MARTIN, CATHARINE M., M.S. Differences in Weight Status, Dietary Quality, and Dietary Behavior across Income and Ethnic Groups: Analysis of 1999 – 2002 National Health and Nutrition Examination Survey. (2007)
Directed By Dr. Lauren Haldeman. 67pp.

Research indicates that low income, minorities are at increased risk for poor dietary behaviors leading to weight gain and poor overall health status. A secondary data analysis of the 1999-2002 National Health and Nutrition Examination Survey was conducted to identify associations between food security status, income level, and ethnicity identification and weight status, dietary quality, and dietary behaviors. The sample included US-born Non-Hispanic White (NHW), Non-Hispanic Black (NHB) and Mexican Americans (MA) aged 20-85 years. Bivariate analyses indicated that while low income individuals and NHB were significantly more likely to be obese than NHW and MA, the overall diet quality among the three groups was not significantly different. However, statistically significant differences for specific dietary behaviors were found. NHW reported higher consumption of milk, NHB reported higher consumption of dark green vegetables, and MA reported higher consumption of dried beans and peas. These results suggest that both income and ethnicity should be considered when addressing nutrition interventions.

DIFFERENCES IN WEIGHT STATUS, DIETARY QUALITY, AND DIETARY BEHAVIOR ACROSS INCOME AND ETHNIC GROUPS: ANALYSIS OF 1999-2002 NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY

By

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A Thesis Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements of the
Master of Science

Greensboro
2007

Approved by

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APPROVAL PAGE

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CHAPTER I

INTRODUCTION

Food security is defined as "access by all people at all times to enough food for an active and healthy lifestyle" (Anderson, 1990). It includes, at a minimum, two main components: (1) "the ready availability of nutritionally adequate and safe foods" and (2) "an assured ability to acquire acceptable foods in socially acceptable ways" (Anderson, 1990). Food insecurity is defined as "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain availability to acquire acceptable foods in socially acceptable ways" (Anderson, 1990). Food security status has only been documented in the United States since 1995, indicating that food insecurity is a relatively new term (ADA, 2006). The most recent report from the United States Department of Agriculture (USDA) suggests that 11.9% of households were food insecure in 2004, an increase from 11.2% in 2003 and 10.3% in 1999 (Nord, Andrews & Carlson, 2005). In fact, the prevalence of food insecurity decreased until 1999 but has steadily increased ever since (ADA, 2006). Along with this, 3.9% of households were food insecure with hunger in 2004, which increased from 3.5% in 2003 (Nord, Andrews & Carlson, 2005). About two thirds of households classified as food insecure, by the federal food security scale, experience the condition as recurring, and around one fifth experience these conditions as frequent or chronic (Nord, Andrews, & Winicki, 2002). The remainder of

households at risk for food insecurity managed to obtain enough food to prevent hunger during the year by using a variety of coping strategies including, but not limited to, consuming a less varied diet, participating in food assistance programs or obtaining emergency food from community food pantries or emergency kitchens (Nord, Andrews & Carlson, 2005).

Some households are at greater risk for food insecurity. These include households with children, led by single women or single men, especially those led by minorities, including Non-Hispanic Blacks and Hispanics, and households with incomes below the poverty line (Nord, Andrews & Carlson, 2005). In fact, in 2004 only 75% and 76% of non-Hispanic Black and Hispanic households respectively were food secure, whereas 91% of non-Hispanic White households were food secure (Nord, Andrews & Carlson, 2005).

The concern surrounding the term food security is related to the fact that food insecurity is associated with a variety of health concerns, both nutritional and non-nutritional. Those who suffer from food insecurity are at higher risk of succumbing to poor dietary intake, stress, depression, extremes in weight (underweight and overweight/obesity) and overall poor health (ADA, 2006). Due to these health related concerns, food security is an objective of Healthy People 2010. Healthy People 2010 has two overreaching goals: (1) "increase quality and years of life" and (2) "eliminate health disparities." Food security is one of 28 focus areas that relate both to quality and length of life. There are also disparities in food security, based on income, education, age, and race, which address the second goal. The target for food security in Healthy People 2010

is to have 94% of all households reporting they are food secure. This would be increased from the baseline of 88%, measured in 1995. There was not a goal for food security in Healthy People 2000, highlighting the recent importance placed on it.

It is an interesting paradox that food insecurity, with and without hunger, can exist in a country with such an abundance of resources. Similarly, the disparities in the prevalence of food security across ethnic groups warrants further examination of the determinants of these levels across groups.

Purpose

The purpose of this study was to identify differences in health status, diet quality and diet behavior across food security/income/ethnicity by performing secondary-data analysis of the National Health and Nutrition Examination Survey (NHANES) for the years 1999-2000 and 2001-2002.

The *long term goal* of this research is to improve the effectiveness of nutrition interventions developed and implemented for low income, culturally diverse groups. To take the first steps toward reaching this goal, the following specific aims were addressed in this project:

Specific Aims were to:

1. Develop a working data set utilizing 1999-2002 NHANES
2. Identify associations between food security/income/ethnicity and weight status, dietary quality and dietary behaviors

Research Questions:

a. Are there significant associations between food security/income/ethnicity and weight status?
b. Are there significant associations between food security/income/ethnicity and dietary quality?
c. Are there significant associations between food security/income/ethnicity and dietary behaviors?

CHAPTER II

LITERATURE REVIEW

Prior to analysis, a literature review was performed to examine the current research, along with gaps in the literature, to justify the need for this study. Research indicates that a variety of factors are associated with food security status. Low income, low education, unemployment, being a minority, participating in a food assistance program, and lacking access to health care are all related to food insecurity. Poor diet quality, poor overall health, and being underweight or overweight are associated with the degree of food insecurity.

Income

Income is the number one independent predictor of food insecurity, with individuals of the lowest incomes being most likely to experience food insecurity (Furness, Simon, Wold & Asarian-Anderson, 2004). Evidence from the 1995 Current Population Survey (CPS) showed that 17% of households with incomes less than 50% of the poverty level were affected by some form of hunger, whereas the rate drops to 1.4% in households with incomes of 185% or more of the poverty level (Hamilton, Cook, Thompson, Buron, Frongillo, Olson & Wehler, 1997). Similar prevalence rates of food insecurity are seen in data from NHANES III (Alaimo, Briefel, Frongillo & Olson, 1998). NHANES III data also suggest that among low-income Americans, 24.8% of

Mexican-Americans, 13.5% of Non-Hispanic Blacks and 11.8% of Non-Hispanic Whites report living in food insufficient households, showing that even when taking income into account, disparities across ethnic groups still prevail with regards to prevalence of food insecurity (Alaimo, Briefel, Frongillo & Olson, 1998).

Since income is the single biggest predictor of food security status, it is not surprising that low income individuals suffer from the same health disparities as food insecure individuals. Having low income affects weight status and dietary intake and behavior. These disparities, among low income individuals, are associated with a variety of factors including access and utilization of health care, access, availability and cost of food and low education.

Schoenburn et al. (2002) found that being overweight or obese is highly associated with low income. For example, among low income women, food stamp participation is positively associated with being obese, but this trend is not seen in low income men (Gibson, 2003). While these data suggest an inverse relationship between income and weight, research examining trends in weight over time indicate that this association may have been weakened over the past years and prevalence may vary by ethnicity (Chang & Lauderdale, 2005; Zhang & Wang, 2004) Low income individuals are more likely to report their health as poor or fair which is mediated not only by physical health but by mental health status due to stress/depression acquired by socioeconomic constraints (Fiscella & Franks, 2000). Self-reported health is a reliable predictor of morbidity and mortality among diverse groups and is responsive to environmental factors (Idler & Benyamini, 1997). Data from the 1994 Behavioral Risk

Factor Surveillance System, also suggests that low income individuals, especially those with low education, are more likely to consume diets of poor quality than their counterparts (Lu, Samuels & Hung, 2002). A study using data from the Continuing Survey of Food Intakes by Individuals (1994-1996) found that 28% of Americans met the recommendations for fruit intake (> 2 servings per day) and 49% met the recommendation for vegetable intake (> 3 servings per day), but intake of fruits and vegetables was even lower among low income individuals (Krebs-Smith & Kantor, 2001). It has also been reported that the purchasing of fruits and vegetables among low income households is limited (Turrell, Hewitt, Patterson & Oldenburg, 2003). Among low income individuals, dietary behavior is strongly associated with self-perceived health status (Lu, Samuels & Hung, 2002).

Demographic Characteristics Associated with Food Security

Along with income, lower rates of food insecurity are evident in households whose head completed high school and is currently employed, indicating a relationship between education and job status and food security status (Alaimo, Briefel, Frongillo & Olson, 1998; Rose, 1999). Participation in the food stamp program and absence of health insurance were also more frequently seen in food insecure households (Alaimo, Briefel, Frongillo & Olson, 1998). With respect to age, research indicates that among low-income adults, aged 20-49, living with a family are more likely to report higher rates of food insecurity than those adults aged 60 or older (Alaimo, Briefel, Frongillo & Olson, 1998; Rose 1999). However, regardless of age, food insecure individuals are more likely to be

of low income, low education, be a minority, and report participation in a food assistance program (Lee & Frongillo, 2001).

Food Security and Diet Quality

Having a limited availability of food, whether the state is transient or chronic, is likely to affect diet quality. Not having enough food to eat is likely to produce more concern with food quantity rather than quality. Individuals living in food insecure households have been documented as having poor diet quality compared to individuals in food secure households (Dixon, Winkleby & Radimer, 2001; Kendall, Olson, & Frongillo, 1996; Rose & Oliveira, 1997). The Healthy Eating Index was developed by the USDA as a measure of assessing overall diet quality. There are 10 component scores that make up the total score. Each of the 10 component scores are out of a possible 10, which makes the total score out of a possible 100. The higher the score, the better one's diet quality. Based on their Healthy Eating Index scores, women in food insufficient households received an average overall score of 58.8 compared to food sufficient households whose average score was 64.7 (Bowman, Lino, Gerrior & Basiotis, 1998). While food insufficient households are rated as having the lowest diet quality, regardless of food sufficiency, most households' diets fall below recommended standards. Examination of individual components of the diet show that food insecure households are more likely to consume fewer fruits and vegetables than food secure households. Kendall et al. found, in a sample of 193 women in rural New York state, that food insecure individuals were more likely to not only consume fewer fruit and vegetables, but they also had lower household food inventories of all food products and consumed lower than

recommended amounts of Vitamin C. There is also a trend that food insecure women are more likely to consume less than recommended amounts of calcium (Kendall, Olson, & Frongillo, 1996, Rose & Oliveira, 1997). This trend is seen in food insecure elderly individuals, aged 65 or older, as well (Rose & Oliveira, 1997). In a study of NHANES III data comparing food insufficient and food sufficient families of younger (20-59 years) and older ($\geq$ 60 years) adults, younger adults of food insufficient households reported significantly less ($p < 0.05$) consumption of milk and milk products, fruit and fruit juices, vegetables, particularly dark green leafy vegetables, salty snacks, and sweets than younger, food sufficient households (Dixon, Winkleby, & Radimer, 2001). Healthy foods often cost more and for food insecure households and even low income households, these costs are offset by purchasing less expensive, more energy dense, and often less nutrient dense, foods (Basiotis, 1992). Previous research suggests a relationship between food security status and diet quality, for which further research is needed. To our knowledge, researchers have not yet looked at ethnic differences related to diet quality and food security.

Food Security and Weight Status

It seems logical that weight status would be associated with the availability of safe and nutritionally adequate food. What had not been studied, until recently, was the association of food security with weight status. Recent research suggests that the degree of food insecurity will affect how an individual's weight will change (Wilde & Peterman, 2006). Originally, food insecurity was associated with weight loss and being underweight, but recent research suggests that this mostly applies in the case of food

insecure households with hunger. The opposite is seen in food insecure households without hunger and marginally food secure households (e.g., those at risk for being food insecure). In these households, food insecurity is associated with being overweight and obese, which has frequently been documented in women (Adams, Grummer-Strawn, & Chavez, 2003; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). A study from Tufts University, using NHANES 1999-2000 and 2001-2002 data, found that both men and women, in marginally food secure households and food insecure households without hunger, were more likely to be obese than their counterparts (Wilde & Peterman, 2006). This association was stronger in women, but still seen in men.

It has also been documented that self-reported overweight and obesity have not been found to be associated with food insecurity (Laraia, Siega-Riz, & Evenson, 2004). These results are based on self-report compared to measured data and thus suggest the need for further exploration in this area. To our knowledge, there are no current published studies examining the disparities in the rates of measured obesity and prevalence of food insecurity across ethnic groups.

Disparities in Diet Quality, Weight and Health Status across Ethnic Groups

Differences in weight and dietary quality and behavior exist across ethnic groups. According to the literature, Non-Hispanic Blacks are significantly heavier than Non-Hispanic Whites (Denney, Krueger, Rogers, & Boardman, 2004; Morin, Stark. & Searing, 2004; Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Along with this, Hispanics tend to exhibit higher levels of obesity than Non-Hispanic Whites, but slightly lower levels than Non-Hispanic Blacks (Denney, Krueger, Rogers, & Boardman,

2004; Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Among Hispanics, Mexican-Americans are reported to have the highest body mass index on average (Denney, Krueger, Rogers, & Boardman, 2004). Recent research estimates that 30.0% of non-Hispanic Whites are obese along with 45.0% non-Hispanic Blacks and 36.8% of Hispanics (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). It is also important to note that among these ethnic groups, diet quality and health status are associated with being overweight or obese. In the HERITAGE Family Study, low calcium intake was found to be associated with adiposity in White men and women and Black men (Loos, Rankinen, Leon, Skinner, Wilmore, Rao, & Bouchard, 2004). Research has also shown that decreased protein intake is associated with abdominal obesity in adults (Merchant, Anand, Vuksan, Jacobs, Davis, Teo, & Yusuf, 2005). Among White, Black and Hispanic Americans, there is an inverse relationship between weight and self-rated health (Okuson, Choi, Matamoros, & Dever, 2001). Among all these groups, as body mass increases, self-rated health decreases with Class II (BMI 35.0-39.9) obese individuals rating their health the poorest (Okuson, Choi, Matamoros & Dever, 2001).

Along with weight status, dietary quality and behavior across these three ethnic groups differ as well. Hispanics tend to consume, on average, one more serving of fruits and vegetables per day than non-Hispanic Whites (Neuhouser, Thompson, Coronado, & Solomon, 2004). Similar results are seen in the National Health Interview Study (2000), where Latinos reported higher intakes of fruits, vegetables and fiber than both non-Latino Whites and Blacks (Thompson, Midthune, Subar, McNeel, Berrigan, & Kipnis, 2005). A

study by Gans et al. (2003) found that White individuals are more likely to consume a lower fat diet and consume lower-fat alternatives, avoid frying, and modify meat to make it healthier than Hispanic and Black participants. Compared to White participants, Blacks have lower intakes of dairy products, especially the consumption of milk and cheese (Ranganathan, Nicklas, Yang, & Berenson, 2005). Along with this, non-Hispanic Blacks are more likely to consume diets that are higher in cholesterol and lower in fiber than non-Hispanic Whites and Mexican-Americans (Diaz, Mainous, Koopman, Carek, & Geesey, 2005). Data from the Continuing Survey of Food Intakes by Individuals 1994-1996 note that non-Hispanic Blacks are more likely to report eating out compared to their counterparts. In fact, among Hispanic and Black participants, Blacks are less likely to adhere to Food Guide Pyramid recommendations than Hispanics. However, among Hispanics, highly-acculturated Hispanics and Hispanics born in the United States tend to eat fewer fruit and vegetable servings, have higher fat intakes (Neuhouser, Thompson, Coronado, & Solomon, 2004) and are less likely to adhere to Food Guide Pyramid recommendations (Sharma, Murphy, Wilkens, Shen, Hankin, Monroe, Henderson, & Kolonel, 2004) than newly immigrated Hispanics. A study of Hispanic men by Gardner et al. (1995) found that their current intake of fat, sugar, and sweetened beverages was higher than their intake prior to immigration. Highly-acculturated Hispanics consume a diet that more closely resembles the diet of non-Hispanic Whites and non-Hispanic Blacks. This introduces the idea that acculturation is important to take into consideration when comparing ethnic groups.

Acculturation

The term acculturation is defined as the process by which an individual or group of individuals adopt the beliefs and behaviors of another culture, usually the host culture. Highly acculturated immigrants in the United States are more likely to report having poorer dietary quality (Gordon-Larsen, Harris, Ward, & Popkin, 2004), poorer overall health status (Dey & Lucas, 2006; Lucas, Barr-Anderson, & Kington, 2005) , increased weight gain (Goel, McCarthy, Phillips, & Wee, 2004; Kaplan, Huguet, Newsom, & McFarland, 2004) and participate in less physical activity than newly immigrated individuals from the same country (Gordon-Larsen, Harris, Ward, & Popkin, 2004). Even when examining groups not traditionally thought to be associated with the term acculturation, including non-Hispanic Blacks and Whites, length of time in the United States is associated with dietary and health outcomes (Lancaster, Watts, & Dixon, 2006). A study examining dietary intake and coronary heart disease among subgroups of black Americans found that non-Hispanic Blacks born in the United States were more likely to have higher intakes of energy, fat, meat, added sugars and sodium and less likely to consume fruits and vegetables and most micronutrients than non-Hispanic and Hispanic Blacks born outside of the United States (Lancaster, Watts, & Dixon, 2006). Regardless of ethnicity/race, foreign-born individuals are younger, less likely to be educated, and more likely to be poor compared to U.S. born individuals (Dey & Lucas, 2006). This research suggests that level of acculturation should be taken into consideration with all ethnic groups, especially when comparing associations across ethnicities.

Summary

The literature suggests that differences in weight status, and dietary quality and behavior exist across food security, income and ethnic groups. Ethnic differences prevail, even when examining food security status and income, which subsequently affects diet quality, health and weight status. Previous research suggests that food insecure, low income, and minority individuals are more likely to be overweight or obese, and more likely to engage in poor dietary behaviors. These behaviors include consumption of fewer fruits and vegetables and poor adherence to food guide pyramid recommendations compared to their counterparts. Thus, this implies a possible relationship between an individual's ethnicity, income and food security status with multiple health indicators. What has not previously been studied, to our knowledge, is the relationship between food security, income, and ethnicity across these key health and dietary factors.

National Health and Nutrition Examination Survey

In order to further investigate the gaps in the research at the national level, the National Health and Nutrition Examination Survey (NHANES) was chosen as the best survey based to answer our research questions. NHANES is the result of the 1956 Health and National Security Act which "provided the legislation authorizing for a continuing survey to provide current statistical data on the amount, distribution, and effects of illness and disability in the United States" (NHANES History, NCHS). NHANES is a "population-based survey designed to collect information on the health and nutrition of the United States civilian, non-institutionalized population, aged two months or older"

(NHANES Analytic Guidelines, NCHS). Sampling for NHANES is a multistage process (NHANES Analytic Guidelines, NCHS). The first stage involves selection of primary sampling units or PSUs. These PSUs are "counties or small groups of contiguous counties" (NHANES Analytic Guidelines, NCHS). From here, segments within each PSU are created. These segments are a "block or group of blocks containing clusters of households" from which households are chosen and then one or more participants from each household chosen is selected (NHANES Analytic Guidelines, NCHS). During a 12 month period, a total of 15 PSUs are visited (NHANES Analytic Guidelines, NCHS). NHANES 1999-2002 combined data sets over-sampled low-income individuals, adolescents 12-19, older individuals 60 years or older, African-Americans, and Mexican-Americans (NHANES Analytic Guidelines, NCHS). Since 1960, the Department of Health and Human Services has conducted eight National Health and Nutrition Examination surveys (NHANES History, NCHS). Beginning in 1999, NHANES became a continuous survey conducted annually, with data being released to the public every two years (NHANES Analytic Guidelines, NCHS). While data sets beginning in 1999 can be analyzed separately, it is highly recommended when possible to combine two or more sets, in order to increase the sample size, increase statistical strength, and increase statistical options (NHANES Analytic Guidelines, NCHS). For the purpose of this research, 1999 to 2000 and 2001 to 2002 were combined to create one master data set. Data for these sets were collected between March 1999 to December 2000 and January 2001 to December 2002 (NHANES Analytic Guidelines, NCHS). For NHANES 1999-2000 the data set contains a total of 9,965 individuals and NHANES 2001-2002 contains

a total of 11,039 individuals (NHANES Analytic Guidelines, NCHS). Wording and methodology of questionnaires, laboratory tests and examination procedures were examined to validate compatibility with the two sub-samples as directed by the Analytic Guidelines.

There are two parts to the NHANES survey: the health examination and the in-home interview. The health examination is performed in a mobile examination center (MEC) and includes all laboratory and examination data (NHANES Information, NCHS). The MEC is made up of four trailers, which are linked sideways and contain high-tech medical equipment used to take a variety of measurements including anthropometrics and examine physical conditioning (NHANES Information, NCHS). During the health examination, a variety of tests are performed including physical exams, urine cultures and blood draws but all internal exams or invasive procedures are excluded (NHANES Information, NCHS). The in-home interview portion included collection of all demographic information and questionnaires including a weight history, behavior questions, as well as questions regarding physical activity and overall disease health. The examinations and surveys completed by participants are dependent on the participant's age and gender (NHANES Analytic Guidelines, NCHS).

Before participating in NHANES, participants sign consent forms for both the examination and in-home interview and receive monetary compensation (NHANES Information, NCHS). Participants also receive a written report of the findings, approximately 12 weeks after the exam (NHANES Information, NCHS). If the health

examination detects an abnormal value, the participant is notified immediately by letter (NHANES Information, NCHS).

CHAPTER III

RESEARCH ARTICLE

Introduction

As a whole, many Americans rank poorly with regard to diet and health, but research suggests that minorities are performing the worst. Due to poor access and availability of healthy food, disparities in socioeconomic status, and a higher prevalence of food insecurity, minorities are more likely to consume diets low in fresh fruits, fresh vegetables and whole grains but high in fat and added sugars (Gordon-Larsen, Harris, Ward, & Popkin, 2004, Neuhouser, Thompson, Coronado, & Solomon, 2004) and this is especially noted among non-Hispanic Black and highly acculturated Hispanic individuals. Disparities also exist with regard to overweight and obesity. Non-Hispanic Blacks (NHB) and Mexican Americans (MA) are more likely to be overweight or obese compared to non-Hispanic Whites (NHW), putting them at increased risk for hypertension, diabetes, coronary heart disease, stroke and certain cancers (Denney, Krueger, Rogers, & Boardman, 2004; Morin, Stark, & Searing, 2004; Ogden, Carroll, Curtin, McDowell, Tabak & Flegal, 2000)

Research also suggests disparities in health and diet across income levels. Low income individuals are at higher risk of being food insecure, which can further intensify these disparities. Schoenburn et al. (2002) found that being overweight or obese is highly

associated with low income. While data suggest a relationship between income and weight, research examining trends in weight over time indicate that the association between weight and socioeconomic status may be weaker than previously thought and the prevalence of overweight and obesity may vary by ethnicity, regardless of income (Chang & Lauderdale, 2005; Zhang & Wang, 2004). Data from the 1994 Behavioral Risk Factor Surveillance System, also suggest that low income individuals, especially those with low education, are more likely to consume diets of poor quality than higher income individuals (Lu, Samuels & Hung, 2002). A study using data from the Continuing Survey of Food Intakes by Individuals (1994-1996) found that 28% of Americans met the recommendations for fruit intake (> 2 servings per day) and 49% met the recommendation for vegetable intake (> 3 servings per day), but intake of fruits and vegetables was even lower among low income individuals (Krebs-Smith & Kantor, 2001).

Nutrition is a key player in the etiology of many chronic diseases, including those responsible for the leading causes of death, and is directly related to the obesity epidemic (U.S. Preventive Services Task Force, 1999). In order to reduce these differences across ethnicities and income, differences among these groups in key dietary and health factors must be addressed. To our knowledge, no study has clearly addressed all of these issues at the national level.

The purpose of this study was to identify differences in health and weight status, dietary quality and dietary behavior across income and ethnicity in a national sample. This study can serve as a springboard for the long-term goal, which is to ultimately use

this knowledge to implement nutrition interventions targeted to specific groups and minimize health disparities across income and ethnic groups.

Methodology

Secondary data analysis of the National Health and Nutrition Examination Survey (NHANES) from 1999 to 2000 and 2001 to 2002 was performed using SPSS® version 12.0.

Creation of Workable Data Set

In order to answer the research questions, a workable data set was created from the existing NHANES database(NHANES Data sets 1999-2000 and 2001-2002, NCHS). The first step in the process was to become familiar with the NHANES website and the analytic guidelines. The analytic guidelines are necessary in order to ensure proper use and analysis of the data. Variables of interest were selected based on availability and compatibility with the research questions. All data are publicly available on the NHANES website through the Centers for Disease Control (NHANES Data sets 1999-2000 and 2001-2002, NCHS). All data are located in one of four files: demographic, examination, laboratory, or questionnaire, and sorted based on survey years (NHANES Data sets 1999-2000 and 2001-2002, NCHS). For this study, variables were selected from the demographic, examination and questionnaire files.

Variables from selected files for the two sub-samples were merged and sorted in ascending order using the common survey participant identification variable, SEQN (NHANES Analytic Guidelines, NCHS). This ensured that the information for each

participant was linked correctly. All data for each subset were merged first and then the sub-samples merged, to create a sample data set for 1999-2002.

Once the data were merged, variable categories were collapsed and recoded as necessary, in order to more appropriately examine the data set. This is explained in more detail in the following sections.

Sample Population

From the total population for the 4-year dataset (N=21,004), the sample population was derived using the following inclusion criteria variables: participation status, ethnicity, age, pregnancy status, and country of birth. Inclusion variables are listed in the table below:

Table 1: Inclusion Criteria

Inclusion Criteria	
Name	*Definition*
Study Participation Status	2 = Both Interview and MEC participation
Age (in Years)	20 to 84 years only
Gender	1 = Male 2 = Female
Ethnicity	1 = Mexican American (MA) 3 = Non-Hispanic White (NHW) 4 =Non-Hispanic Black (NHB)
Pregnancy Status	2 = SP not pregnant
Country of Birth	1= Born in the United States

Individuals must have completed both the interview and MEC examination portions of the survey. Based on self-report, only individuals classifying themselves as Mexican-American (MA), Non-Hispanic White (NHW) or Non-Hispanic Black (NHB) were included in this sample. MA were chosen instead of all Hispanics to create a more

homogenous population. Since the focus of this project was on adults, only individuals aged 20 – 84 years were chosen for the analysis. An 84 year cut point was chosen due to the fact that age is top coded at 85 and therefore individuals older than 84 cannot be further differentiated. Women who were pregnant at the time of the interview were excluded, as BMI is an independent variable and being pregnant would skew these results. Only individuals born in the United States were used in our analyses. Preliminary results revealed statistically significant differences between key demographic, health and dietary variables across ethnic groups and therefore selection of only those born in the United States was necessary to create a more homogenous population.

Variable Definitions

Tables 2 and 3 present the variables of interest examined in this study. Table 2 lists all variables used to describe the sample population and Table 3 lists the variables necessary to answer the research questions.

Demographic variables for this study, not previously described, include health insurance, education, income, and food security status. Health insurance is a dichotomous variable, where respondents reported a simple yes or no to having health insurance (NHANES Questionnaire, NCHS). For those with insurance, additional questions allowed them to specify the type of insurance coverage. Education was a self-reported, dichotomous variable and participants were asked the highest level of education completed.

Table 2: Descriptive Variable Definitions

Name	*Definition*
Gender	1. Male 2. Female
Age (in Years) at time of Screening	Continuous
Health Insurance	1. Yes 2. No
Type of Health Insurance	1. Private 2. Medicare 3. Medicaid 4. Other
Education	1. Less than high school 2. High school diploma or equivalent 3. More than high school
SES: Poverty Income Ratio	1. Low Income ($\leq$ 1.85) 2. Middle Income (1.86 – 3.99) 2. High Income ($\geq$ 4.00)
Food Security Status	1. Food Secure 2. Food Insecure

The poverty income ratio (PIR) is the variable chosen to represent income. PIR is the "ratio of income to the family's appropriate. For NHANES, PIR values are computed using family income data. PIR values below 1.0 indicate an income below the poverty level. This variable was recoded into a categorical variable, since the variable is top coded at 5 and would therefore not give a true mean. Income was divided into three categories: low ($\leq$ 1.85), middle (1.86-3.99) and high ($\geq$ 4.00). Food security is based on the 18-item Food Security Survey module (or 10 items for households without children), formerly known as the Core Food Security Module, and was administered to one adult in the household, even if there was more than one family in the household. This is consistent with the CPS categorical measure from the Guide to Measuring Household Food Security, Revised 2000. Individuals are placed into one of four categories: food secure, marginally food secure, or at risk, food insecure with hunger or

food insecure without hunger. In the data set, moderate and severe hunger were combined to create one food insecure with hunger category for ease of analysis. For the purposes of our analysis, a dichotomous variable was created for food security status. Food secure and marginally food secure became "food secure" and food insecure with and without hunger became "food insecure."

The variable chosen to indicate weight status was body mass index (BMI) (Table 3). Body Mass Index is reported in NHANES as a continuous variable (NHANES Examination Protocol, NCHS). A categorical variable was developed for the purposes of this study to describe individuals as being underweight ($< 18.5 kg/m^2$), normal weight ($18.5 – 24.9\ kg/m^2$), overweight ($25.0 – 29.\ kg/m^2 9$) or obese ($\geq 30\ kg/m^2$) for use in bivariate analyses.

Finally, diet was examined using the following variables as guides: diet-behavior related questions and the healthy eating index (HEI). Diet behavior questions are very limited in NHANES. The type and number of diet-behavior questions are limited and the questions are often designed with specific age groups in mind, particularly young children and older adults, and were then only asked to those individuals, limiting their overall use. To compare with reported research, participant's past 30 day milk consumption, the number of times they have eaten restaurant food in the past week, and frequency of consumption of dark green vegetables and dried beans and peas in the past month were chosen for this analysis. In the database, milk consumption is a categorical variable (Table 3) whereas the other diet-related behavior questions are represented as continuous variables. For the purposes of these analyses, the continuous variables were

collapsed to create categorical variables. For monthly dried bean and pea and dark green vegetable consumption, the following categories were created: rarely (never consume or consume 1 to 3 times per month), sometimes (consume 4 to 16 times per month) and most days (consume 17 or more times per month). For restaurant food consumption, the following categories were created: never eats restaurant food, eats restaurant food once a week, eats restaurant two to three times per week and eats restaurant food four or more times per week. Since diet is related to food security, selection of these variables is appropriate to examine the possible relationship between diet-related behaviors and food security status. The variables selected for this analysis were the best indicators of diet behavior available in NHANES for the selected age group in this study. Since the literature suggests that fruit, vegetable, dairy and fiber intake are lower in food insecure and low income groups and vary among ethnic groups, they were the most appropriate choices. Frequency with which a participant eats at a restaurant has not been examined in food insecure groups according to published literature, but is a variable of interest, since increased consumption of restaurant food is associated with poorer diet quality, including increased energy intake, total fat and saturated fat intake coupled with decreased vegetable and micronutrient intake (Bowman & Vinyard, 2004; Satia, Galanko, & Siega Riz, 2004).

Table 3: Dependent and Independent Variable Definitions

Type	*Variable Name*		*Definition*
Dependent	Food Security Status		1. Food Secure 2. Food Insecure
	SES: Poverty Income Ratio		1. Low Income ($\leq$ 1.85) 2. Middle Income (1.86 – 3.99) 3. High Income ($\geq$ 4.00)
	Ethnicity		1. Mexican Americans (MA) 2. Non-Hispanic White (NHW) 3. Non-Hispanic Black (NHB)
Independent	Weight Status: Body Mass Index		1. Underweight (<18.5) 2. Normal weight (18.5 – 24.9) 3.Overweight (25.0 – 29.9) 4. Obese ($\geq$30.0)
	Diet Quality: Healthy Eating Index (HEI)	Total HEI	1. Mean scores 2. a. Above or equal to 70% b. Below 70%
		Grain	
		Fruit	
		Vegetable	
		Meat	
		Dairy	
		Total Sodium	
		Total Fat	
		Sat Fat	
		Total Cholesterol	
		Variety	
	Diet Behavior:	Past 30 day Milk Consumption	0. Never 1. Rarely 2. Sometimes 3. Often
		# times/week eat restaurant food	1. Never 2. Once a week 3. Two to Three times per week 4. Four or more times per week
		# times/mos eat dark green veg	1. Rarely 2. Sometimes 3. Most days
		# times/mos eat dried beans/peas	1. Rarely 2. Sometimes 3. Most Days

The Healthy Eating Index (HEI) was chosen as an indicator of diet quality. The HEI data were based on one 24-hour recall, which was collected via the NHANES computer assisted dietary interview (CADI) system, which uses a multiple pass method, that prompts the interviewer to ensure a more complete recall (NHANES Analytic

Guidelines, NCHS; NCPP, HEI Index Data). HEI is a measure of overall quality of an individual's diet based on the dietary guidelines and is frequently used in research as a measure of diet quality. There are a total of 10 components each worth 10 points with a possible total score of 100. The 10 components and scoring are listed in Table 4 below:

Table 4: Scoring Criteria for HEI Components (Basiotis, Carlson, Gerrir, Juan & Lino, 2004)

Component	**Criteria for score of 0**	**Criteria for score of 10**
Grains	0 servings	6-11 servings
Vegetables	0 servings	3-5 servings
Fruit	0 servings	2-4 servings
Milk	0 servings	2-3 servings
Meat	0 servings	2-3 servings
Total Fat	≥45% calories from fat	<31% calories from fat
Saturated Fat	≥15% calories from sat. fat	<10% calories from sat. fat
Sodium	≥4800mg	<2400 mg
Cholesterol	≥450mg	<300mg
Variety	<4 different categories a day	>7different categories a day

Respondents' total scores, as well as the component scores, are listed as continuous variables in the data set. For the purposes of this research study, HEI was examined as a mean score.

Statistical Analyses

SPSS® for Windows v. 12.0 was used to analyze the data. Descriptive analyses were performed to characterize the target population. Bivariate analyses with the total sample were used to identify the association between food security/income/ethnicity and all independent variables. The file was then split by income and bivariate analyses were

performed to explore ethnic differences within income levels. Chi square analyses were used for categorical variables and one-way ANOVA for continuous variables.

Results

Baseline Characteristics

A total of 6,282 participants were eligible for the study based on the inclusion criteria. Of those 3,880 were non-Hispanic White (NHW), 1,540 were non-Hispanic Black (NHB) and 862 were Mexican-American (MA).

For all three ethnic groups, approximately half the respondents were male (Table 5). There were no differences in age between the three groups; the average age was 51.1 ± 17.65 (Table 5). Compared to NHB and MA, NHW had the highest percentage of participants reporting coverage by health insurance (Table 5).

Table 5: Total Sample Characteristics by Ethnic Group

	NHW	**NHB**	**MA**
Gender (%) Male	(N=3880) 51.2	(N=6282) 48.2	(N=862) 47.6
Age (mean±SD)	(N=3880) 52.4 ±18.33	(N=1540) 48.3 ± 16.92	(N=862) 50.0 ±17.71
Covered by Health Insurance (%) Covered by Private Insurance (%)	(N=3842) 88.4 (N=3374) 80.5	(N=1510) 81.6 (N=1212) 70.6	(N=849) 82.3 (N=688) 71.5
Education (%) Less than High School	(N=3876) 17.2	(N=1534) 40.5	(N=861) 43.7
PIR (%) Below 1.85	(N=3559) 28.4	(N=1343) 49.3	(N=773) 43.2
Food Security Status Food Secure (%)	(N=3746) 93.5	(N=1466) 87.1	(N=815) 85.8

For all ethnic groups, more than 70% of all respondents reported having private health insurance with a higher percentage of NHW reporting they have private insurance compared to NHB or MA (Table 5). A greater percentage of NHW also report a higher level of education and food security and a lower level of poverty compared to NHB and MA (Table 5). Fewer than 20% of NHW reported not completing high school, whereas, over 40% of both the NHB and MA groups did not complete high school (Table 5). Over 70% of NHW reported incomes above poverty, whereas a little less than half of both the NHB and MA groups reported incomes above the poverty cut-off value (Table 5). Only 6.5% of NHW reported being food insecure, while 12.9% of NHB and 14.5% of MA reported being food insecure which is approximately double the number of NHW (Table 5).

Food Security

Weight Status

Before any ethnic group comparisons were conducted, bivariate analyses were performed with the entire sample examining differences in food security groups. Table 6 presents the results of comparisons of weight status by food security group. Food security is significantly associated with body mass index (BMI) ($\chi 2(2)=4.95$, $p=0.084$).

Table 6: Body Mass Index by Food Security

	Food Secure	Food Insecure
BMI (%)	(N=5279)	(N=524)
Underweight/Normal (<25.0)	31.60	31.30
Overweight (25.0-29.9)	34.97	30.92
Obese (≥30.0)	33.43	37.79

More than two-thirds of both the food secure and food insecure groups were overweight or obese. However, a higher percentage of food insecure individuals were obese compared to food secure individuals.

Dietary Quality

Comparisons of food secure/insecure groups by diet quality (Tables 7) revealed no differences with overall diet quality (HEI index) and for all the components that make up the index, except for total fat and this association was significant ($\chi 2(1)=2.99$, $p=0.084$).

Table 7: Mean Scores for Total and Component Healthy Eating Index (HEI) Scores for Food Secure and Food Insecure Individuals.

Mean Scores	Food Secure (N=4443)	Food Insecure (N=433)
HEI Scores		
Total HEI	64.17	65.06
Grains	6.76	6.90
Fruit	4.17	4.30
Vegetables	5.68	5.69
Meat	6.57	6.45
Dairy	5.59	5.81
Total Fat	6.97*	7.27*
Saturated Fat	6.69	6.78
Cholesterol	7.78	7.75
Sodium	6.48	6.52
Variety	7.53	7.59

*p=0.084

A higher percentage of food secure individuals scored poorly on the total fat intake component compared to food insecure individuals (Table 7). It is clear however,

based on the Healthy Eating Index, that both food secure and food insecure individuals were consuming a poor diet that is low in fruit, vegetables, and dairy.

Dietary Behavior

Comparisons of food security with diet behavior revealed statistically significant differences in reported consumption of milk ($\chi 2(3)=19.27$, $p=0.000$), dark green vegetables ($\chi 2(2)=52.29$, $p=0.000$), and restaurant food consumption ($\chi 2(3)=88.38$, $p=0.000$) (Table 8).

Table 8: Diet Behavior by Food Security

%		Food Secure	Food Insecure
Milk Consumption		(N=5443)	(N=544)
	Never^	12.92	15.07
	Rarely^	12.88	15.99
	Sometimes^	26.36	30.88
	Often^	47.84	38.05
Dried Bean and Pea Consumption		(N=2924)	(N=323)
	Rarely*	34.27	35.91
	Sometimes*	42.58	38.08
	Most Days*	23.15	26.01
Dark Green Vegetable Consumption		(N=2924)	(N=323)
	Rarely *	16.24	27.55
	Sometimes*	27.74	36.84
	Most Days*	56.02	35.60
Restaurant Food Consumption		(N=5479)	(N=548)
	Never*	24.69	43.07
	Once per week*	22.23	17.34
	2-3 x per week*	28.58	23.36
	$\geq$ 4 x per week*	24.49	16.24

^ categories as defined by NHANES

* categories created for the purposes of this study

Food secure individuals were more likely to report consumption of milk, dark green vegetables and restaurant food than food insecure individuals (Table 8). In fact, more than half of food secure individuals consumed dark green vegetables "most days" whereas a little more than a third of food insecure individuals (36%) reported eating these types of vegetables on a regular basis. No differences were noted with regard to dried bean and pea consumption (Table 8); only a fourth of both groups reported regular consumption.

For the remainder of the analyses, dietary behaviors will be examined by looking at the frequency most highly associated with good health. Frequent consumption of milk, dark greens and dried beans and peas are all associated with good health. Eating less frequently in a restaurant is also associated with better health.

Based on these results, a comparison of weight status, dietary quality, and dietary behavior among food security groups was considered to not likely show meaningful data patterns due to the fact that no differences were evident in key health and dietary variables for the entire sample. It is possible that there is another key variable masking these differences. A logical next step was to explore this possibility. Since income is one of most important predictors of food security and because differences in income level were seen across the ethnic groups and across food security groups, it was decided to pursue examination of possible differences in the dietary and health indicators within and between ethnic groups by income.

Income

Weight Status

Bivariate analyses were performed using income as the dependent variable. Table 9 includes the results of comparisons between BMI and income. Income was split into three categories based on the PIR: Low ($\leq$ 1.85), Middle (1.8-3.99) and High ($\geq$ 4.00). Across income groups, statistically significant differences ($\chi 2(4) = 28.44$, $p = 0.000$) were noted with regard to body mass index. Comparisons indicated that high income individuals were less likely to be obese than low or middle income individuals but slightly more likely to be overweight.

Table 9: Body Mass Index by Income

Income	N	**Body Mass Index** (%)		
		Under/Normal	*Overweight*	*Obese*
Low	1892	32.35	31.82	35.84
Middle	1772	28.67	35.78	35.55
High	1802	33.07	37.35	29.58

Dietary Quality

Table 10 displays the results of comparison of mean HEI scores (overall and component) with income category. No significant differences were noted with regard to the overall HEI score.

Comparisons of the individual component scores and income, however, did reveal statistically significant differences in the sodium ($F(2)= 2.24$, $p = 0.099$), fruit ($F(2) = 3.27$, $p = 0.038$), and dairy components ($F(2) = 3.542$, $p = 0.029$) (Table 10).

Table 10: Mean HEI Total and Component Scores by Income

HEI Category	**Income**	**Mean**
Overall HEI	*Low* (N=1625)	64.31
	Middle (N=1463)	64.42
	High (N=1436)	64.03
Grains	*Low* (N=1625)	6.84
	Middle (N=1463)	6.80
	High (N=1436)	6.65
Fruit	*Low* (N=1625)	4.15
	Middle (N=1463)	4.38
	High (N=1436)	4.01
Vegetable	*Low* (N=1625)	5.70
	Middle (N=1463)	5.70
	High (N=1436)	5.73
Meat	*Low* (N=1625)	6.60
	Middle (N=1463)	6.56
	High (N=1436)	6.52
Dairy	*Low* (N=1625)	5.62
	Middle (N=1463)	5.76
	High (N=1436)	5.93
Total Fat	*Low* (N=1625)	6.96
	Middle (N=1463)	6.98
	High (N=1436)	6.97
Saturated Fat	*Low* (N=1625)	6.61
	Middle (N=1463)	6.58
	High (N=1436)	6.78
Cholesterol	*Low* (N=1625)	7.81
	Middle (N=1463)	7.65
	High (N=1436)	7.91
Sodium	*Low* (N=1625)	6.44
	Middle (N=1463)	6.41
	High (N=1436)	6.67
Variety	*Low* (N=1625)	7.59
	Middle (N=1463)	7.62
	High (N=1436)	7.39

High income individuals were less likely to adhere to fruit recommendations compared to low and middle income individuals, but were more likely to adhere to dairy and sodium recommendations.

Dietary Behavior

Tables 11 through 14 present the results of comparisons between diet behavior and income. Comparisons of milk consumption and income revealed no differences across income groups (Table 11). In fact, regardless of income level, almost half reported consuming milk "often" (Table 11).

Table 11: Milk Consumption by Income

Income	**Milk Consumption (%)**			
	*Never^*	*Rarely^*	*Sometimes^*	*Often^*
Low (N=1995)	13.13	14.14	25.71	47.02
Middle (N=1810)	12.21	13.15	27.24	47.40
High (N=1833)	12.98	12.60	27.55	46.86

^ categories as defined by NHANES

Differences were not evident in comparisons of dried bean or pea consumption across income (Table 12). Only about one-quarter of individuals across all income groups reported consuming dried beans and peas "most days".

Table 12: Dried Bean and Pea Consumption by Income

Income	**Dried Bean and Pea Consumption (%)**		
	*Rarely**	*Sometimes**	*Most Days**
Low (N=1082)	35.49	39.93	24.58
Middle (N=1034)	33.75	41.59	24.66
High (N=1098)	33.24	43.81	22.95

*categories created for the purposes of this study

Across income groups, comparisons revealed statistically significant ($\chi 2(4) = 70.37$, $p = 0.000$) differences in dark green vegetable consumption (Table 13).

Table 13: Dark Green Vegetable Consumption by Income

Income	**Dark Green Vegetable Consumption (%)**		
	*Rarely**	*Sometimes**	*Most Days**
Low (N=1082)	21.72	33.36	44.91
Middle (N=1034)	17.70	28.05	54.26
High (N=1098)	12.39	25.41	62.20

*categories created for the purposes of this study

All income groups were likely to report consuming dark green vegetables "most days", with high income reporting the most frequent consumption (Table 13).

Significant ($\chi 2(6) = 362.294$, $p = 0.000$) differences were also noted in comparisons of weekly restaurant food consumption and income (Table 14). Low income individuals were more likely to report "never" eating in a restaurant compared to their counterparts (Table 14).

Table 14: Restaurant Food Consumption by Income

Income	**Weekly Restaurant Food Consumption (%)**			
	*Never**	*Once**	*2-3 times**	*4 or more times**
Low (N=2005)	37.81	22.24	24.14	15.81
Middle (N=1828)	24.02	20.51	30.42	25.05
High (N=1842)	13.46	22.78	31.00	32.79

*categories created for the purposes of this study

Ethnicity

Weight Status

Bivariate analyses were performed using ethnicity as the dependent variable for all key diet and health variables (Table 15). Based on these comparisons, significant ($\chi 2(4) = 83.503$, $p = 0.000$) differences were noted across ethnic groups with regard to weight (Table 15). NHB were more likely to be obese than NHW or MA, but MA were more likely to be overweight (Table 15). NHW were more likely to be under/normal weight compared to NHB and MA (Table 15).

Table 15: Body Mass Index by Ethnicity

Ethnic Group	N	**Body Mass Index** (%)		
		Under/Normal	*Overweight*	*Obese*
NHW	3744	34.86	35.34	29.81
NHB	1472	28.33	30.91	40.76
MA	832	24.28	37.50	38.22

Dietary Quality

Comparisons of overall HEI scores and individual component scores by ethnicity did not indicate any differences in overall diet quality (Table 16). Based on their HEI scores, respondents had poor overall diet quality that was low in fruits, vegetables and dairy.

Table 16: Mean HEI Total and Component Scores by Ethnicity

HEI Category	Ethnic Group		
	NHW (N=3097)	**NHB** (N=1228)	**MA** (N=730)
Overall HEI	64.28	64.18	64.14
Grains	6.74	6.74	6.92
Fruit	4.17	4.20	4.15
Vegetable	5.70	5.64	5.75
Meat	6.55	6.52	6.68
Dairy	5.58	5.66	5.64
Total Fat	7.02	6.96	6.92
Saturated Fat	6.63	6.71	6.68
Cholesterol	7.84	7.42	7.50
Sodium	6.57	6.41	6.23
Variety	7.49	7.60	7.66

Dietary Behavior

Tables 17 through 20 display results of comparisons of ethnicity and diet behavior. Across ethnic groups, comparisons indicated significant differences in milk consumption ($\chi 2(6) = 240.70$, $p = 0.000$), dark green vegetable consumption ($\chi 2(4) = 45.49$, $p = 0.000$), dried bean and pea consumption ($\chi 2(4) = 65.73$, $p = 0.000$) and restaurant food consumption ($\chi 2(6) = 145.78$, $p = 0.000$). NHW were more likely to report consuming milk "often" compared to NHB and MA (Table 17). More than half of NHW reported consuming milk "often". Across all groups, it is also important to note

that within each ethnicity, individuals are most likely to report consuming milk "often" (Table 17).

Table 17: Milk Consumption by Ethnicity

Ethnic Group	**Milk Consumption (%)**			
	*Never^*	*Rarely^*	*Sometimes^*	*Often^*
NHW (N=3863)	10.43	11.13	24.72	53.71
NHB (N=1513)	19.70	18.04	29.80	31.45
MA (N=861)	13.94	14.63	30.66	40.77

^ categories as defined by NHANES

MA were more likely to report consuming dried bean and peas on a regular basis ("most days") than NHW and NHB. However, across all groups, individuals were most likely to report "sometimes" consuming dried beans and peas (Table 18).

Table 18: Dried Bean and Pea Consumption by Ethnicity

Ethnic Group	**Dried Bean and Pea Consumption (%)**		
	*Rarely**	*Sometimes**	*Most Days**
NHW (N=2208)	35.10	42.75	22.15
NHB (N=851)	38.19	40.89	20.92
MA (N=388)	20.88	40.72	38.40

*categories created for the purposes of this study

NHB reported the highest frequency of consumption of dark green vegetables (Table 19). However, regardless of ethnicity, individuals were most likely to report consuming dark green vegetables "most days" (Table 19) with at least half of NHW and NHB and nearly half of MA consuming them "most days" (Table 19).

Table 19: Dark Green Vegetable Consumption by Ethnicity

Ethnic Group	Dark Green Vegetable Consumption (%)		
	*Rarely**	*Sometimes**	*Most Days**
NHW (N=2208)	18.21	27.81	53.96
NHB (N=851)	10.93	30.08	58.99
MA (N=388)	24.48	31.19	44.33

*categories created for the purposes of this study

With regard to weekly restaurant food consumption, NHW were more likely to report consuming restaurant food four or more times per week with NHB consuming restaurant food the least frequently (Table 20).

Table 20: Restaurant Food Consumption by Ethnicity

Ethnic Group	Weekly Restaurant Food Consumption (%)			
	*Never**	*Once**	*2-3 times**	*4 or more times**
NHW (N=3880)	22.01	22.42	28.58	26.98
NHB (N=1540)	36.82	19.22	26.59	17.48
MA (N=862)	25.41	23.67	29.45	21.58

*categories created for the purposes of this study

Ethnicity by Income

The file was split by income group and bivariate analyses were performed with ethnicity as the dependent variable for all key independent variables. The data were examined in two ways: between ethnic groups by income and then across ethnic groups.

Weight Status

Between ethnic groups

Significant differences between ethnicity and weight status were noted across low ($\chi 2(4)=15.03$, $p=0.005$), middle ($\chi 2(4)=35.83$, $p=0.000$), and high ($\chi 2(4)=44.83$, $p=0.000$) incomes (Table 21). Regardless of income, NHW are more likely to be under

or normal weight compared to NHB and MA (Table 21). Among low and middle income individuals, MA were more likely to be overweight compared to NHB who were more likely to be obese. The opposite is true among high income individuals, where MA were more likely to be obese and NHB wer more likely to be overweight.

Within ethnic group

Among NHW, low income individuals were the most likely to be obese, but among NHB, this was true for the middle income individuals. Among MA, high income individuals were the most likely to be obese with low income individuals being most likely to be under or normal weight. Interestingly, regardless of income level, well over 60% of NHW, NHB and MA were either overweight or obese.

Table 21: Body Mass Index by Ethnicity and Income

Income	Ethnic Group	N	**Body Mass Index** (%)		
			Under/Normal	*Overweight*	*Obese*
Low (N=1892)	**NHW**	951	35.44	31.02	33.54
	NHB	625	31.20	30.08	38.72
	MA	316	25.32	37.66	37.03
Middle (N=1772)	**NHW**	1103	31.37	37.53	31.10
	NHB	412	25.73	28.40	45.87
	MA	257	21.79	40.08	38.13
High (N=1892)	**NHW**	1379	36.48	37.35	26.18
	NHB	249	23.29	38.15	38.60
	MA	174	20.11	36.21	43.68

Dietary Quality

The Healthy Eating Index was examined using mean scores comparison by income across ethnic groups (Table 22).

Within/Between ethnic groups (Total HEI scores)

Statistical analysis did not reveal any significant differences with regard to overall HEI scores in ethnic and income groups (Table 22). Across all groups, participants scored poorly with regard to overall diet quality.

Individual component score comparisons indicated statistically significant differences, but only for middle and high income groups, for grains (High: $F(2)=2.73$, $p=0.066$), meat (Middle: $F(2)=4.58$, $p=0.010$; High: $F(2)=2.36$, $p=0.094$), cholesterol (Middle: $F(2)=4.75$, $p=0.009$), sodium (Middle: $F(2)=5.75$, $p=0.003$) and variety (Middle: $F(2)=3.22$, $p=0.040$) scores.

Between ethnic groups

Among high income individuals, MA scored the best with regards to grain and dairy component scores compared to NHB and NHW. Among middle income individuals, NHB scored the highest with regard to meat, sodium, and variety components compared to NHW and MA, but NHW scored better in the cholesterol component.

No differences were noted for the fruit, vegetable, dairy, total fat, or saturated fat component scores. However, a trend was noted with regard to the vegetable component score among high income individuals only with NHB scoring the lowest and MA scoring the highest. It is important to note, however, that over half of high income MA are still scoring poorly with regard to vegetable intake.

Table 22: Mean HEI Total and Component Scores by Ethnicity and Income

HEI Category	Income	Ethnic Group		
		NHW (N =2814)	**NHB** (N =1057)	**MA** (N = 651)
Overall HEI	*Low* (N=1623)	64.17	64.51	64.38
	Middle (N=1463)	64.48	64.90	63.11
	High (N=1436)	64.11	62.85	65.09
Grains	*Low* (N=1623)	6.90	6.64	6.99
	Middle (N=1463)	6.73	7.01	6.78
	High (N=1436)	6.58	6.65	7.18
Fruit	*Low* (N=1623)	4.09	4.21	4.20
	Middle (N=1463)	4.33	4.72	4.06
	High (N=1436)	4.05	3.58	4.33
Vegetable	*Low* (N=1623)	5.72	5.72	5.65
	Middle (N=1463)	5.56	5.75	5.99
	High (N=1436)	5.76	5.27	5.95
Meat	*Low* (N=1623)	6.71	6.44	6.54
	Middle (N=1463)	6.36	6.91	6.85
	High (N=1436)	6.55	6.12	6.86
Dairy	*Low* (N=1623)	5.66	5.49	5.72
	Middle (N=1463)	5.35	5.77	5.23
	High (N=1436)	5.75	5.81	5.71
Total Fat	*Low* (N=1623)	6.87	7.06	7.03
	Middle (N=1463)	7.09	6.89	6.68
	High (N=1436)	7.02	6.78	6.85
Saturated Fat	*Low* (N=1623)	6.47	6.72	6.81
	Middle (N=1463)	6.63	6.68	6.24
	High (N=1436)	6.74	6.76	7.12
Cholesterol	*Low* (N=1623)	7.64	7.75	8.01
	Middle (N=1463)	7.89	7.35	7.11
	High (N=1436)	7.91	8.04	7.71
Sodium	*Low* (N=1623)	6.37	6.69	6.17
	Middle (N=1463)	6.65	6.82	6.29
	High (N=1436)	6.75	6.67	6.16
Variety	*Low* (N=1623)	7.61	7.54	7.63
	Middle (N=1463)	7.47	7.96	7.69
	High (N=1436)	7.38	7.20	7.71

Even though differences were not noted among these individual component scores, scores were consistent across all groups. Overall, individuals, regardless of income or ethnicity, are consuming diets low in fruits, vegetables and dairy.

Within ethnic groups

Among NHW, high income individuals scored the lowest with regard to meeting the recommendations for grains but among NHB, high income individuals scored the highest in this category. Among NHB, low income individuals had the lowest intake of grains. Comparisons also revealed that among NHW, middle income individuals were least likely to meet the recommendation for meat. The opposite trend was noted among NHB and MA, with middle income individuals being most likely to meet these recommendations. Examination of cholesterol scores revealed that, among MA, middle income individuals scored the lowest. This trend is seen among NHB as well. For sodium, among NHB middle income individuals were least likely to meet the recommendation. Among both NHW and MA, it is the low income individuals who were least likely to meet this recommendation.

Dietary Behavior

Tables 23 through 26 display the results of comparisons between ethnicity and diet behaviors by income.

Between ethnic groups-Milk

Comparisons indicated that past 30 day milk consumption was statistically significant different across all income groups (Low: $\chi 2(6)=82.27$, $p=0.000$; Middle: $\chi 2(6)=84.47$, $p=0.000$; High: $\chi 2(6)=81.15$, $p=0.000$) by ethnicity (Table 23). Regardless

of income, NHW were more likely to consume milk "often" compared to NHB and MA, with NHB reporting they were more likely to "never" consume milk. Over half of all NHW consume milk "often" but less than half of MA and NHB do.

Within ethnic groups-Milk

Among MA, NHB, and NHW, low income individuals were the most likely to consume milk "often" (Table 23).

Table 23: Past 30 Day Milk Consumption across Ethnicity and Income

Income	Ethnic Group	**Milk Consumption (%)**			
		*Never^*	*Rarely^*	*Sometimes^*	*Often^*
Low (N=995)	**NHW (N=1006)**	9.44	13.12	22.07	55.37
	NHB (N=655)	19.39	16.34	30.08	34.20
	MA (N=334)	11.98	12.87	28.14	47.01
Middle (N=1810)	**NHW (N=1133)**	9.53	9.97	25.68	54.81
	NHB (N=415)	18.31	20.00	28.43	33.25
	MA (N=262)	14.12	16.03	32.06	37.79
High (N=1833)	**NHW (N=1405)**	11.39	10.60	25.98	52.03
	NHB (N=252)	22.22	20.24	29.76	27.78
	MA (N=176)	12.50	17.61	36.93	32.95

^ categories as defined by NHANES

Between ethnic groups-Dried Bean and Pea

Significant differences in dried bean and pea consumption were evident across low ($\chi 2(4)=19.91$, $p=0.001$), middle ($\chi 2(4)=38.09$, $p=0.000$) and high ($\chi 2(4)=14.87$, $p=0.005$) income groups by ethnicity (Table 24). Regardless of income, MA were more likely to consume dried beans and peas on "most days" compared to NHW or NHB with over half of all MA in all three income groups reporting consumption of beans and peas

"often." At least one-third of the MA reported consuming dried beans and peas most days whereas more than one-third of NHW and NHB reported consuming dried beans and peas only "rarely."

Within ethnic groups-Dried Bean and Pea

Among NHW, middle income individuals were more likely to report consuming beans "often" but among NHB, low income individuals were more likely to report frequently ("often") consuming dried beans and peas (Table 24). Among MA, similar percentages of individuals across all incomes reported consuming dried beans and peas "often" (Table 24).

Table 24: Monthly Dried Bean and Pea Consumption across Ethnicity and Income

Income	Ethnic Group	**Dried Bean and Pea Consumption (%)**		
		*Rarely**	*Sometimes**	*Most Days**
Low (N=1082)	**NHW (N=567)**	38.10	40.39	21.51
	NHB (N=385)	36.10	39.38	24.42
	MA (N=130)	22.31	39.23	38.46
Middle (N=1034)	**NHW (N=665)**	34.14	40.90	24.96
	NHB (N=232)	43.10	41.41	15.52
	MA (N=137)	16.06	45.26	38.69
High (N=1098)	**NHW (N=840)**	33.81	44.52	21.67
	NHB (N=158)	36.08	43.67	20.26
	MA (N=100)	24.00	38.00	38.00

*categories created for the purposes of this study

Between ethnic groups-Dark Green Vegetables

Significant differences in dark green vegetable consumption were noted only with the low ($\chi 2(4)=38.34$, $p=0.000$) and middle ($\chi 2(4)=16.82$, $p=0.002$) income groups (Table 25).

Table 25: Monthly Dark Green Vegetable Consumption across Ethnicity and Income

Income	Ethnic Group	**Dark Green Vegetable Consumption (%)**		
		*Rarely**	*Sometimes**	*Most Days**
Low (N=1082)	**NHW (N=567)**	25.40	23.86	40.74
	NHB (N=385)	12.99	31.95	55.06
	MA (N=130)	31.54	35.38	33.08
Middle (N=1034)	**NHW (N=665)**	19.10	25.71	55.19
	NHB (N=232)	10.34	32.33	57.33
	MA (N=137)	23.36	32.12	44.53
High (N=1098)	**NHW (N=840)**	12.86	25.95	61.19
	NHB (N=158)	8.86	23.42	67.72
	MA (N=100)	14.00	24.00	62.00

*categories created for the purposes of this study

NHB, regardless of income, were more likely to report consuming dark green vegetables on "most days" compared to NHW and MA, with high income NHB reporting consuming them most frequently. Conversely, MA were the most likely to report "rarely" consuming dark green vegetables.

Within ethnic groups-Dark Green Vegetables

Among all ethnic groups, high income individuals were the most likely to report consuming dark green vegetables most frequently ("often").

Between ethnic groups-Restaurant Food

Statistically significant differences in the frequency with which individuals eat in a restaurant were noted across all groups (Low: $\chi 2(6)=22.60$, $p=0.001$; Middle: $\chi 2(6)=21.72$, $p=0.001$; High: $\chi 2(6)=21.51$, $p=0.001$) (Table 26). NHB, regardless of income, were the least likely to report eating restaurant food four or more times per week than NHW and MA (Table 26).

Within ethnic groups-Restaurant Food

Low income individuals were the most likely to report never eating in a restaurant and this trend was true among the three ethnic groups (Table 26).

Table 26: Frequency of Restaurant Food Consumption across Ethnicity and Income

Income	Ethnic Group	**Weekly Restaurant Food Consumption (%)**			
		*Never**	*Once**	*2-3 times**	*4 or more times**
Low (N=2005)	**NHW (N=1009)**	35.08	23.88	23.48	17.54
	NHB (N=662)	43.66	17.82	24.32	14.19
	MA (N=334)	34.43	26.05	25.75	13.77
Middle (N=1828)	**NHW (N=1141)**	22.87	20.77	29.44	26.90
	NHB (N=424)	30.42	19.10	31.84	18.63
	MA (N=263)	18.63	21.67	32.32	27.37
High (N=1842)	**NHW (N=1409)**	12.06	22.85	30.73	34.35
	NHB (N=257)	21.01	24.51	28.79	25.68
	MA (N=176)	13.64	19.31	36.36	30.68

*categories created for the purposes of this study

Discussion

The purpose of this study was to identify differences in health status, dietary quality and dietary behavior across income and ethnic groups using data from combined 1999-2002 NHANES data set.

Baseline Characteristics

Differences were noted with regard to baseline characteristics, with non Hispanic Whites (NHW) reporting that they were more likely to be covered by health insurance, more likely to be educated, less likely to be poor, and more likely to be food secure compared to Mexican Americans (MA) and non Hispanic Blacks (NHB). Before

country of birth was added to inclusion criteria, preliminary analyses indicated stark differences in demographic and socioeconomic variables between NHB and MA. After selecting only those individuals born in the United States, the MA profile tended to parallel that of NHB, and this is not surprising since they suffer from similar economic and social hardships.

Food Security

Previous published research indicates that there were differences with regard to weight status and diet between individuals living in food secure and food insecure households. However, we found no differences with regard to food security and key dietary variables or weight status, which does not support the research that associates poor diet (Dixon, Winkleby, & Radimer, 2001; Kendall, Olson, & Frongillo, 1996; Rose & Olivera, 1997) and being overweight or obese with food insecurity (Adams, Grummer-Strawn & Chavez, 2003; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). For HEI component scores, total fat was associated with food security status but did not agree with previous research in that food secure individuals were more likely have a higher total fat intake. Previous research had reported those living in food insecure households were likely to have a higher total fat intake. There were also no significant associations between weight and food security status. The results did reveal a trend indicating that those living in food insecure households were more likely to be obese than those living in food secure households, but those living in food secure households were more likely to be overweight. Recent research suggests that food insecurity, especially food insecure without hunger and marginally food secure, is associated with being overweight and

obese, especially among women (Adams, Grummer-Strawn, & Chavez, 2003; Townsend, Peerson, Love, Achterberg, & Murphy, 2001; Wilde & Peterman, 2006). The majority of this research focuses on regional trends across the United States, but there are studies supporting these relationships at the national level (Wilde & Peterman, 2006). It is possible that no differences were found because marginally food secure individuals are grouped with food secure individuals and food insecure with and without hunger are grouped together as well. It is also possible that the lack of significant associations were found because other variables were masking these differences, including income and acculturation.

Differences associations were evident between dietary behaviors by food security status were evident. Those living in food secure households were more likely to consume milk, dark green vegetables, and restaurant food more frequently than those living in food insecure households. This is consistent with the literature that suggests that those living in food insecure households are less likely to consume milk and vegetables, especially dark leafy green vegetables, than food secure households (Dixon, Winkleby, & Radimer, 2001). While research has not specifically examined restaurant food intake among food secure and food insecure, it is logical to suggest that food insecure individuals eat in restaurants less frequently because according to the data, they are more likely to be low income, and therefore may not have excess money to spend at a restaurant.

Weight Status

Differences were observed with regard to weight status across income and ethnicity and these results were not surprising. High income, NHW individuals were less

likely to be obese compared with their counterparts which supports previous research which indicates that overweight and obesity are disproportionately higher in low income communities (Molarius, Seidell, Sans, Tuomilehto, & Kuulasmaa, 2000) and among minorities (Ogden, Carroll, Curtin, McDowell, Tabak & Flegal, 2006; Denney, Krueger, Rogers & Boardman, 2004; Morin, Stark & Searing, 2004). When the file was split and weight status was examined both by ethnicity and income groups, MA were more likely to be obese than NHB or NHW among high income individuals but NHB were more likely to be obese among low and middle income individuals indicating that income and ethnicity play a role in weight status.

Dietary Quality

Based on our analysis, there were no differences in overall diet quality across ethnicity by income groups. Overall, individuals of all incomes and ethnicities are doing poorly with regard to overall diet quality. Certain component scores were different, however, when examining ethnic groups by income. This seems contradictory because if there are differences across ethnicities in component scores, then there should be differences with regard to overall diet quality. Statistically significant differences may not be evident because the differences between certain component scores may be balanced by the non-significant differences across other component scores.

Statistically significant differences in fruit, dairy, and sodium intake were found across income groups, with high income groups consuming the least fruit, middle income groups consuming the most sodium, and low income groups consuming the least dairy. It is surprising that high income individuals are consuming the least fruit when it seems that

based on income and access alone they would be most likely to purchase fruits and vegetables. Availability and accessibility of fruits and vegetables, however, does not equate to consumption and this may be the reason for this difference.

In fact, when examining just ethnicity, no differences were found with regard to any of the dependent variables. But differences do emerge when the data set was examined by both income and ethnicity, stressing the importance of taking both into account when addressing nutrition interventions. Differences were noted for the grain, meat and meat alternatives, cholesterol, sodium and variety component scores but only in the middle to high income groups across ethnicity. This suggests that among low income individuals, ethnicity may not be associated with diet quality.

High income MA were more likely to meet the grain recommendations compared to high income NHB and NHW which may be due to the fact that high income individuals and MA are more likely to meet Food Guide Pyramid recommendations (Sharma, Murphy, Wilkens, Shen, Hankin, Monroe, Henderson, & Colonel, 2004) . Among middle income individuals, NHB were more likely than NHW and MA to meet the recommendations for meat and meat alternatives, sodium, and variety. However, even for NHB, individuals are doing poorly with regard to sodium and meat intake indicating the need for improvement.

No strong associations were evident for the fruit, vegetable, dairy, total fat or saturated fat component scores across ethnicity and income, which was unexpected. These results do not support previous research which indicates that MA have higher intakes of fruit (Thompson, Midthune, Subar, McNeel, Berrigan, & Kipnis, 2005) and are

more likely to adhere to Food Guide Pyramid recommendations (Sharma, Murphy, Wilkens, Shen, Hankin, Monroe, Henderson & Colonel, 2004). Research also states that NHW are more likely to consume milk and milk products (Ranganathan, Nicklas, Yang & Berenson, 2005) and more likely to consume a lower fat diet (Gans, Burkholder, Risica & Lasater, 2003) suggesting that differences should have been noted across groups with regard to diet. Even for the areas where differences were evident, all groups need improvement in all areas and dietary interventions should focus on all these areas if researchers want to see an improvement in overall diet quality.

Dietary Behavior

All of the measures for diet behavior were highly associated with ethnicity and income. There were statistically significant differences between income groups with regard to dark green vegetable and restaurant food consumption. This is logical since they are the two diet behaviors examined in this study which are most likely to be affected by income. Vegetables are far more perishable than dried products, and even milk products, and consuming food in a restaurant is more costly than eating at home. To support this supposition, high income individuals were more likely to report consuming dark green vegetables "most days" and more likely to report consuming restaurant food four or more times per week. The opposite extreme was noted in the low income group.

Across ethnic groups, NHW were more likely to report consuming milk more often than NHB or MA and this held true regardless of income. This reflects previous research that shows NHW are more likely to consume dairy more often than NHB (Ranganathan, Nicklas, Yang, & Berenson, 2005). It is interesting that based on the HEI

component score for dairy, there were no differences across ethnic groups, yet differences are seen when the question is asked as a dietary behavior with preset response categories rather than as a 24 hour recall. It is important to note however, that the HEI dairy score includes all dairy products, not just milk, which may explain this discrepancy. The HEI scores and the dietary behaviors are also determined using different tools, which may also account for these differences. The HEI scores are determined using one 24-hour recall and the dietary behaviors determine by a questionnaire that asks the respondent to report past monthly milk consumption.

MA were more likely, regardless of income, to report consuming dried beans and peas on "most days." Culturally, this is not surprising, since beans are traditionally staples in the MA diet and research indicates that Hispanic individuals typically have higher intakes of fiber than both non-Latino Whites and Blacks (Thompson, Midthune, Subar, McNeel, Berrigan, & Kipnis, 2005).

Regardless of income, NHB were more likely to consume dark green vegetables on most days compared to NHW and MA. This may be due to cultural traditions which are evident in the published research which indicate that certain foods are traditional favorites in the African-American diet and these foods include dark green vegetables such as collard greens (Kittler & Sucher, 1998).

NHB, regardless of income, were the least likely to eat in a restaurant. This does not support the research that indicates that NHB report eating out more than NHW and MA, but this is usually fast food. Within the high income group, NHW were more likely to eat out 4 or more times per week. The variable used in these analyses for restaurant

food consumption does not differentiate between types of establishment. Fast food and fine dining are all included in this category, possibly explaining why our findings do not support previous research.

For diet behavior, the greatest barrier to eating healthy for minorities in low income communities might be access and availability to healthy food in conjunction with poor nutrition knowledge and cost. Low income individuals view fresh fruit and vegetable purchases as "prohibitively expensive". This concept was not examined in this study due to the fact that access and availability of food and nutrition knowledge could not be examined within the limits of this dataset. However, there is a need to examine this more closely in future studies.

It is interesting that more associations between ethnicity/income/food security and health and diet were not noted since differences in key baseline characteristics across ethnicity were noted. Education, food security status and income have been shown to have an effect on diet and health and it is reasonable to predict that differences would have been noted in health and diet across ethnicity and income. This, however, was not the case thus warranting further future research.

Limitations

There are limitations that must be addressed when working with a national database. NHANES is a cross-sectional study, meaning that only one measure is taken at one moment in time and may not be indicative of true behavior. Along with this, much of the data used for the purposes of this research study are based on self-report, which may not be indicative of true behaviors as well. However, the sample size is large enough

to account for over and underreporting which should normalize the data. The sampling process is also a limitation in that all institutionalized individuals and individuals without phones are excluded from the sample, meaning that the sample is not representative of the entire United States population. However, this is the best national database for examining health and diet across ethnic groups.

There is limited dietary information provided by only one 24-hour recall which is used in formulating Healthy Eating Index (HEI) scores. One of the limitations to using a national database is that the data are not specifically collected for research purposes and often times, the questions may be phrased in a way that makes it difficult for use in answering research questions. This is the case for our study when examining diet behavior. Also, many questions are asked with a specific population in mind and therefore may not be asked of all participants. In this case, some questions were eliminated from our study because they were not asked of our entire sample population.

While limitations exist, this study was able to provide initial data supporting the notion that nutrition and health interventions should be culturally appropriate and need to take income into account. This research examined food security and income with diet and health-related behaviors across three ethnic groups at the national level. The results did not reveal any statistically significant differences with regard to food security. Further research is necessary in this area to better understand if there are truly any differences in the determinants of food security across ethnic groups. This is especially true at the national level. Even though there is a lack of research in this area, there are clearly differences in weight status, dietary quality and dietary behavior across income

and ethnicity which supports our research questions. However, it does seem that taking income and ethnicity into consideration collectively is necessary when addressing nutrition interventions.

CHAPTER IV

EPILOGUE

If I were to repeat this research, I would still pursue examining the differences in food security by ethnicity, but I would probably use a different sample population, either a different subgroup of NHANES or a completely different group all together. If I used NHANES again, I would consider looking at females in the population or children, or the relationship of children in a household to adult food security status. Obtaining a large enough sample with these three ethnic groups in a different population might be difficult, but I think research in this area is warranted and this would be the focus of my research.

The most useful thing about using a database like NHANES is that the data are readily available. However, the data for NHANES is designed to determine prevalence rates. It is not collected for research purposes and certain questions cannot be answered. If I were to continue with the research, I would expand the dietary behavior questions: "What types of restaurants does the population eat in most frequently?" "Where do they shop for groceries?" I would try to determine the types of foods consumed: "Do they eat whole grains and fresh fruits and vegetables, or do they prefer canned ones?" "What types of meats and dairy products are consumed (full fat vs. low fat vs. fat free)." I would also investigate the consumption of fried foods, types of cereal consumed, consumption of soda and fruit drinks and consumption of snack foods. As part of the research, I would

conduct a simple health survey that asked participants to self-rate their overall health status (e.g. excellent, good, fair or poor), since this measure of health is used frequently in the literature. In addition to exploring the variables selected from the NHANES data, I would also be interested in examining physical activity, social support, mental health status, community meal participation and key household variables such as head of household and number of children in the household. If examining issues with food security, I would also be interested in examining disparities across chronic and seasonal food insecurity.

Based on our measure of health status, no significant differences where noted among income or ethnic groups. This may be due to the fact that the health index we created from the database was not a good measure of overall health status. The relationship between food insecurity/income/ethnicity and health status is an important aspect of this research that warrants further investigation.

One aspect of research that I missed in doing secondary data analysis was I did not get the opportunity to go out into the community and recruit participants. I was not able to interview the participants myself. This can often be a disadvantage because so much can be learned about behavior by just talking with someone face to face. Sometimes the answer given on paper may not be the whole story and a participant may provide more valuable information if given the opportunity to verbally respond and elaborate. Research using NHANES was not without its rewards and benefits. It allowed me to work with a large sample size, which in other research settings is not always possible due to money and time constraints. Most data is usually examined from a

regional level, but with NHANES, I was also able to look at the data from a national standpoint.

I learned a lot about myself and my interests throughout this research study. It is interesting that when I first came to graduate school, I was working in a different lab which focused on basic science. I soon realized that my ultimate goal was to work with people, not cells and tissues. When I began my work with Dr. Haldeman, I did not know that I would be working with a national data set or with this population. I began with Jamaicans, looking at the effects of acculturation in this population, but ended up working with three ethnic groups and the NHANES database. My research changed drastically as did I through out my years here. Even though at times, the study was frustrating and it seemed like we would never be able to use the data set to answer our questions, in the end it was a very rewarding experience. It showed me that patience and determination provide their own rewards in the long run. I know that if I put my mind to something I can attain my goal, even if that ultimate goal is not quite what I thought it would be in the beginning.

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