between acanthosis nigricans prevalence and socio-economic factors; however, this information does not necessitate support for a direct causal relationship. In lieu of the data's correlations involving socio-economic factors and the prevalence of acanthosis nigricans, further research should explore these categorical correlations using a larger sample population. Increasing the sample sizes will help heighten the confidence for interpreting the data. In addition, the larger sample sizes for both the control and case groups will greatly benefit the statistical interpretation representative of the general population under study. Rationale for this assertion emanates from the investigation's

unfortunate experiences where unexpected situations in the survey deployment and collection processes limited the sample sizes for both the case and control populations. These limiting aspects include survey distribution management and possible survey questionnaire enhancement. Concerning the school districts' deployment of the surveys, the investigation incurred additional costs resulting from lost surveys, obtaining necessary parent/guardian consent, and additional project management. This aspect of the study was the result of insufficient resources. Additional resources would help fund adequate management of the survey deployment and collection processes and this would result in higher response rates in the observable frequencies of parent/guardian consent forms and surveys and overall student participation. By increasing the case and control sample sizes, the quantities for each data cell may increase due to the increase in probability. The increase in frequencies used for bivariate tabular analysis might yield additional correlations in categorical socio-economic variables and acanthosis nigricans prevalence.

Because of the measurable correlations, this investigation hopes to stimulate not only further scientific research related to studying AN prevalence and socio-economic factors, but this thesis' investigation hopes to encourage policy development in order to help government programs, particularly Texas, with their efforts to address the continued rise in obesity and adolescent diabetes. In lieu of the findings relative to the Texas' ANTES program, this study offers the following policy recommendations for consideration:

1) Re-organize the current Texas ANTES screening program for acanthosis nigricans and place the regulatory authority under the state

department of state health services so the program may utilize the physician provider communication channels and the division of epidemiology in conducting surveillance and reporting;

2) Screen schoolchildren first for their body mass index. Based on the study's data depicting schoolchildren with high BMI levels, school nurses should first screen schoolchildren using their BMI level. Again, this is accomplished by taking their weight and height measurements and calculating the BMI (formula: BMI = [weight in pounds/ height in inches/height in inches] * 703). School nurses can first screen school children for their BMI and identify those schoolchildren with BMI levels at or above the 85^{th} percentile as at-risk and screen this at-risk cohort for acanthosis nigricans and their blood pressure level; and

3) The state should create an advisory committee comprised of physicians, urban and rural school nurses, and parents with diabetic and/or obese schoolchildren to advise the re-organized state screening program.

APPENDIX A

Health & Wellness School Project
ISD Forms

April 12, 2005

Mr. [First Name] [Last Name]
Superintendent
Name of ISD
Address
City, Texas Zip Code

RE: Health & Wellness School Project

Dear Mr. [Last Name],

Attached is information pertaining to the Health & Wellness School Project. We are soliciting approval from your school district in implementing this project in 3rd, 4th, and 5th grades. Participation means allowing measurement and analysis of approximately 40 students in each selected school. The time required is approximately 1 hour per student and the testing will be conducted in one session. I will be calling you during the next week to answer any questions you might have. Please contact me, or the primary investigator, Dr. Robert Galloway, if you have any questions or concerns. You may reach us at:

Craig Walker
Secondary Investigator
Texas State University
512.451.1524
walkercommunications@yahoo.com

or

Robert Galloway, PhD
Principal Investigator & Advisor
Texas State University
512.245.8239
rg23@txstate.edu

Thank you for your time in considering this request.

Sincerely,

Craig Walker
Secondary Investigator

Attachments

Brief Overview of the Health & Wellness School Project

The Brief Overview of the Health & Wellness School Project is a surveillance system that will help monitor student health and wellness in schoolchildren. Specifically, the project will monitor the impact of socio-economics on obesity and overweight in school children in Texas.

This study will provide data that is representative of rural and urban Texas.

Approximately 40 students from the 3rd, 4th, and 5th grades will be invited to participate from the following selected schools. Data will be randomly selected from each school's data sample and analyzed.

The time required from each student is approximately one-hour minutes.

Participating students will complete a questionnaire that will assess their self-reported knowledge of nutrition, health, wellness, access to health care, and physical activity, or exercise.

A trained data collector will administer the student questionnaire.

NO student names or individual schools will ever be identified with their data.

Participating school districts will receive the following information following the project:

1. A report of their district's data.
2. A copy of the project's final report.

Health & Wellness School Project Parent or Guardian Consent, Class Selection Guidelines, and Active Consent

1. Your district requires students to return their consent signed by their parent or guardian ONLY IF their parent or guardian WANTS their child to participate in the project.

2. Select enough students in the 3rd, 4th, and 5th grades to total around 40 students.

3. The questionnaires must be completed by at least 30 or more students as there may be students whose parents, or guardian, do not wish for them to participate.

4. Students should be recruited from regular core classes (i.e., classes that everyone in the grade level is required to take, like English).

5. Students should not be selected from classes that are not part of the core curriculum such as honors classes, English as a Second Language, Band, or any other electives (Note: This is to ensure a representative sample of students from each school).

6. Students who return a consent form signed by a parent or guardian stating they DO WANT their child to take part in the project are allowed to take the questionnaire survey.

7. Information from this project will be confidential and used to ensure the continuation of education and health care services.

8. You must return this consent form if you want your child to be part of this study!

Thank you for your assistance and participation!

MEMORANDUM

To: Name of ISD School Nurse Director

From: Craig Walker, Texas State University

Re: Health & Wellness School Project

Date: Fall 2004

Attached you will find Guidelines for student selection and a Parents letter and Consent form for the Health & Wellness School Project surveys. Thank you for your willingness to allow your students to participate. Again, each campus will only require one hour to complete the project, and a Spanish-speaking project team member and myself will conduct the entire session. The team will be in Austin, Texas on _____date_____ . The time schedule will be as follows:

Name of ISD — November 23rd at 1:30pm

Please let me know where you would like the survey to be conducted. Let me know if you have any questions. Thanks.

School Nurse Survey Procedures

- Send Yellow Colored Paper with English/Spanish "Parent/Guardian Consent Form & PTO Parent Survey" stapled to English/Spanish "Health & Wellness School Project Information Forms" to all children in 3rd, 4th, and 5th grades;

- Collect "Parent/Guardian Consent Form & PTO Parent Survey";

- Contact Secondary Administrator of the Health & Wellness School Project;

- Identify children 3rd, 4th, and 5th grades that have acanthosis nigricans (AN);

- Select two students, who do not have AN, with each student that has AN based on similar, matched characteristics of gender, ethnicity/race, height, and weight – these students will comprise the "control" group;

- Students with AN (research study group) and matched students without AN (control study group) will be required to take a questionnaire. The Secondary Administrator of the Health & Wellness School Project, accompanied with a Spanish-speaking person, will administer the questionnaire. This questionnaire will be administered during a scheduled visit and it will require a designated room, like the cafeteria, for testing the group in one sit-down setting. **If a student with AN (study subject) or a student without AN (control subject) does not have an associated "Parent/Guardian Consent Form", then send a "Parent/Guardian Consent Form" home with the student for the 2nd time to try and obtain their Consent**;

- The results from the student questionnaires will be randomly sampled and analyzed using matched-pair comparison and Chi-Squared statistical analysis to measure the correlation of socio-economics in the causal chain of acanthosis nigricans and will be used to help support policy efforts to increase funding for education and health care; and,

- Questions or concerns, please contact Craig Walker, Secondary Investigator at Texas State University's Department of Health Administration by calling 512-451-1524.

Letter of Participation and Agreement from School District

Name of Independent School District would like to participate in the Health & Wellness School Project and will work with you to assure that the project receives our full consideration.

_____ _____

Signature of School District Representative Date

_____

Printed Name

_____

Position Held

APPENDIX B

Health & Wellness School Project
Student Questionnaire
3rd, 4th, & 5th Grades

You are about to be asked numerous questions about what you know about your health, nutrition, wellness, diet, and physical exercise.

An adult will conduct the survey.

Absolutely no one at home or at school will see your answers.

Taking part in this project is completely up to you, and your choice to participate in this project will not affect your grades, or other school activities, in any way.

All of your information will be kept confidential.

By signing in the space below, you agree to take part in this project.

_____

Student Signature Date

Health & Wellness School Project
Student Questionnaire (Bubble Survey)
3rd, 4th, & 5th Grades

Directions:
The following questions are about what kids know about their health, access to health care, what they eat, what they know about nutrition, and their physical activity (exercise). Your answers will help us learn about students in Texas and will be used to design better health & wellness programs. Read each question carefully and pick the answer that is true for you. Mark that answer on your student questionnaire as shown in the example below. This is not a test and there are no right or wrong answers; so, please take time answering each question truthfully. Remember, your answers will be kept private.

Marking Instruction: Answer the question(s) completely.
Student Information:

What school do you go to?_____

1. Write your school ID Number.

2. Write today's date.

3. Write your grade.

4. Write your birth date.

5. Write your age.

6. Are you a girl or boy?
   _Girl _Boy

7. How do you describe yourself?
   Answers:
   American Indian or Alaska Native
   Asian
   Black or African American
   Hispanic or Latino
   Native Hawaiian or Other Pacific Islander
   White, non-Hispanic, non-Latino

8. How tall are you?_____

9. What do you think you weigh?_____

10. How many times in the past year have you seen a doctor because you were sick or injured?
    0 times 1 time 2-5 times 6-10 times More than 10 times

11. How many times in your life have you ever been to the doctor because you were sick?
    0 times 1 time 2-5 times 6-10 times More than 10 times

12. Yesterday, how many times did you eat hamburger meat, hot dogs, sausage (chorizo), steak, bacon, or ribs?
    _None _1 Time _2 Times _3 or More Times

13. How many times in your life have you ever been to the hospital because you were sick or hurt?
    0 times 1 time 2-5 times 6-10 times More than 10 times

14. How many times in your life have you ever been to the emergency room at the hospital because you were sick or hurt?
    0 times 1 time 2-5 times 6-10 times More than 10 times

15. How many times in your life have you ever been to the school nurse because you did not feel well?
    0 times 1-3 times 4-5 times 6 or more times

16. The last time you received medical care, was it at a doctor's office, clinic, hospital, some other place, or telephone call?
    Doctor's office Clinic, hospital Other place Telephone call

17. Yesterday, how many times did you eat any kind of cheese, cheese spread or a cheese sauce?
    _None _1 Time _2 Times _3 or More Times

18. Yesterday, how many times did you drink any kind of milk?
    _None _1 Time _2 Times _3 or More Times

19. If you have any brothers or sisters do they go to the doctor's office, clinic, or hospital more than you do?
    _Yes _No

20. If so, how many times?
    0 times 1 time 2-5 times 6-10 times More than 10 times

21. Do you think you are healthy most of the time?
    _Yes _No

22. Do you believe regular sodas or soft drinks are high in sugar?
    _Yes _No

23. Do you think home cooked meals are better for you than meals from McDonalds or Burger King?
    _Better for you _About the same _Not better for you

24. Do you eat three regular meals a day?
    _Yes _No

25. How many total times have you missed school because of health problems?
    0 times 1 time 2-5 times 6-10 times More than 10 times

26. Other than your regular meals, how many snacks do you eat in a day?
    None 1 snack 2-5 snacks 6-10 snacks More than 10 snacks

27. When you choose something to eat, do you choose the food because it:
    Tastes good?
    Someone said it was good for you?
    Just to get full?

28. How important is nutrition to your diet?
Very important Important Neutral Not important

29. Have you ever tried to lose weight?
    _Yes _No

30. Are you trying to lose weight now?
    _Yes _No

31. Are French fries good for you to eat?
    _Yes _No

32. Are Big Mac hamburgers good for you to eat?
    _Yes _No

33. Do you usually take a vitamin pill?
    _Yes _No

34. Have you felt sad or depressed during the past year?
_Yes _No

35. Yesterday, how many times did you eat French fries or chips?
_None _1 Time _2 Times _3 or More Times

36. Yesterday, how many times did you eat vegetables?
_None _1 Time _2 Times _3 or More Times

37. Yesterday, how many times did you eat fruit?
_None _1 Time _2 Times _3 or More Times

38. Yesterday, how many times did you drink fruit juice?
_None _1 Time _2 Times _3 or More Times

39. Yesterday, how many times did you drink any punch, Kool-Aid, sports drinks, or other fruit-flavored drinks? Do no count fruit juice.
_None _1 Time _2 Times _3 or More Times

40. Yesterday, how many times did you drink any sodas or soft drinks?
_None _1 Time _2 Times _3 or More Times

41. Yesterday, how many meals did you eat?
_None _1 Time _2 Times _3 or More Times

42. Yesterday, how many times did you eat or drink a snack?
_None _1 Time _2 Times _3 or More Times

43. Do you eat the school lunch served in the cafeteria?
Yes
Sometimes
No

44. Do you usually eat or drink something for breakfast?
Yes
Sometimes
No

45. When you think about how you usually eat, would you say that your eating habits are:
Healthier than your friends
About the same as your friends
Much less healthy than your friends

46. In an average week when you are in school, on how many days do you go to physical education (PE) classes?
    _0 _1 _2 _3 _4 _5

47. Do you take physical education (PE) class?
    _Yes _No

48. Do you take part in any other organized physical activities or take lessons, such as soccer, football, martial arts, dance, gymnastics, or tennis after school?
    _Yes _No

49. During an average physical education (PE) class, how many minutes do you spend actually exercising or playing sports?
    Less than 10 minutes
    10 to 20 minutes
    21 to 30 minutes
    31 to 40 minutes
    41 to 50 minutes
    51 to 60 minutes
    More than 60 minutes

50. During the past 12 months, on how many sports teams run by your school did you play (do not include PE classes)?
    _0 teams _1 team _2 teams _3 teams or more

51. Do you watch TV?
    _Yes _No

52. How many hours per day do you usually watch TV or video movies?
    Less than 1 hour a day
    1-2 hours a day
    3-4 hours a day
    More than 4 hours a day
    Don't watch TV

53. Do you play video games like Nintendo, Sega, Sony PlayStation, arcade games, X-Box, Game Cube, etc.?
    _Yes _No

54. How many hours per day do you usually spend playing video games or arcade games?
    Less than 1 hour a day
    1-2 hours a day
    3-4 hours a day
    More than 4 hours a day
    Don't play video games

55. Do you like to eat the school lunch served in the cafeteria?
    Yes
    Sometimes
    No

56. Would you like to:
    Weigh more Stay about the same weight Weigh less

57. Compared to other students in your grade who are as tall as you, do you think you weigh:
    The right amount
    Too much
    Too little (or not enough)

58. How many total servings of fruits and vegetables should you eat each day?
    2 servings
    3 servings
    4 servings
    5 servings
    Don't know

59. The foods that you eat and drink are healthy so there is no reason for you to make any changes to your diet.
    Yes
    No
    Don't know

60. Do you think you eat can make a difference in your chances of getting heart disease or cancer?
    Yes
    No
    Don't know

61. Do you think people, who are underweight, are more likely to have a higher risk of health problems than people who are not overweight?
    Yes
    No
    Don't know

62. Do you think skipping meals such as breakfast or lunch hurts your ability to do well in your classes?
    Yes
    No
    Don't know

63. Do you think people, who are overweight, are more likely to have a health problem than people who are not overweight?
    Yes
    No
    Don't know

64. Are you willing to try new foods?
    Yes
    No
    Don't know

65. Do you think the school lunch served in the cafeteria is nutritious?
    Yes
    No
    Don't know

Thank you for your help!

APPENDIX C

el Proyecto Escolario de Salud y Bienestar
Encuesta para Estudiante
Grados 3, 4, y 5

El cuestionario te va preguntar muchas preguntas sobre lo que sabes de tu salud, la nutricíon, bienestar, dieta y actividades físicas.

Un adulto va dar la encuesta.

Totalmente ninguna persona en casa ni escuela no va ver tus respuestas.

Tu participación en este proyecto es tu decisión completamente, y tu escogido a participar en este proyecto no afecta de ninguna manera tus marcos, ni otras actividades escolarias.

Toda tu información va ser secreta.

Si firmes bajo, tu aceptas participar en este proyecto.

_____

Firma de Estudiante Fecha

el Proyecto Escolario de Salud y Bienestar
Encuesta para Estudiante
Grados 3, 4, y 5

Direcciónes:
Las preguntas siguientes son sobre el conocimiento de niños de su salud, su acceso de aseguranza de salud, lo que comen, lo que saber de la nutricíon, y sus actividades físicas (los ejercicios). Tus respuestas nos van ayudar aprender sobre los estudiantes de Texas y las respuestas van ser usados para diseñar programas mejores de salud y bienestar. Lée cada pregunta con cuidado y escoge la respuesta que es verdad para tí. Marca esa respuesta en tu cuestionario como el ejemplo bajo. Este cuestionario no es una prueba y no hay respuestas correctas ni equivocadas; entonces, favor de contester con verdad. Acuérdate de que tus respuestas van ser secretas.

Instrucciónes de marcar: Rellena los círculos completamente.
Información del estudiante:

¿Cuál escuela asistes?_____

1. Rellena el número de indentifición de tu escuela.
2. Rellena la fecha de hoy.
3. Rellena tu grado.
4. Rellena tu fecha de nacimiento.
5. Rellena tu edad.
6. ¿Eres niño o niña?
   _ niña _ niño
7. ¿Cómo describes tú?
   Respuestas:
   Americano Nativo o Nativo de Alaska
   Asiático
   Negro o Americano-Africano
   Hispano o Latino
   Nativo de Hawaii o de las Islas Pacíficas
   Blanco, y no eres Hispano o Latino
8. ¿Cuál es tu talle?_____

9. ¿Cuánto pesas tú?_____.

10. ¿Durante este año, cuántas veces visitaste un médico porque tú estuviste enfermo o herido?
    0 veces 1 vez 2-5 veces 6-10 veces más que 10 veces

11. ¿Cuántas veces visitaste un médico porque tú estuviste enfermo?
    0 veces 1 vez 2-5 veces 6-10 veces más que 10 veces

12. ¿Ayer, cuántas veces comiste carne de hamburguesa, hot dogs, chorizo, bistec, tocino, o costillas?
    _nunca _1 vez _2 veces _3 o más veces

13. ¿En toda tu vida, cuántas veces visitaste un hospital porque tú estuviste enfermo o herido?
    0 veces 1 vez 2-5 veces 6-10 veces más que 10 veces

14. ¿En toda tu vida, cuántas veces visitaste la sala de emergencia de un hospital porque tú estuviste enfermo o herido?
    0 veces 1 vez 2-5 veces 6-10 veces más que 10 veces

15. ¿En toda tu vida, cuántas veces visitaste la enfermera de tu escuela porque tú no te sentiste bien?
    0 veces 1-3 veces 4-5 veces 6 o más veces

16. ¿La última vez que tú recibiste ayuda médica fue a la oficina de un médico, una clínica, hospital, otro lugar, o una llamada telélfonica?
    Oficina de un Médico Clínica, Hospital Otro Lugar una Llamada Telélfonica

17. ¿Ayer, cuántas veces comiste cualquier tipo de queso, cheese spread o salsa de queso?
    _nunca _1 vez _2 veces _3 o más veces

18. ¿Ayer, cuántas veces bebiste cualquier tipo de leche?
    _nunca _1 vez _2 veces _3 o más veces

19. ¿Si tienes hermanos o hermanas, visiten a la oficina de un médico, una clínica, o hospital más que tú?
    _Sí _No

20. ¿Si sí, cuántas veces?
    0 veces 1 vez 2-5 veces 6-10 veces más que 10 veces

21. ¿Piensas que tú estás sano la mayoria del tiempo?
    _Sí _No

22. ¿Piensas que las bebidas gaseosas tienen mucho azúcar?
_Sí _No

23. ¿Piensas que las comidas preparadas en casa son más sanas que las comidas de McDonalds o Burger King?
_ Más Sanas _Son Iguales _ Menos Sanas

24. ¿Comes tres comidas regulares cada día?
_Sí _No

25. ¿Cuántas veces no asistes escuela por los problemas de salud?
0 veces 1 vez 2-5 veces 6-10 veces más que 10 veces

26. ¿Aparte de tus comidas regulares, cuántos bocados comes cada día?
Ninguno 1 bocado 2-5 bocados 6-10 bocados más que 10 bocados

27. ¿Cuándo escoges algo de comer, escoges por:
¿Buen sabor?
¿Alguien dice que es sano?
¿Solamente para llenar?

28. ¿Es una dieta nutritiva importante para tí?
Muy Importante Importante Neutral No es Importante

29. ¿Has tratado de bajar peso (adelgazar)?
_Sí _No

30. ¿Tratas de bajar peso ahora?
_Sí _No

31. ¿Son las papas fritas sanas?
_Sí _No

32. ¿Son las hamburguesas Big Mac sanas?
_Sí _No

33. ¿Normalmente tomas una píldora de vitamina?
_Sí _No

34. ¿Estabas triste o deprimente este año?
_Sí _No

35. ¿Ayer, cuántas veces comiste las papas fritas o chips?
_nunca _1 vez _2 veces _3 o más veces

36. ¿Ayer, cuántas veces comiste vegetales?
_nunca _1 vez _2 veces _3 o más veces

37. ¿Ayer, cuántas veces comiste frutas?
_nunca _1 vez _2 veces _3 o más veces

38. ¿Ayer, cuántas veces bebiste jugo de fruta?
_nunca _1 vez _2 veces _3 o más veces

39. ¿Ayer, cuántas veces bebiste cualquier tipo de bebidas de ponche, Kool-Aid, las bebidas de deportes o otras bebidas de sabores de fruta? No incluyas jugo de fruta.
_nunca _1 vez _2 veces _3 o más veces

40. ¿Ayer, cuántas veces bebiste bebidas gaseosas?
_nunca _1 vez _2 veces _3 o más veces

41. ¿Ayer, cuántas comidas comiste?
_nunca _1 vez _2 veces _3 o más veces

42. ¿Ayer, cuántas veces comiste o bebiste bocados?
_nunca _1 vez _2 veces _3 o más veces

43. ¿Almuerzas el almuerzo cocinado en la cafetería de la escuela?
Sí
A veces
No

44. ¿Normalmente desayunas?
Sí
A veces
No

45. Piensa de lo que tú come normalmente. ¿Son tus hábitos de comer:
Más sanos que los hábitos de comer de tus amigos
Iguales que tus amigos
Mucho menos sanos que tus amigos

46. ¿Durante una semana normal del año escolario, cuántas días asistes clases de la educación física (PE)?
_0 _1 _2 _3 _4 _5

47. ¿Asistes clases de la educación física (PE)?
_Sí _No

48. ¿Participas en actividades físicas organizadas o tomas clases después de la escuela, como el fútbol, el fútbol Americano, los artes marciales, el baile, la gymnasia, o el tenis?
    _Sí _No

49. ¿Durante una clase de la educación física (PE), cuántos minutos pasas hacer ejercicios o jugar deportes?
    Menos que 10 minutos
    10 a 20 minutos
    21 a 30 minutos
    31 a 40 minutos
    41 a 50 minutos
    51 a 60 minutos
    Más que 60 minutos

50. ¿Durante los 12 meses pasados, participaste con cuántos equipos de deportes de tu escuela (no incluyas las clases de la educación física)?
    _0 equipos _1 equipo _2 equipos _3 equipos o más

51. ¿Miras la televisión?
    _Sí _No

52. ¿Normalmente, cuántas horas miras la television o películas de video por día?
    Menos que 1 hora por día
    1-2 horas por día
    3-4 horas por día
    Más que 4 horas por día
    No miro la TV

53. ¿Juegas los juegos de video como Nintendo, Sega, Sony PlayStation, los juegos de arcade, X-Box, Game Cube, etc.?
    _Sí _No

54. ¿Normalmente, cuántas horas por día juegas los juegos de video o arcade?
    Menos que 1 hora por día
    1-2 horas por día
    3-4 horas por día
    Más que 4 horas por día
    No los juego

55. Me gusta comer el almuerzo cocinado en la cafeteria.
    Sí
    A veces
    No

56. ¿Quieres?:
Pesar más Mantener más o menos el peso de ahora Pesar menos

57. ¿Si te comparas a los otros estudiantes de tu grado que tienen el mismo talle, piensas que tú pesas?:
    La cantidad apropiada
    Demasiado
    Insuficiente

58. ¿Cuántos servings completos de frutas y vegetales debes comer cada día?
    2 servings
    3 servings
    4 servings
    5 servings
    No sé

59. La comida que comes y bebes es sana, entonces no hay razón cambiar tu dieta.
    Sí
    No
    No sé

60. Lo que comes puede afectar la posibilidad de que tú sufres de la enfermedad del corzón o del cáncer.
    Sí
    No
    No sé

61. Las personas que no pesan suficiente tienen la probabilidad de más riesgos de problemas de salud que las personas que no pesan demasiado.
    Sí
    No
    No sé

62. Cuando falto comer concinas como el desayuno o almuerzo hace daño a mi capacidad tener éxito en mis clases.
    Sí
    No
    No sé

63. Las personas que pesan demasiado tienen la probabilidad de más riesgos de problemas de salud que las personas que no pesan demasiado.
    Sí
    No
    No sé

64. Estoy dispuesto a tratar comidas nuevas.
    Sí
    No
    No sé

65. Pienso que el almuerzo cocinado en la cafetería es nutritivo.
    Sí
    No
    No sé

¡Gracias por tu ayuda!

APPENDIX D

Parent/Guardian Consent Form and Survey
English & Spanish Translations

Please read – your response could help increase money to Texas school children.

- **Texas State University – San Marcos, Texas has asked the Town ISD (TISD) to send the following "PTO Parent Survey" to the parents whose children are enrolled in 3rd, 4th, and 5th grades. Parents of TISD are asked to consider responding to this voluntary survey, however you do not have to do this if you do not want to.**

- **The purpose of this voluntary survey is to assess the socio-economic aspect of the community. The information will be confidential and will be used to help support policy efforts to increase funding for education and health care.**

- **Questions or concerns, please contact Craig Walker, Secondary Investigator at Texas State University's Department of Health Administration by calling 512-451-1524.**

Parent/Guardian Consent Form

If you want your son/daughter to take part in the **Health & Wellness School Project**, please sign and return this form. You may refuse for your child to participate, or may discontinue your child's participation at any time without penalty.

If YOU WANT your son/daughter to participate, please sign below and send this form to his/her school nurse as soon as possible.

Parent/Guardian _____ Date _____

Student's Name _____

If you have any questions or concerns about the project or your son/daughter's participation, please contact:

Craig Walker Secondary Investigator Texas State University 512.451 1524 walkercommunications@yahoo.com	or	Robert Galloway, PhD Principal Investigator & Advisor Texas State University 512 245 8239 rg23@txstate.edu

If you have any questions as to your son's/daughter's rights as a research subject, call the Committee for the Protection of Human Subjects at Texas State University in San Marcos, Texas at 512-245-2314.

Return to Teacher ASAP!

The following is a voluntary survey. Please circle the appropriate answer and return the survey to your child's school.

1. **Child's grade in school?** □ *3rd* □ *4th* □ *5th*

2. **Occupation?** □ *Clerical* □ *Mechanical* □ *Technical* □ *Supervisor* □ *Management* □ *Other*

3. **Marital status?** □ *Single* □ *Married* □ *Widowed* □ *Divorced* □ *Separated*

4. **Race & ethnicity?** □ *Asian* □ *Black* □ *Hispanic* □ *White* □ *Other*

5. **Household annual income?**

   □ *Up to $9,999* □ *$10,000 to $19,999* □ *$20,000 to $29,999*
   □ *$30,000 to $39,999* □ *$40,000 to $49,999* □ *$50,000 & up*

6. **Health care source (mark the type of care below and circle the specified source)?**

   □ *Government (Healthy Kids/CHIP, CHAMPUS, Prime Care, TRICARE, Medicare, Medicaid, city/county/state)*

   □ *Employer-provided/assisted (HMO, PPO, or Managed Care)*

   □ *Self-provided health insurance (fee-for-service, or individual)*

7. **Does anyone in your family have a dark ring around their neck? A physician may or may not have diagnosed this as acanthosis nigricans.**

   □ *Yes* □ *No*

   If yes, then who? □ *Parent* □ *Child* □ *Brother* □ *Sister*

8. **Does anyone in your family have diabetes?** □ *Yes* □ *No*

   If yes, then who? □ *Parent* □ *Child* □ *Brother* □ *Sister*

9. **Does anyone in your family have high blood pressure?** □ *Yes* □ *No*

   If yes, then who? □ *Parent* □ *Child* □ *Brother* □ *Sister*

Return to Teacher ASAP!

<u>Favor de leer –</u> su respuesta podría aumentar los fondos para la educación de los niños en el estado Texas.

- **La Universidad del Estado en Texas de San Marcos ha pedido que el distrito escolar independiente de Cuidad (ISD) envíe esta «Encuesta Para los Padres PTO» a los padres de los niños de los grados 3, 4 y 5. La Universidad en Texas de San Marcos le agradecería si ud. responde a la siguiente encuesta voluntaria. No es necesario responder.**

- **El propósito de esta encuesta voluntaria es para evaluar los aspectos socioeconómicos de la comunidad. La información será confidencial y solamente usada para ayudar a aumentar los fondos para la educación y el seguro de salud.**

- **Si usted tiene preguntas o preocupaciones, contacte al Sr. Craig Walker, Investigador Secundario en el Departamento de Administración de la Salud de la Universidad del Estado de Texas. El número telefónico es el 512-451-1524.**

La Forma del Consentimiento del Padre/Guardián

Si ud. quiere que su hijo/a participe en **El Proyecto Escolar de Salud y Bienestar**, por favor firme y devuelva esta forma. Ud. puede rehusarse a que su hijo/a participe, o interrumpir la participación de su hijo/a en cualquier momento.

Si UD. QUIERE que su hijo/a participe, por favor firme a la mayor brevedad y mande esta forma a la enfermera de la escuela de su hijo/a.

Padre/Guardián _____ Fecha _____

Nombre del estudiante _____

Si usted tiene preguntas o preocupaciones sobre el proyecto o la participación de su hijo/a, póngase en contacto con:

Craig Walker Investigador Secundario Universidad del Estado de Texas 512 451 1524 walkercommunications@yahoo com	o	Robert Galloway, PhD Investigador Principal y Consejero Universidad del Estado de Texas 512.245 8239 rg23@txstate edu

Si ud. tiene preguntas sobre los derechos de su hijo/a al participar como sujeto de investigaciones, favor de llamar al Comité para la Protección de los Sujetos Humanos de la Universidad del Estado de Texas en San Marcos. El número telefónico es el 512-245-2314.

¡Devuelva al Maestro Cuanto Antes!

Esta es una encuesta voluntaria. Circule la respuesta apropiada y devuelva la encuesta a la escuela de su hijo/a.

¿El grado de su hijo/hija? □ *3* □ *4* □ *5*

¿Ocupación? □ *de Oficina* □ *Mecánico* □ *Técnico* □ *Supervisor* □ *Administración* □ *Otro*

¿Estado civil? □ *Soltero* □ *Casado* □ *Viudo* □ *Divorciado* □ *Separado*

¿Raza? □ *Asiático* □ *Negro* □ *Hispano* □ *Blanco* □ *Otro*

1. **¿Ingreso anual familiar?**

   □ *Hasta $9,999* □ *$10,000 a $19,999* □ *$20,000 a $29,999*
   □ *$30,000 a $39,999* □ *$40,000 a $49,999* □ *$50,000 y mas*

2. **¿Tipo de a seguro de salud (marque el tipo de seguro)?**

   □ *del Gobierno (Healthy Kids/CHIP, CHAMPUS, Prime Care, TRICARE, Seguro Médico del Estado, Programa de Ayuda Médica, ciudad/condado/estado)*

   □ *Seguro que provee su el empleo (HMO, PPO, o Managed Care)*

   □ *Ud. paga por una póliza (paga por cada servicio, o individual)*

3. **¿Hay alguien en su familia que tiene una mancha alrededor el cuello como un anillo de piel oscura? Los médicos lo han diagnosticado con el nombre de *acanthosis nigricans*.**

   □ *Sí* □ *No*

   ¿Si la respuesta es sí, quién? □ *Padre* □ *Hijo/a* □ *Hermano* □ *Hermana*

4. **¿Hay una persona en su familia que tiene diabetes?** □ *Sí* □ *No*

   ¿Si la respuesta es sí, quién? □ *Padre* □ *Hijo/a* □ *Hermano* □ *Hermana*

5. **¿Hay una persona en su familia que tiene alta presión?** □ *Sí* □ *No*

   ¿Si la respuesta es sí, quién? □ *Padre* □ *Hijo/a* □ *Hermano* □ *Hermana*

¡Devuelva al Maestro Cuanto Antes!

APPENDIX E

ANTES Individual Screening Form

ISD:_____ **School:**_____**Grade:**_____

Teacher (home room)_____**Nurse:**_____

Identification_____**Date:**_____

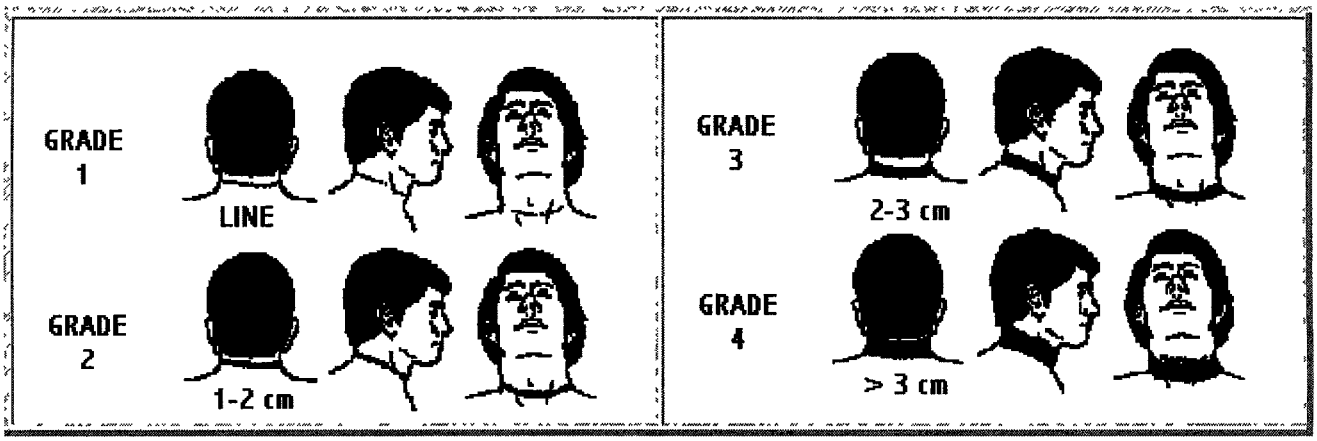
Sex: ____**M** _____**F** **Height (inches)**_____ **Weight (pounds)**_____

Race/Ethnicity_____

Blood Pressure (right arm): _____ **1st reading (after 5 minutes rest)**

_____**2nd reading (5 minutes after the 1st reading)**

Circle Acanthosis Nigricans Grade: **0** **1** **2** **3** **4**



Referred to Physician: _____yes _____no

Date:_____

Physician's Diagnosis:

_____

Treatment: _____Diet _____Exercise _____Medication _____Other

Authority of HB 1860
1999-2000

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Craig Alan Walker was born in Houston, Texas, on July 15, 1969. He is the son of Larry L. Walker, MD, past president of the Texas Surgical Society and Diana J. Walker. After graduating from Millsaps College in Jackson, Mississippi, with a Bachelor of Arts in Philosophy, he served as a hunting guide in the Bitter Root Wilderness Area of Idaho at the legendary Lewis and Clarke "Horse Camp." Following this experience, he worked for Texas United States Senator Lloyd Bentsen as a healthcare research aide, and went on to become chief of staff to Texas State Representative Patricia Gray where he helped write and enact telemedicine state law and managed healthcare reform. In subsequent years, he lobbied for Texas rural hospitals, rural clinics, and advocacy groups, as well as other numerous corporate healthcare clients. Upon completing this activity, he accepted a position as vice president of HealthCare Computer Corporation and assisted in managing the company, writing patents, marketing, sales, and general management operations, and represented the organization concerning state, federal, and international relations. In the summer of 2004, he formed ZubrComm, LLC, and established a partnership with a Polish company to design and market an inexpensive picture archiving and communications system software for small to medium-sized physician practices and hospitals. In January 2005, he was accepted into the 2005 Class of Tenet Healthcare Corporation's Leadership Development Program. He is currently an adjunct faculty at St. Edward's Uni [110] School of Management and Business and consults with Texas State University-San Marcos' telehealth program. He plans to begin employment with Tenet Healthcare Corporation in August of 2005.

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