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Association of body mass index, fruit and vegetable intake, and acculturation in a sample Las Vegas Hispanic population

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ASSOCIATION OF BODY MASS INDEX, FRUIT AND VEGETABLE INTAKE AND
ACCULTURATION IN A SAMPLE LAS VEGAS HISPANIC POPULATION

by

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Bachelor of Science
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ABSTRACT

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The U.S. is experiencing a rising prevalence of overweightedness that has been identified as the second leading cause for chronic health conditions threatening public health. Overweightedness has grown disproportionately among ethnic sub-groups. In the fastest going minority population in the U.S., Hispanic Americans are observed with disparately high body mass index, placing them at heightened risk for poor health outcomes. Research suggests five servings of fruit and vegetables, in any combination, provides a sound nutritional base for healthful living and helps to maintain normal body weight.

Americans are known to have poor eating habits while foreign-born populations have well-balanced diets that are plentiful in fruit and vegetables. With migration and acculturation to the U.S., migrant diets frequently deteriorate into the poor eating habits of the typical American. The greatest differences are noted between first- and second-generation, however, the negative impact remains relatively unchanged from that point forward.

This study conducts an analysis of secondary data to determine the relationship of overweightedness and fruit and vegetable consumption in a survey sample of Hispanics

living in the Las Vegas metropolitan area. Secondly, it evaluates the relationship of fruit and vegetable consumption and acculturation, measured by language of preference.

In a sample of 318 respondents, fruit and vegetable consumption was non-significant in association to healthier body weight. However, a χ^2 analysis of BMI and daily fruit and vegetables suggests that 87% of those classified as normal weight eat five or more fruits and vegetables daily. Concerning acculturation and daily fruit and vegetable consumption, a sample of 321 respondents demonstrated a significant ($p < 0.05$) relationship between acculturation and fruit and vegetable consumption. A negative relationship between the two showed that highly acculturated individuals were 6.6 (S.E. 0.319) times more likely to fall below the minimum daily recommendation for fruit and vegetables daily.

Understanding the general characteristics of Hispanic Americans living in the Las Vegas metropolitan, and the tendency for overweightedness in the population provides insight for potentially poor health outcomes and a future impact on public health. Targeted health programming may be warranted.

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CHAPTER 1

INTRODUCTION

Many chronic health conditions would be improved or prevented by consuming a diet that provides adequate nutrition and promotes appropriate body weight. A startling number of Americans are overweight or obese as a result of poor food choices and physical inactivity, placing them at a greater risk for poor health outcomes (Balluz, Okoro, & Mokdad, 2008; Goel, McCarthy, Phillips, & Wee, 2004). The U.S. Dept. of Health and Human Services' initiative, Healthy People 2010, lists overweight and obesity as the second leading indicator for chronic conditions threatening public health (DHHS, 2000). Research shows a positive association between consuming fruit and vegetables and maintaining normal body weight (Carrera, Gao & Tucker, 2007; Joffe & Robertson, 2001; Rolls, Ello-Martin & Carlton, 2004).

Adequate nutrition is elemental to human health, yet Americans are in the forefront of poor eating habits. Americans rely heavily on convenient foods, foods prepared and eaten outside the home that are often nutritionally incomplete and high in calories, fat, and salt (Casagrande, Wang, Anderson, & Gary, 2007). A majority of Americans are overweight, suggesting an overabundance of food in their diet, however the diets of overweight and obese populations frequently lack the dietary micro- and macro-nutrients necessary to protect against chronic illnesses (Tucker, Falcón, & Bermúdez, 1997).

In epidemiologic research, Body Mass Index (BMI) is a commonly used measure to compare health outcomes by the degree of adiposity in a population. Studies frequently associate high BMI values ($>25 \text{ kg/m}^2$) with chronic health conditions such as diabetes, arthritis, hypertension, and hypercholesterolemia (Barcenas et al., 2007; Balluz, Okoro, &

Mokdad, 2008; Bowie, Juon, Cho, & Rodriguez, 2007; Joliffe, 2004; Wright, Riggs, Jeffrey, & Chen, 2008). Estimates for the U.S. suggest the annual burden of disease related to overweightedness is nearly 300,000 deaths and \$117 billion in healthcare costs (Bowie, Juon, Cho, & Rodriguez, 2007).

The USDA *Dietary Guidelines for Americans* recommend three to five servings of fruit or vegetables in combination daily (USDA). Data from the National Health and Nutrition Examination Survey (NHANES) for 1988-1994 highlight how few Americans eat recommended amounts of fruit and vegetables (Casagrande, Wang, Anderson, & Gary, 2007). Such findings were the impetus for fruit and vegetable consumption goals for the year 2000 that were included in the original Healthy People initiative.

Surveillance of NHANES 1999-2002 data found small but important regional increases in fruit and vegetable consumption, likely the result of Healthy People inspired campaigns such as 5-A-Day for Better Health (Casagrande, Wang, Anderson, & Gary, 2007). Healthy People 2010, the second initiative, increased the goals for American to 75% meeting the two or more serving of fruit and 60% meeting at least three vegetables daily (USDA). However, at the writing of Healthy People 2010, disparities by ethnic subgroups were apparent. Research shows that in 2000 only 32% of Hispanic Americans (HA) met the minimum recommendation for fruit consumption and 47% for consuming vegetables (Healthy People, 2001).

The Healthy People 2010 additionally outlines the importance of normal body weight for healthy living. Objective 19-1 sets the goal for 60% of Americans to be in the healthy body weight range with a BMI of 18.5–25(kg/m²), (Healthy People, 2001). Objective 19-2 promotes a reduction in the proportion of the currently obese Americans (BMI \geq 30) to

less than 15% of the total population (Healthy People, 2001). Age-adjusted NHANES 1988-1994 data for the largest subset of the Hispanic American (HA) population, Mexican Americans (MA), demonstrated that only 30% were maintaining a healthy body weight (BMI 18.5-25 kg/m²), (DHHS, 2000). Ogden et al. (2006) report the majority of MA population (73.4% [SE 1.9]) fall into either the overweight or obese category.

Despite the tendency for higher BMI, Hispanics demonstrate lower morbidity and mortality than non-Hispanic Whites (Abraido-Lanza, Chao, & Flórez, 2005; Hummer et al., 2000; Lin et al., 2003; Singh & Siahpush, 2002; Sorlie, Backlund, Johnson & Rogot, 1993). Suggestions that adherence to a native Hispanic diet is key to averting negative health outcomes (Abraido-Lanza, Chao, & Flórez, 2005) because native Hispanic diets provide a wide variety of fruit and vegetables (Abraido-Lanza, Chao, & Flórez, 2005, Romero-Gwynn et al., 1993).

Hispanic American research suggests that those who adhere to a native Hispanic diet demonstrate better health outcomes than others of similar SES, education or health insurance status who consume a typical American diet (Abraido-Lanza, Chao & Flórez, 2005). Research shows that health status declines as migrants acculturate to a host country's diet (Bowie, Juon, Cho, & Rodriguez, 2007). The adoption of Western eating habits after migration has been investigated (Bermúdez, Falcón, & Tucker, 2000; Himmelgreen et al., 2004; Lin, Bermúdez, & Tucker, 2003; Monroe et al., 2003). However, there is little research on HA populations in Las Vegas, Nevada. This study will investigate the association of fruit and vegetable consumption to BMI and acculturation in HA residing in Las Vegas, Nevada. Surveillance data are vital to reduce disparate burden of disease and health inequities.

CHAPTER 2

LITERATURE REVIEW

Hispanic Americans

In 1970, U. S. Census questionnaires began collecting ethnicity and race of origin information (US Census Bureau, 2001). The classification of Hispanic American (HA) refers to a heterogeneous population originating from Central America, Cuba, Dominican Republic, Mexico, Puerto Rico, Spain, or South America (Fernández et al., 2003). The HA population is currently the fastest growing minority in the U.S. (Bowie, Juon, Cho, & Rodriguez, 2007; Kuczmarski, Kuczmarski, & Najjar, 1995; Neuhouser, Thompson, Coronado & Solomon, 2004). A report from the U.S. Census Bureau stated that, as of July 2006, Hispanics comprised more than 15% of the total U.S. population (U.S. Census, 2007). Additionally, census information predicts that all minorities will, collectively, be more than half of the 'all minorities' population by the year 2042 (Bernstein & Edwards, 2008; Neuhouser, Thompson, Coronado & Solomon, 2004; US Census Bureau).

Among minority groups HA populations have growth rapidly. Between 1980 and 2000, the number of census respondents who self-identified as HA increased dramatically. From 1980 to 1990, census data indicate a 13.2% growth in the HA population, and by comparison, 1990 to 2000 data show a startling 57.9% increase (US Census Bureau 2007). Detailed information, gleaned from 2000 census data, show growth rates by HA sub-population: MA increased 52.9%; Puerto Rican Americans (PR) 24.9%; Cuban Americans (CA) 18.9%, and the 'other' category grew by 96.9% (U.S. Census Bureau, 2000).

Some of the growth in the HA population may be attributable to new data collection

methods implemented for the 2000 census. Officials expanded census polling areas, reworded questionnaires to obtain detailed information, and created more inclusive ethnic and racial categories (U.S. Census, 2001). HA categories for the 2000 census included: Mexican/ Mexican American/Chicano; Puerto Rican; Cuban; or other Spanish/Hispanic/Latino (US Census Bureau, 2001). The net effect has been a likely increase in Hispanic populations identified. Additionally, the 2000 census reported 35.3 million people identified into at least one HA category (Fernández et al., 2003) and of the 35.3 million, 60% identified as of Mexican decent (Gregory-Mercado et al., 2007; U.S. Census Bureau, 2006). By 2050, HA are projected to number 102.6 to 133 million and represent 24 to 30% of the total U.S. population (Bowie, Juon, Cho, & Rodriguez, 2007; Neuhouser, Thompson, Coronado & Solomon, 2004; Satia, 2009; US Census Bureau, 2007).

In the State of Nevada, HA are the majority among minority populations. The State of Nevada Demographer provides ethnicity data for 2005 showing HA comprise 23.31% of the state's population while non-Hispanic blacks make up 6.88%, Asian/Pacific Islander 6.34%, and Native American 1.33% (State of Nevada Demographer website). Nevada has been identified as one of 15 states with at least 500,000 Hispanic residents and as one of 22 states where Hispanics are the largest minority group (U.S. Census, 2007).

Body Mass Index (BMI)

Body Mass Index (BMI) values are commonly used in epidemiologic research to associate the adiposity of populations to health issues (Fernández et al., 2003; Keys, Fidanza, Karvonen, Kimura, & Taylor, 1972). BMI is easily calculated, making it a fast and effective measure for describing under- or overweightedness. The World Health Organization (WHO) defines BMI as the measure of weight over height squared, expressed in kilo-

grams per meter squared (wt/ht^2 or kg/m^2), (Beydoun & Wang, 2009; CDC; WHO, Technical Support Series, No. 895, 2000). Universally accepted BMI classifications are: underweight $\leq 18.5 \text{ kg}/\text{m}^2$, normal weight $18.5\text{-}25 \text{ kg}/\text{m}^2$, overweight $25\text{-}30 \text{ kg}/\text{m}^2$, and obese $\geq 30 \text{ kg}/\text{m}^2$ (CDC, WHO, Technical Support Series, No. 895, 2000). Barcenas et al. (2007) include an additional classification, extreme obesity defined as $\text{BMI} \geq 40 \text{ kg}/\text{m}^2$.

BMI from Self-reported Height and Weight

BMI is easily calculated from survey data which makes it a cost effective tool for assessing weight related health issues in a population. However, there is a general tendency for survey data to overestimate height and/or underestimate weight. As a result, BMI values calculated from self-reported data frequently may under represent the true degree of adiposity (Kuczmarski, Kuczmarski, & Najjar, 2001). A problem area for men in self-reported data, and to a lesser degree women, is the over-reporting height (1.3% and 0.6%, respectively, $\text{SD } 1.5$; $p < 0.001$), (Palta, Prineas, Berman & Hannan, 1982). Rowlands (1990) found that men and women over-reported height by 1.4cm and 0.6cm, respectively. Additionally, height overestimations seem to steadily increase with age. It has been suggested that age related over-reporting of height may be the mistake of reporting height as measured in youth, perhaps the last time it was measured, without consideration of the natural loss of stature over time (Palta, Prineas, Berman & Hannan, 1982). Conversely, Palta and colleagues (1982) found an inverse relationship for women and men for under-reporting weight that decreases with age (1.6% and 3.1%, respectively). Rowlands (1990) found the percent of error in self-reported weight data grew in association with the extent of subjects' overweightedness.

Acknowledging the issues with self-report BMI data, Palta et al. suggest that discre-

pancies have little impact on the epidemiologic value of BMI data. However, caution is warranted for using self-report BMI when calculating relative risk and attributable risk (Rowland, 1990), and careful consideration should be exercised when making inference with self-report data (Flegal, Carroll, Ogden, & Johnson, 2009; Mokdad et al., 1999). Finally, what appears to be most important about self-report BMI data is that elevated BMI reported may represent a greater adiposity in that population than data may suggest. It is also important to note that Craig and Adams (2008) found the phenomenon of under- and over-reporting of height and/or weight was more common in European Americans (EA) than in minority groups (Craig & Adams, 2008).

BMI does not a measure of percent body fat – it approximates adiposity. However, the magnitude of under- or over-reported data seems to have little impact on the usefulness of the information. Craig and Adams (2008) determined the Cohen’s kappa estimate was 0.443 (N=724; SE 0.008) for pregnant women, or moderate agreement between self-reported and direct measure BMI. Rowland (1990) also cites self-report and direct measured BMI are highly correlated. Additionally, both self-report and direct measure BMI are highly correlated to true measures of percent body fat, e.g. hydrodensitometry ($r= 0.8$, $p= <0.001$), (Ellis, 2007). Flegal et al. (2009) found that percentage fat measurements are highly correlated to BMI, 0.716 to 0.839, varying slightly by age and gender.

Accurately measuring the percent body fat for subject, e.g. hydrodensitometry, is often impractical for epidemiological research since it requires subjects to submit to elaborate testing conditions (Brodie, Moscrip, & Hutcheon, 1998). Ellis (2007) created a list of considerations for selecting adiposity study measurements: cost, training of data collectors, data maintenance and operating costs, precision, and accuracy. Direct measure BMI,

with researchers directly collecting weight and height measurements from subjects, meets the first 4 of Ellis' recommendations but does not meet the precision or accuracy consideration. However, Ellis (2007) further suggests that BMI survey data reasonably approximates body fat and maximizes resources, which makes it a good measure for research comparison.

In spite of limitations associated to self-reported BMI data, researchers find the benefits are both acceptable and reasonable for estimating adiposity in a research population because BMI highlights the general tendency of that population for health trend comparisons (Joliffe, 2004; Nagaya, Yoshida, Takahashi, Matsuda, & Kawai, 1999; WHO).

BMI Trends in the U.S.

Americans are heavier than ever before. NHANES longitudinal data chronicles the rising weights in the U.S. (Kuczmarski, Flegal, Campbell, & Johnson, 1994; Dixon, Sundquist & Winkleby, 2000). Beginning with the first NHANES collection (1976-1980) to a follow-up assessment (1988-1994) BMI increased by 8% in both genders and for all ethnicities (Sundquist & Winkleby, 2000). Additionally, the prevalence of obesity (BMI ≥ 30) in the U.S. doubled over the last 25 years (Barcenas et al., 2007; Beydoun and Wang, 2009; Stein & Colditz, 2004). A comparison of NHANES 1976-1980 and 1999-2000 data show the proportion of people classified as obese (BMI ≥ 30) increased by 110% (Bowie, Juon, Cho, & Rodriguez, 2007; Stein & Colditz, 2004). NHANES 2000 data revealed that nearly 65% of Americans have a BMI $> 25 \text{ kg/m}^2$, categorizing them as either overweight or obese (as cited by Bowie, Juon, Cho, & Rodriguez, 2007; Flegal, Carroll, Ogden, & Johnson, 2002). Projection models of NHANES 1988-1994 and 1999-2004 data suggest a strong possibility that BMI will continue to rise (Beydoun & Wang,

2009; Ogden et al., 2006).

BMI trends in Hispanic Americans

The growing prevalence of overweightedness in the American populous appears even greater among HA. From 1991 to 1998, HA surveillance data show obesity (BMI ≥ 30) increased, from 12% to 21% (Bowie, Juon, Cho, & Rodriguez, 2007). In the largest HA subset, MA ranked highest in a combined category of overweight and obese: EA 62.3% [SE 2.3]; African American (AA) 69.7% [SE 1.0]; and MA 73.4% [SE 1.9] (Ogden et al., 2006).

Additionally, MA and AA women show a greater proclivity for obesity (BMI ≥ 30 ; OR 95% C.I.; MA = 1.31 [1.11-1.55], AA = 2.01 [1.76-2.29]) when compared to EA women (Ogden et al., 2006). However, Beydoun and Wang (2009) observed a little difference in BMI among MA women in the highest percentile; it appears to be holding steady. By gender, MA men are more likely than MA women to be overweight (BMI ≥ 25 ; 44.2% vs. 29.0%), and MA women have a greater tendency to be classified as obese (BMI ≥ 30 ; 25.1% vs. 23.3%), (Bowie, Juon, Cho, & Rodriguez, 2007). Beydoun and Wang (2009) developed predictive models using NHANES data that suggest MA and EA men will experience higher growth rates in general and central obesity in the years to come.

Fernández et al. (2003) found that HA women experienced a higher percent body fat than AA or EA women with the same BMI measurements, suggesting poorer health outcomes over the long term. Ogden et al. (2006) found that Hispanic women had a greater weight issue than EA for being classified as overweight; HA women were classified as 71.9-75.4% [SE 2.4-2.8] overweight and EA women 57.3-58% [SE 1.4-3.3] overweight during three consecutive NHANES report cycles.

The Well Integrated Screening and Evaluation for Women Across the Nation (WISEWOMAN) are a heart disease studies sponsored by the Centers for Disease Control (CDC), which funds many cross-sectional WISEWOMAN projects nationwide. The Arizona WISEWOMAN project associated diet to the BMI in EA and HA women aged 40 to 64 years living in Utah, New Mexico, Arizona and Colorado (Murtaugh et al., 2007). Arizona WISEWOMAN found HA women with disparately high BMI. Additionally, the study found an inverse weight distribution for EA women 40.1% (normal weight = <25 BMI), 30.4% (overweight = ≥ 25 -29.9 BMI), and 29.5% (obese = ≥ 30 BMI) and HA women 21%, 36.7%, and 42.3%, respectively (Murtaugh et al., 2007).

Beydoun and Wang (2009) discussed whether or not genetic predisposition may be a factor for high adiposity among populations. The research acknowledged that genetics may amplify lifestyle and environment influences however that on their own environmental and lifestyle factors account for the largest part of health disparities found in minority populations (Beydoun & Wang, 2009).

Fruit and Vegetables

Carrera and colleagues (2007) demonstrated that low fruit and vegetable consumption results in less healthy, unbalanced diets. The World Health Organization (WHO) categorizes fruit and vegetables as single food items without specifying recommended quantities of either. A WHO report states that fruit and vegetables, excluding potatoes, eaten in variety for a total daily contribution of ≥ 400 g per day provides enough micro-nutrients for healthy living (WHO Tech. Rpt. Series, # 895, chapter 4).

Studies find that too few Americans eat the recommended daily quantity of fruit and vegetables (Casagrande, Wang, Anderson, & Gary, 2007; Li et al., 2000; Serdula et al.,

2004). Comparison of NHANES 1988-1994 and 1999-2002 data show 62% of Americans did not eat whole fruits on a daily basis and 75% did not drink fruit juices; in fact, only 16.8% to 17.5% of one sample analyzed met the daily minimums for either (Casagrande, Wang, Anderson & Gary, 2007). Additionally, the same diet analysis found that one-quarter of the sample ate no servings of vegetables on a daily basis (Casagrande, Wang Anderson, & Gary 2007).

Native Hispanic and Other Diet Types

Corn was first domesticated during Mesoamerican times, prior to the 16th century, and continues as a staple in many native Hispanic diets (Janer, 2008; Romero-Gwynn et al., 1993). Interestingly, Aztec and Mayan cultures developed a nutrient liberating process for corn called *nixtamalization* that allowed a predominately plant based diet to be nutritionally complete (Janer, 2008).

The HA population is culturally mixed and therefore influenced by many dietary traditions (Fernández et al., 2003; Singh & Siahpush, 2002). Spanish and European settlers were highly influential to Hispanic cultures; Table 1 highlights the many food types introduced to Hispanic diets by foreign settlers (Janer, 2008; Romero-Gwynn, Gwynn, Gri-vetti, McDonald, Stanford, Turner, et al., 1993). Additionally, regional native Hispanic diets reflect food resources dictated by topography and climate. Janer (2008) describes differences among native Hispanic diets as varying by country of origin and food sources available. Whatever the regional origin, each native Hispanic diet provides the nutritional requirements of healthy living (Gregory-Mercado et al., 2007; Romero-Gwynn et al., 1993).

The literature shows many styles of native Hispanic diet, but there are some commo-

nalities among them: cheeses, soups, legume dishes, and generally tomato-based sauces. Janer (2008) describes this as a result of “centuries of fusion” from intermixing cultures. Table 2 provides an incomplete list of foods typically found in native Mexican, Puerto Rican, and Cuban diets.

Table 1. Historic Influences and Transition of Hispanic Diet[†]

Prehistoric Diet (Up to the 16 th century)	Spanish Influences (16 th to the 19 th century)	European Influences (18 th century and later)
Corn	<i>Addition of:</i>	<i>Addition of:</i>
Chili	Milk	Rice
Chocolate	Cheese	Pastas
Beans, squash	Lentils and chickpeas	Oil
Variety of vegetables (tomatoes, avocados, squash, greens, etc.)	Banana and citrus fruits	Sugar
Fruits	Pork & Beef	
Wild game	Wheat	
	Bread making	

[†]Compilation of the research of Janer, 2008 and of Romero-Gwynn, Gwyn, Grivetti, McDonald, Stanford, Turner, et al., 1993

Table 2. Typical Foods of Mexican, Cuban, and Puerto Rican Native Diets[†]

Mexican Native Diet	Cuban Native Diet	Puerto Rican Native Diet
- Tortillas (corn and flour)	- Rice and Pasta	- Rice and Pasta
- Legumes: Pinto, Red, & Black Beans, Lentils, Chickpeas	- Legumes: mainly Black Beans	- Legumes: mainly Red Beans
- Dairy (predominately cheese and milk-based drinks)	- Dairy (cheese and milk)	- Dairy: Whole Milk, Butter, Cream Cheese
- Chiles, Tomatoes, Avocadoes, Eggplant, Squash, Greens	- Squash, Beans, Sweet Potatoes, Tomatoes, Chiles, Vianda (starchy tubers)	- Squash, Beans, Sweet Potatoes, Tomatoes, Chiles, Vianda (starchy tubers)
- Chocolate	- Bananas, Plantains, Papaya, Pineapple	- Cilantro
- Fruits: Citrus, Bananas, Jicama	- Yucca (cassava)	- Plantains, Yucca (cassava)
- Papaya, Prickly Pear, and Tomatillos	- Dried Salt Cod, Fish and Shellfish, Beef, Poultry, Pork and Goat	- Fried, Stewed, and Canned Fish, Poultry, Beef, Pork and Sausages
- Beef, Eggs, Poultry, Pork		

[†]Compilation of the research of Janer, 2008; Romero-Gwynn, Gwynn, Grivetti, McDonald, Stanford, Turner, et al., 1993; and Romero-Gwynn & Gwynn 1994.

It is difficult to encapsulate a diverse population into a general category and even more difficult to singularly classify their diet. For instance, Mexican descendents show a preference for beef over fish, while the opposite is true for Puerto Ricans, yet either group might consume quantities of both seafood and beef. While some native Hispanic diets feature more white sauces than tomato-based sauces, there undoubtedly will be crossover and food diversity among diets (Janer, 2008; Murtaugh, 2007). Table 3 provides consumption frequencies as a non-inclusive illustration of fruit and vegetable dietary patterns of Hispanic Nevadans a whole.

Table 3. Comparison of Fruit and Vegetable Consumption Patterns by Year for Hispanic Adults in Nevada[†]

	Hispanic Adults (\geq 18 Year)			
	Less than 5 servings/day		5 or more servings/day	
	<i>n</i>	(%) C.I.	<i>n</i>	(%) C.I.
1996	130	(79.6) 70.5 – 88.7	31	(20.4) 11.3 – 29.5
1998	1528	(77.9) 75.1 – 80.7	452	(22.1) 19.3 – 24.9
2000	1669	(78.7) 76.1 – 81.3	433	(21.3) 18.7 – 23.9
2002	2469	(77.7) 75.5 – 79.9	685	(22.3) 20.1 – 24.5
2003	2339	(79.6) 77.5 – 81.7	633	(20.4) 18.3 – 22.5
2005	2433	(77.5) 75.2 – 79.8	684	(22.5) 20.2 – 24.8
2007	3091	(78.1) 76.1 – 80.1	936	(21.9) 19.9 – 23.9

[†]Data derived from BRFSS interactive website. BRFSS is a stratified and weighted probability telephone survey conducted by the Centers for Disease Control and Prevention. Website: <http://apps.nccd.cdc.gov/brfss/>

Native patterns of food consumption change as people migrate to the U.S. and adapt to new food sources or try new food preparation techniques. In the literature, the typical

American's diet is referred to as a "Western" diet that includes red meats, nutrient-depleted grains, high-fat dairy products and more frequent dining in restaurants and fast food establishments, or the simple stated, eating more foods high in fat, salt and calories (Murtaugh et al., 2007). The "Prudent" diet is typified by low-fat dairy, whole wheat, fruits, vegetables, legumes, broths and nuts (Murtaugh et al., 2007). The "prudent" diet most closely resembles that of the native Hispanic diet as both are plentiful in fruit and vegetables (Murtaugh et al., 2007).

Murtaugh et al. (2007) found that "Western" and "dieter" patterns of eating increased the risk of being overweight and obese, unrelated to ethnicity. The prudent and native Hispanic diets in contrast demonstrated 50% less obesity in EA and HA (Murtaugh et al., 2007; Newbury, Muller, & Hallfrisch, 2003).

Trends in Hispanic American Diets

HA women participating in the Arizona WISEWOMAN study were observed as eating higher caloric diets and having twice the risk of overweightness compared to EA, regardless of their diet of choice: Western, Prudent, Native Hispanic, Mediterranean, (Murtaugh et al., 2007). Murtaugh et al. noted that when a higher percent of energy intake (caloric dietary contribution) came from vegetables, overweightedness minimally decreased. The native Hispanic diet is traditionally high in both fruit and vegetables, and associated to lower rates of overweightness and obesity within Hispanic populations (page 1319, Murtaugh et al., 2007).

Research notes high fruit and vegetable consumption among HA women than HA men and HA sub-populations show even more differentiation. Only 10.7% of MA; 11.7% of Puerto Rican American (PR), and 12.1% of Cuban American (CA) consumed one or

more fruits a day (Fanelli, Kuczmarski, & Najjar, 1995). The research showed that only 0.9% of MA and PR and 1.3% of CA ate one or more vegetables per day (Fanelli, Kuczmarski & Najjar, 1995). Such consumption patterns suggest a lack in the diets of HA living in the U.S. for meeting WHO recommendations for ≥ 400 g of fruit and/or vegetable daily (WHO, tech report).

Acculturation

Acculturation is a significant predictor of diet trends (Neuhouser, Thompson, Coronado & Solomon, 2004). Those born outside the U.S. consume more fruits, vegetables and legumes than people born or living in the U.S. (Dixon, Sundquist & Winkleby, 2000). Multiple studies suggest that highly acculturated HA eat fewer fruit and vegetables than those less acculturated (Bermúdez, Falcón & Tucker, 2000; Monroe et al., 2003; Murtaugh et al., 2007; Neuhouser, Thompson, Coronado & Solomon, 2004; Otero-Sabogal, Sabogal, Pérez-Stable & Hiatt, 1995).

Related to acculturation, Romero-Gwynn et al. (1993) noted a transition away from native food preparation methods to that of Americanized techniques that had a negative impact on nutritional and caloric content of the diet. Romero-Gwynn and colleagues (1993) found a 30% increase in the consumption of typical American food after migration to the U.S. Further, Americanized food preparation methods are thought to be highly influenced by advertising, limited food availability, restrictions placed on food selection by assistance programs, and by the desire to fit in to American culture (Romero-Gwynn et al., 1993). The most dramatic shift in MA fruit consumption (decrease of 10-14%) was noted to happen between the first and second generation of living in the U.S. (MA men and women caloric adjusted mean intake, -12% and -14%, respectively), (Monroe et al.,

2003). Most interestingly, consumption patterns established in the second generation of MA populations living in the U.S. remain fairly stable in subsequent generations (Monroe et al., 2003).

Research suggests that less acculturated MAs consume more fruit and vegetables than more acculturated groups (Gregory-Mercado et al., 2007). Monroe et al. (2003) found a 7% to 43% decrease in MA consumption of peaches, apricots, mangos, papayas, tangerines, pears, avocados, bananas and oranges associated to increased acculturation. Additionally, second generation MA consumed more apples, apple-sauce, and orange, grapefruit and other juices that may be associated to price and market availability of fresh produce (Monroe et al., 2003).

Primary language spoken in the home is a common measure of acculturation (Bersamin, Hanni & Winkley, 2008; Carrera, Gao & Tucker, 2007; Dixon, Sundquist & Winkleby, 2000; Winkleby, Albright, Howard-Pitney, Lin & Fortmann, 1994). Research shows that as people transition from being foreign-born and native speaking, to American migrants but still native speaking, and finally to American residents primarily speaking English, the consumption of fruit and vegetables decline at each stage (Dixon, Sundquist & Winkleby, 2000).

Researchers describe a phenomenon known as the “Hispanic Paradox,” low morbidity and mortality co-existing with indicators for poor health outcomes such as high BMI (Abraido-Lanza, Chao, & Flórez, 2005; Harvard Health Letter, 2003). Typically, new migrants are among the least advantaged in society and consequentially suffer poor health outcomes. Some suggest that stress of migration or institutionally imbedded and overtly experienced discrimination in a host country manifests as poor health outcomes. Howev-

er, Hispanic populations, who should demonstrate similarly described poor health outcomes, seem to have a protective factor that supports their health (Abraido-Lanza, Chao, & Flórez, 2005; Harvard Health Letter, 2003).

Several theories on the Hispanic Paradox suggest that adherence to a culturally based diet provides the protective factor that bolsters health (Abraido-Lanza, Chao, & Flórez, 2005; Casagrande, Wang, Anderson & Gary, 2007; Harvard Health Letter, 2003). Other theories on the Hispanic Paradox that explain the phenomenon are beyond the purview of this report. The importance of the noted health protection observed is that it wanes with acculturation and the adoption of an American lifestyle (Casagrande, Wang, Anderson, & Gary, 2007; Harvard Health Letter, 2003).

Literature Reviewed and Data Sources

National Health and Nutrition Examination Survey (NHANES) and Hispanic Health and Nutrition Examination Survey (HHANES) are two major sources of ethnicity data for this report. The CDC's National Center for Health Statistics combines personal interviews with physical examination, an extensive survey approach, to collect annual NHANES data. In HHANES, the same technique is used to gather information from 5,000 participants who will more accurately represent HA. HHANES is probability sample of Puerto Rican, Mexican, and Cuban descendants ≥ 20 years of age living in the U.S. Additionally, there are nationally and regionally funded opportunities that provide for state-level collection of minority demographic and disease information. A list of the studies reviewed for this project is provided in Appendix A.

CHAPTER 3

QUESTIONS, OBJECTIVES, AND HYPOTHESES

Research Questions

- What is the relationship of fruit and vegetable intake to body mass index in a sample Hispanic population from the Las Vegas, Nevada?
- What is the association of acculturation to fruit and vegetable consumption in a sample Hispanic population in Las Vegas, Nevada?

Objectives

- The study will explore associations between body mass index and fruit and vegetable consumption through analyses of survey data from a sample Hispanic population in Las Vegas, Nevada.
- The study will examine acculturation and fruit and vegetable intake in a sample of Hispanic residents of Las Vegas, Nevada.

Hypotheses

Hypothesis 1: Fruit and Vegetable Intake

Fruit and vegetable consumption is inversely associated with BMI values in Hispanics residing in the Las Vegas area.

Hypothesis 2: Acculturation

Fruit and vegetable consumption is negatively associated with acculturation in the Las Vegas Hispanic community.

CHAPTER 4

METHODOLOGY AND DATA COLLECTION

Data Collection

The Cannon Survey Center at the University of Nevada, Las Vegas conducted a telephone survey on behalf of the Southern Nevada Health District and the University of Nevada, Las Vegas School of Community Health Sciences. The center administered the survey from mid-April to mid-June 2007 using a random digit dialing method. Trained survey interviewers called telephone numbers in ZIP code areas that were pre-identified in the most recent U.S. Census as high density Hispanic residential. Calls were placed on weekdays between 10:00AM and 7:00PM with a maximum of three attempts per residence. Only one questionnaire was completed for each telephone number or residence. Respondents were given the option to complete the survey in either English or Spanish.

At the initial contact with the household, interviewers explained the purpose of the call and asked to speak to a resident of the household 18 years of age or older. Potential respondents were invited to participate in a survey related to health behaviors and health status. Interviewers explained that information would be shared anonymously and collectively. Further, respondents were told they would not directly benefit from the interaction but collective responses from hundreds of Hispanic Clark County residents would be useful to address Hispanic public health issues in the Las Vegas area. Additionally, respondents were told their participation was completely voluntary and they could refuse to answer any question or end the interview at anytime. A verbal agreement to participate in lieu of a signed waiver of consent was pre-approved by the University of Nevada, Las Vegas Institutional Review Board. Subjects were asked to self identify ethnicity by ans-

wering the question, “Do you consider yourself Hispanic?” Only those identifying as Hispanic participated in the survey and their responses included in the data set.

Of many items collected, only seven responses were considered for in depth analyses in this study: 1) age; 2) gender; 3) education; 4) BMI; 5) daily consumption of fruit and vegetables; and 6) acculturation. A diagrammatical summary of the questionnaire and survey process is provided in Figure 1. Additionally, a list of survey questions used for this study are provided in Appendix B.

Data Definitions and Variables

Spanish Speaking/Acculturation – In this study, completion of the survey in English categorized the respondent as high acculturation while completion of it in Spanish was classified as low acculturation. In the literature, acculturation is commonly defined by choice of language or the primary language spoken in the home (Bersamin, Hanni & Winkley, 2008; Carrera, Gao & Tucker, 2007; Dixon, Sundquist & Winkleby, 2000; Winkleby, Albright, Howard-Pitney, Lin & Fortmann, 1994). Additional measures such as country of birth and length of residence in a host country are proxy measures of acculturation used in conjunction to language preference (Abraido-Lanza, Chao, & Floréz, 2005; Cantero, Richardson, Baezconde-Garanati, & Marks, 1999; Crespo et al., 2001; Himmelgreen et al., 2004; Singh & Siahpush, 2002). Other measures include generation, age of migration, and education levels (Cabassa, 2003; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005; Negy & Woods, 1992). Combined measures of acculturation are beyond the scope of this investigation.

Lara and colleagues (2005) discuss the advantage and disadvantage of relying on language as the sole measure of acculturation. Advocates of single language constructs cite

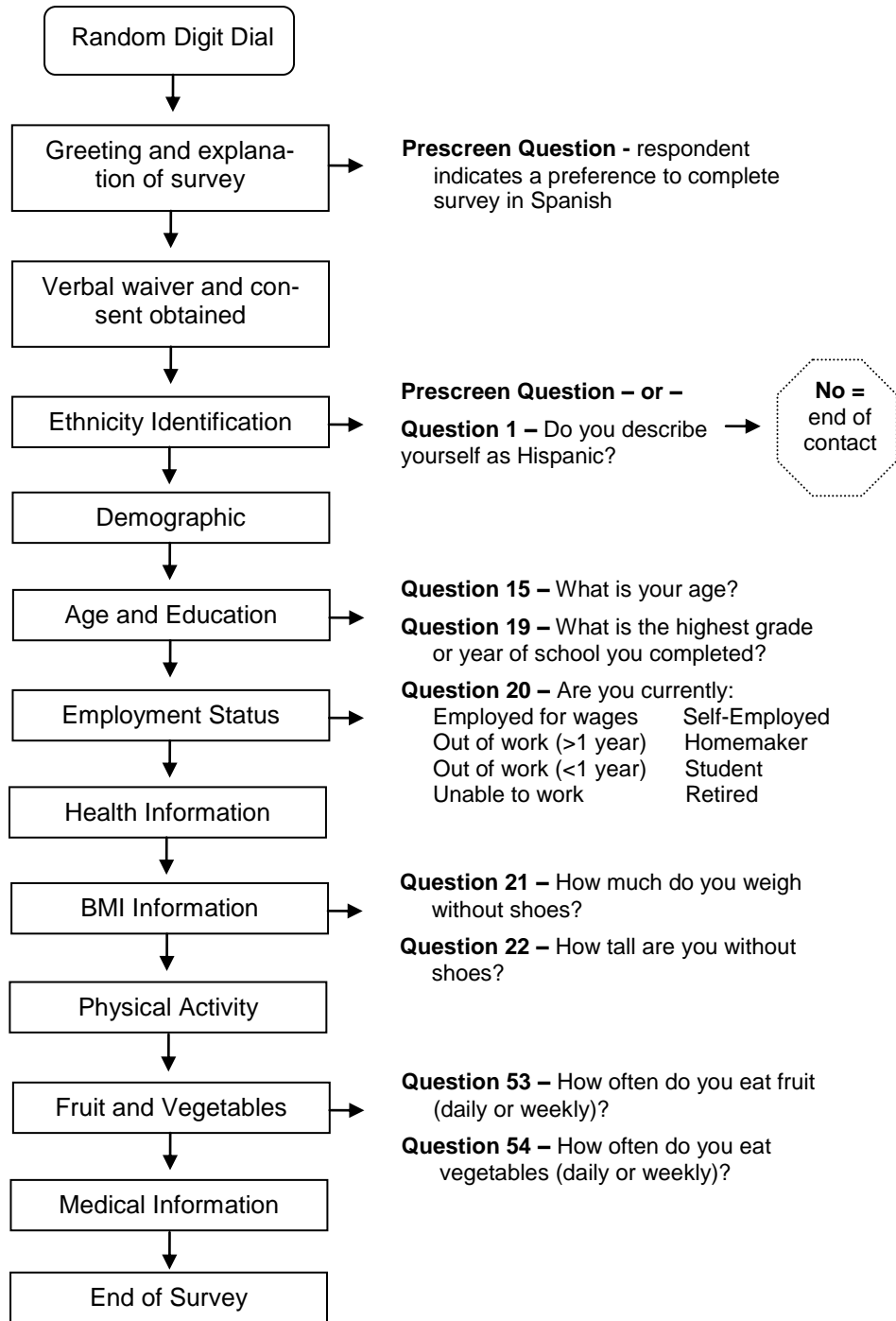


Figure 1: Flow diagram of survey information

psychometrically based studies that show language preference as the defining factor of variations between acculturation scales and it is a readily available measure; opponents

suggest that communication constructs do not adequately encapsulate acculturation and are overused (Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005; Marin, 1992).

There is no standardized measure of acculturation identified in the literature. For this research, acculturation was coded as 2 for low acculturation (completed the survey in English) and 1 for high acculturation (completed the survey in Spanish) using Predictive Analytic SoftWare (PASW, 17.0; Chicago, Illinois).

BMI – BMI is frequently used to estimate population adiposity and has practical application in epidemiological research. BMI was calculated as kilogram/meters².

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height}^2 \text{ (m)}}$$

For this study, BMI was calculated using the *compute variable* function of the student version of PASW 17.0. Additionally, BMI was transformed into several variables for different reporting purposes. BMI in the continuous form provided a mean, median and mode and in the dichotomous form (normal weight = 0, overweight = 1) for logistic regression. BMI was converted into ranges (BMI_range) defined by WHO: underweight (BMI ≤ 18.5), normal weight (BMI >18.5 and <25), overweight (BMI ≥ 25 and <30); obese (BMI >30 and <40), and extreme obesity (BMI >40) for descriptive purposes.

Fruit & Vegetable – Fruit and vegetable raw scores were manipulated to generate different variables contingent on the comparison. Two continuous variables were combined to create Daily Fruit and Vegetable (DFV), the arithmetic sum of Daily Fruit and of Daily Vegetables, for frequency analysis. DFV was converted into a dichotomous variable to accommodate binary logistic regression. The dichotomy categories were adequate (≥ 5 servings) or inadequate consumption (<5 servings) based on the WHO recommendation that adults consume ≥400 g of DFV and on the Centers for Disease Control suggestion

that ≥ 400 g is equivalent to 5 servings. Ultimately, a binary form of the variable was coded as 1 for inadequate consumption and 2 for adequate consumption. A range variable was created through the visual binning function of PASW 17.0 to summarize categorical patterns for description purposes: 0 to 4 DFV = low fruit and vegetable consumption; 4 to 6 DFV = moderate fruit and vegetable consumption; and 6 to 10 DFV = high fruit and vegetable consumption; and > 10 DFV = extremely high fruit and vegetable consumption.

Age – Age is a covariate of adiposity that has been extensively identified by the literature. Research finds that obesity has a naturally occurring relationship to age (Ogden et al., 2006), and supporting data show that increasing BMI appears to plateau around the age of 49 (Bowie, Juon, Cho, & Rodriguez, 2007). Age appears to also confound errors related to self-reported height and weight as well (Palta, Prineas, Berman & Hannan, 1982). Age was included in the study to control for its affects. The continuous variable (Age) was manipulated and evaluated for descriptive statistics in age ranges and utilized in a continuous form for logistic analyses.

Gender – Gender differences in Hispanic populations have been noted in BMI research (Palta, Prineas, Berman & Hannan, 1982; Rowland, 1990) and associated to errors in self-reported weight and height values used to calculate BMI. Subsequently, the influence of gender was included in recession analyses to control for possible affects.

Education – Education has been associated to dietary intake and weight related issues. Education in the dataset included several pre-determined descriptive categories: 1) pre-school only; 2) elementary (1st to 8th grade); 3) some high school (9th to 11th grade); 4) high school graduate or GED; 5) some college or technical school; and 6) college gradu-

ate or higher degree. The dichotomous variable reduced the number of cells with low frequencies in some categories. An unusually high number of respondents identified as having an 8th grade education or less. This prompted the split of the variables dichotomy at the 8th grade mark. For regression analysis, the variable was dichotomized into 1 for $\leq 8^{\text{th}}$ grade and 2 for high school attendance or higher.

Statistical Methods

The dataset was examined for normality through the descriptive statistics ‘explore’ option, excluding cases pairwise, and through regression diagnostics in PASW 17.0. The standardized residuals highlighted that at least one observation was 4.56 SD greater than the residuals mean (Appendix C). In depth inspection of the data found an observation of BMI with a value of 52.84. Additionally, the BMI boxplot revealed 13 outlying data observations including the data point >4 SD (Appendix D). The remaining data points in the residuals examination did not exceed the 10% threshold for outliers (dataset outliers = 3%). Indicators of influence, DfBetas and Leverage (.02 ($K+1/n$) or 0.0004228), revealed no influential data points of interest in BMI. However, there were four data points with variance/covariance issues (CVR_i $1 \pm [3(k+1)/n]$ or 0.9365–1.0634) related to DFV that are addressed in a later section. One extreme outlier (ID 1443, BMI = 52.84) was removed from the dataset and the revised database utilized for subsequent analyses.

BMI had a problem with kurtosis that was corrected by square root transformation (BMI_{kurtosis} 2.768, sqrtBMI_{kurtosis} 1.613), (Appendix D). The transformed variable was manipulated to create alternate forms needed for logistic regression and descriptive statistics: sqrtBMI_binary (1 = normal weight, 2 = overweight), and sqrtBMI_range (0 = normal weight, 1 = overweight, 2 = obese, BMI >30).

The Age variable was also evaluated for normality. Initial screening showed the mean was larger than the median and the median larger than the mode ($\mu = 38.30$, $SD = 15.02$; $mdn = 35$; and $mode = 32$), presenting a positive skew to the data. A square root transformation of Age (sqrtAge) reduced the number of visible outliers on the boxplot from eight to just one (Appendix E). The transformed age variable (sqrtAge) brought observations on the observed vs. expected plot closer to the best fit line and mildly reduced the positive skew on a histogram of the data (Appendix E). The transformation had no impact on kurtosis, which was a non-issue and remained 0.270 before and after transformation. The variable sqrtAge was used for subsequent analyses.

There were four observations with a Mahalanbis distance $> |25|$. A visual inspection of the data points across variable categories showing high values for DFV; the values ranged from 20 to 24 daily servings and were high in comparison to the residual mean ($\mu = 4.6$, $SD = 3.2$). The codebook/questionnaire did not include a question about vegetarianism. No data entry error was apparent and the possibility of vegetarianism seemed a plausible, however, the four observations were associated to variance/covariance values outside of the tolerance range (lower tail $CVR_i = 0.9365$, upper tail $CVR_i = 1.0634$). The observations of concern were removed from the dataset (ID 1990, 7145, 5346, & 5753).

The DFV variable presented with a high number of missing cases that could be problematic for logistic regression as it removes cases listwise from the calculation. To avoid a reduction in power due from too few observations, missing cases were substituted using the 'linear trend at point' method in the 'replace missing values' option in PASW 17.0. This replaced missing values by regressing existing patterns to find a predicted value. Additionally, the DFV variable was square root transformed to handle a problem with

kurtosis ($DFV_{1_{kurtosis}} = 4.835$; $\sqrt{DFV_{1_{kurtosis}}} = 2.471$). The $\sqrt{DFV_{1_{kurtosis}}}$ variable was coded as binary ($\sqrt{DFV_{1_{binary}}}$) for logistic regression with 1 representing inadequate consumption (<5 servings) and 2 representing adequate consumption (≥ 5 servings). Additionally, $\sqrt{DFV_{1_{kurtosis}}}$ was coded into ranges as previously described to characterize the sample population for descriptive statistics.

After data adjustments, Kolmogorov-Smirnov and Shapiro-Wilks testing demonstrated that all variables produced p-values <0.05, signaling a violation of normality in the dataset. Therefore, logistic regression was employed to model the relationship between Z , an unknown, and the probability of an outcome given the predictor variables:

$$Z_i = \log \left(\frac{\pi_i}{1 - \pi_i} \right)$$

Logistic modeling assumes that Z has a linear association to predictor variables and that predictors are related to the probability of the outcome when substituting Z . Computations for logistic regression use an iterative maximum likelihood method to estimate regression coefficients. Logistic regression uses maximum likelihood to estimate log likelihood, the odds of the observed values of the dependent predicted by the observed values of the independent variables, for an event.

$$Z_i = \frac{1}{1 + e^{-(b_0 + b_1 x_{i1} + b_2 x_{i2} + \dots + b_p x_{ip})}}$$

Maximum likelihood is preferred when assumptions of normality cannot be met in the distribution of the error term or in the dependent variable (Garson, 2010). Binary logistic regression assumes quantitative variables coded for contrast (0 or 1) and proper specification (Garson, 2010). For this research, logistic regression examined BMI, DFV, gender, education, and age (model 1) and DFV, acculturation, gender, education, and age (model 2) and employed a direct method with all variables entered simultaneously.

CHAPTER 5
STUDY RESULTS

Demographic Statistics

A survey of Hispanic adults ($n = 326$) living in the Las Vegas metropolitan area provided a sample with more female respondents than male (female $n = 173$, 53.1%; male $n = 153$, 46.9%), (Table 4). Compared to U.S. Census estimates for the same year, the nation had the inverse proportion of Hispanic women to men (female = 48.3%, male = 51.7%), (US Census, 2009). The majority in this sample were 25 to 45 years of age ($n = 172$, 52.8%) and age distribution had a consistent pattern across genders.

An unusual pattern was noted for acculturation. The overwhelming majority of men and women in the sample were classified as high acculturation (high acculturation males $n = 115$, 75.2%; high acculturation women $n = 131$, 75.7%). Acculturation for this study was defined by the completion of the survey in Spanish. In comparison, a small proportion of the respondents preferred Spanish when completing the survey (low acculturation males $n = 38$, 24.8%; low acculturation women $n = 42$, 24.3%). Census data for 2007 show 27.4% of Nevadans over the age of 5 spoke a language other than English in the home (US Census; September 30, 2008). Nationally in 2007 Spanish was the most frequently spoken language in the home ($n = 34,547,000$; 12.3% of persons 5 years or older), (US Census; September 29, 2008).

Other differences were apparent by gender. A gap in employment showed that 35.6% more men than women were employed outside of the home (male working $n = 96$, 62.2% [S.E. 0.096]; female working $n = 46$, 26.6% [S.E. 0.099]). An additional 7.2% of the men and 4.6% of the women identified as retired, suggesting past employment and possible

Table 4. Demographic Characteristics of the Sample Las Vegas Hispanic Population

	Male N (%)	Female N (%)	Total N (%)
Gender	153 (46.9)	173 (53.1)	326 (100)
Age			
18 to 25 years	31 (20.3)	41 (24.3)	72 (21.1)
25 to 45 years	81 (52.9)	91 (53.8)	172 (52.8)
45 to 65 years	30 (19.6)	26 (15.4)	56 (17.2)
> 65 years	11 (7.2)	11 (6.3)	22 (6.7)
missing	0 (0.0)	0 (0.0)	4 (1.2)
BMI			
Normal Weight	49 (32.0)	52 (30.1)	101 (33.7)
Overweight	65 (42.5)	75 (43.4)	140 (41.7)
Obese	38 (24.8)	41 (23.7)	79 (23.3)
missing	1 (0.7)	5 (2.8)	6 (1.8)
Fruit & Vegetables			
Less than 5 a day	94 (54.3)	102 (66.7)	196 (60.1)
>5 servings a day	79 (45.7)	51 (33.3)	130 (39.0)
Acculturation			
Low	115 (75.2)	131 (75.7)	246 (75.5)
High	38 (24.8)	42 (24.3)	80 (24.5)
Employment Status			
Employed – Wages	93 (60.2)	41 (23.7)	134 (41.1)
Self-employed	3 (2.0)	5 (2.9)	8 (2.5)
Out-of-work > 1 yr	7 (4.7)	4 (2.3)	11 (3.4)
Out-of-work < 1 yr	11 (7.2)	6 (3.5)	17 (5.2)
Homemaker	16 (10.6)	97 (56.0)	113 (34.6)
Student	4 (2.7)	5 (2.9)	9 (2.8)
Retired	11 (7.2)	8 (4.6)	19 (5.8)
Unable to Work	6 (4.0)	2 (1.2)	8 (2.5)
Refused to answer	2 (1.4)	2 (1.2)	4 (1.2)
missing	–	3 (1.7)	3 (0.9)
Education			
None/Kindergarten	6 (3.9)	5 (2.9)	11 (3.4)
Elementary (1 - 8)	53 (34.7)	60 (34.7)	113 (34.7)
Some H.S. (9 - 11)	40 (26.1)	35 (20.2)	75 (23.0)
H.S. Grad/GED	34 (22.2)	48 (27.8)	82 (25.2)
Some College	12 (7.8)	11 (6.4)	23 (7.1)
≥ College Grad	8 (5.3)	11 (6.4)	19 (5.8)
missing	–	3 (1.6)	3 (0.9)
Marital Status			
Married	70 (45.8)	93 (53.8)	163 (50.0)
Divorced	13 (8.5)	8 (4.6)	21 (6.4)
Widowed	4 (2.6)	10 (5.8)	14 (4.3)
Separated	9 (5.9)	12 (6.9)	21 (6.4)
Never Married	40 (26.1)	25 (14.5)	65 (19.9)
In a Partnership	17 (11.1)	22 (12.7)	39 (12.0)
missing	–	3 (1.7)	3 (0.9)

Statistics calculated in PASW 17.0

retirement income. Retirement was not included as part of the employment variable.

The majority of men and women identified as married (married men $n= 70$, 45.8%; married women $n= 93$, 53.8%) or as part of an unmarried couple (male $n= 17$, 11.1%; women $n= 22$, 12.7%).

A notable disparity was evident for educational attainment. Surprisingly, 38.1% of the sample reported an 8th grade or less education (male $n = 59$ or 38.6%; female $n = 65$ or 37.6%). For the year 2006, U.S. estimates show that only 5.7% of the American adult population had $\leq 8^{\text{th}}$ grade education. High school graduation rates were low for the sample population in comparison to national estimates (sample 25.2% vs. U.S. 31.6%). This trend was mirrored for some college attendance (sample 7.1% vs. U.S. 8.3%) and for college graduation (sample 5.8% vs. U.S. 17.0%), (U.S. Census 2007).

An inspection of the mean distribution of age, BMI and DFV highlighted that men in the sample were slightly older than women, that both groups had a tendency for overweightness, and on average, neither group met the daily recommendation for fruit and vegetable consumption (Table 5).

Table 5. Mean Distribution of Age, BMI and Daily Fruit and Vegetables for a Sample Hispanic Las Vegas, NV Population

		Mean \pm S.D.	Min-Max	Median	Mode
Age	Male	39.29 \pm 15.1	18 – 82	37	40
	Female	37.41 \pm 15.1	18 – 80	33	25*
BMI	Male	27.41 \pm 5.3	17.2 – 47.1	26.64	24.26
	Female	27.10 \pm 5.5	15.3 – 47.7	26.51	27.49*
Daily Fruit & Vegetables	Male	4.13 \pm 2.3	0.00 – 14.0	4.0	4.0
	Female	4.36 \pm 2.5	0.00 – 14.0	4.0	4.0

* Multiple modes detected – smaller reported (female: age mode = 11 observations each for 25 and 32; BMI mode = 6 observation each 27.49 and 29.36)

Statistics calculated in PASW 17.0

Relationship of BMI to DFV – Model 1

A binary logistic regression of survey data for the sample of Hispanics living in the Las Vegas metropolitan area examined 318 observations (missing = 8) to determine the relationship between BMI and DFV. A direct method of regression included all variables in the model (sqrtBMI_binary, sqrtDFV_1binary, sqrtAge, education, and gender) and converged after 4 iterations of the data. The Omnibus goodness of fit test showed significance, indicating an appropriateness for all variables included in the model ($\chi^2 = 12.254$, 4 d.f., p -value 0.016). The Hosmer and Lemeshow test provided conflicting results, signaling an inappropriateness of variables in the model ($\chi^2 = 15.947$, 8 d.f., p -value 0.043).

Cox-Snell and Nagelkerke tests provided a pseudo R^2 for percent of variance explained by the model that give cause for concern. Cox-Snell and Nagelkerke tests suggest the model of predictors merely add 3.8 -5.3% more prediction of weightedness in the sample (Appendix F). On the model classification table of the full model showed 100.0% of overweightedness and 1% of normal weightedness were correctly classified. A comparison of the full model to the constant only model showed 0.3% more overweightedness correctly classified ($\text{model}_{\text{constant}} = 68.6\%$, $\text{model}_{\text{full}} = 68.9\%$). This is very poor model performance.

The Wald statistic, the test of a null hypothesis that the logit coefficient is equal to zero, found that sqrtAge was the only variable to significantly contribute BMI classification in this sample (Wald = 10.852, 1 d.f., p -value 0.001, CI = 1.166 – 1.833). The correlates of BMI and predictor variables are listed on Table 6.

The lack of salient results by logistic regression and poor model performance suggest the statistical approach may be ineffective for this particular dataset. Concerning the null

hypothesis that BMI is not associated to DFV, the data indicate a failure to reject the null. Therefore, in this dataset, BMI is not associated to DFV consumption. The weakness of the approach merits follow-up evaluation.

Table 6. Correlates of BMI and Predictor Variables[†]

Variable	B	S.E.	Wald	Sig.	Exp(B)	95% C.I. Exp(B)	
						Lower	Upper
DFV	-0.141	0.255	0.305	0.581	0.869	0.528	1.431
Gender	-0.133	0.248	0.289	0.591	0.875	0.539	1.423
Age	0.380	0.115	10.852	0.001	1.462	1.166	1.833
Education	-0.008	0.259	0.001	0.976	0.992	0.597	1.648
Constant	-1.107	0.958	1.334	0.248	0.331		

[†]All variables entered in one step (full model)
 Statistics calculated in PASW 17.0

An alternate examination of variables was warranted. As such, variables were considered separately in χ^2 analyses to provide risk estimations, odd ratios, for the population represented by the data. Separate chi-square examinations of sqrtBMI_binary to sqrtDFV_binary, gender and education were completed using the crosstabs function of PASW 17.0.

Considering BMI vs. DFV, the χ^2 risk estimate table provided output that was nearly the same as from logistic regression (0.874). The estimate shows that 87.4% of normal weight respondent were classified having adequate DFV intake, yet not significantly so (Fisher's Exact $p > 0.05$). Additionally, more than an 8th grade education was 85.7% related to normal weightedness. Again, the association was not significant between education and BMI (Fisher's Exact $p > 0.05$); however the analysis suggests that gender plays a

factor as well with males 94% more likely to be classified as normal weight.

Relationship of DFV with Acculturation – Model 2

A second binary logistic regression was conducted for the sample of Hispanic adults living in the Las Vegas area (321 observations, missing = 5). This assessed the relationship between fruit and vegetable consumption and acculturation. The full model included sqrtDFV_1 binary as the dependent variable and acculturation, sqrtAge, education, and gender as covariates in the model. Convergence resulted after 4 iterations of the data.

The Omnibus test for goodness of fit found significance, indicating the appropriateness for all variables included in the model ($\chi^2 = 52.660$, 4 d.f., p -value <0.001). Additionally, the Hosmer and Lemeshow test showed non-significance, which verified the appropriateness of variables in the model ($\chi^2 = 14.408$, 8 d.f., p -value 0.072). The Hosmer and Lemeshow test further showed a linear relationship between the continuous variable (sqrtAge) and the dependent variable (sqrtDFV_1binary). The Cox-Snell and Nagelkerke pseudo R^2 tests suggest the full set of variables may account for 4.4 – 6.1% for fruit and vegetable consumption. Model 2 demonstrated 1.5% more classification of DFV in the full model versus the constant only model (model_{full} = 71.3%; model_{constant} = 60.7%), (Figure 2). The full model classification table suggested 89.2% of low DFV consumption and 43.7% of high DFV consumption was correctly classified by the full set of variables included in the model (Appendix G). The Wald statistic, the test of a null hypothesis of the logit coefficient equal to zero, found acculturation was significant (Wald = 35.485, 1 d.f., p -value <0.001, CI = 3.581–12.512) as was gender (Wald = 6.134, 1 d.f., p -value 0.013, CI = 0.323–0.877).

Concerning the null hypothesis for model 2, that is, fruit and vegetable consumption is

positively associated to acculturation in the Las Vegas Hispanic community, the data indicate to reject the null. In the sample of surveyed Hispanics living in Las Vegas area, acculturation was negatively associated to DFV. In other words, as acculturation increases DFV consumption decreases in the same population.

Model 2 performed better than Model 1 with 71.3% classification of the dependent variable sqrtDFV_1binary (Appendix H). Correlates of DFV and predictor variables are listed (Table 7). Those respondents identified as high acculturation were 6.6 (S.E. 0.319) times more likely to consume <5 servings of fruit and/or vegetables daily. Additionally, men are 0.532 (S.E. 0.259) less likely to meet the minimum daily recommended amount of fruit and vegetables than women in the sample. In the sample population, high acculturation demonstrated a relationship to inadequate DFV (<5 servings) consumption similar to trends described in the literature. The findings were not surprising given the reports of previous research.

Table 7. Correlates of DFV and Predictor Variables[†]

Variable	B	S.E.	Wald	Sig.	Exp(B)	95% C.I. Exp(B)	
						Lower	Upper
Acculturation 0=high 1=low	1.901	0.319	35.485	0.000	6.694	3.581	12.512
Gender 0= male 1= female	-0.631	0.255	6.134	0.013	0.532	0.323	0.877
Age	0.118	0.109	1.170	0.279	1.125	0.909	1.392
Education 0= ≤ 8 th 1= > 8 th	0.85	0.276	0.94	0.759	1.088	0.634	1.867
Constant	-2.743	0.914	9.015	0.003	0.064		

[†]All variables entered in one step (full model)
Statistics calculated in PASW 17.0

Age had an association to DFV, albeit it was not significantly associated. With each year increase in age, DFV unit consumption increased by 0.118 (S.E. 0.109). Not surpris-

singly, there was an association between educational attainment and DFV consumption. Those with a 9th grade or higher education were 8.8% more likely to meet the recommendation for 5 or more servings of fruit and vegetables each day.

CHAPTER 6

DISCUSSION

A secondary analysis of data collected for Hispanic Americans living in the Las Vegas metropolitan area did not show the hypothesized relationship between adequate daily fruit and vegetable consumption and normal BMI. In the study, adequate DFV (≥ 5 servings) with all covariates included in the model was non-significant for classifying BMI. However, there was a minimal association in the decrease of log odds for overweightedness (regression coefficient = 0.869, S.E. 0.255).

The overweight category in the sample was less than national estimates for Nevada Hispanic populations (sample overweight 41.7%, BRFSS Nevada Hispanic overweight 44.0%) yet the local HA sample was higher than Nevada's general population estimates (sample overweight 41.7%, BRFSS Nevada estimates 38.4%). The sample findings support research showing a high prevalence of overweightedness among Americans, particularly in Hispanic sub-populations.

Overweight/obesity rates for HA in Las Vegas were additionally much higher than the goals set for the nation in Health People 2010. The Health People 2010 goals sought for 60% of Americans to be in the normal weight category (BMI < 25) and to reduce obesity (BMI > 30) to less than 15% by the year 2010. Additionally, BMI disparities in Hispanic sub-populations may be apparent in the distribution of weightedness. BRFSS data show that Clark County Nevadans presented with 37.0% normal weight (BMI < 25), 38.4% overweight (BMI ≥ 25 to < 30), and 24.6% obese (BMI > 30) in 2007 (BRFSS), but the race specific BRFSS data showed Hispanic Nevadans had the inverse distribution with 29.0% normal weight (CI 23.1–34.9), 44.0% overweight (CI 37.3–50.7), and 27.0% ob-

ese (CI 21.5–32.5). This is in keeping with the Murtaugh et al. (2007) study showing BMI distribution in Hispanic American women was the opposite of the weight dispersion for Caucasian women.

Research shows disparately high BMI in HA women (Ogden et al. 2006, Murtaugh et al., 2007) and highlights the proclivity for overweightedness among HA women (Murtaugh et al. 2007). However, Beydoun and Wang (2009) suggest that it is Hispanic men who will experience increasing growth in general and central obesity in the years to come. The Las Vegas Hispanic sample of men presented with slightly higher rates of obesity than the women (24.8% and 23.7%, respectively) which may be a foreshadowing of Beydoun and Wang's (2009) prediction. While the relationship was not significantly expressed by the dataset, 67.7% of the men in the sample presented as overweight or obese compared to 64.8% of the women, which again is suggestive of the predictive analyses that HA men will experience higher overweightedness in the future.

The calculation of BMI using self-report data has known limitations with research showing a general tendency for men to over report height and women to under report weight. Physical activity or regular exercise could impact the calculation of BMI relative to an individual's muscle mass, and this brings to mind a concern about the survey's employment question. The greater proportion of men identified as 'working for wages' however working for wages was not defined by type of employment. The questionnaire did not illuminate job tasks as more physical or intellectual. Men working in construction trades could have greater muscle mass than an accountant, which could impact BMI calculations to a small degree.

Inherent limitations of self-report data do not negate the value of the measure. BMI

has been highly correlated to methods ascertaining more precise measures of percent body fat. BMI is a highly valued epidemiological tool. Yet, these inherent BMI limitations lead to a commonly held theory – the weights observed may actually be higher than indicated (Ellis, 2007).

There are several potential limitations with reported daily fruit and vegetables in the study. First, a review of the survey questionnaire showed that respondents were not given food definitions or guidelines on portion size to consider (Appendix B). As respondents were not provided definitions for what constitutes a fruit or vegetable or quantifications of what is an appropriate serving size, the data may be misrepresentative. Both the WHO and CDC standards state that potatoes should not be included in the count of daily fruit and vegetables. Respondents may not intuitively exclude potatoes and/or know appropriate portion sizes. Finally, survey data are subject to a recognized drawback with recall bias.

Additionally, the variable DFV presented with a high number of missing cases that were substituted using the ‘linear trend at point’ method in the replace missing values option in PASW 17.0. The process substituted missing observations with values derived by a regression of existing points to establish a predicted value. In total, 39 observations of the 326 case dataset were replaced in this manner. The operation is a study limitation since greater than 5% of the dataset’s observations were affected ($n = 39$, 11.9%). Even though, linear trend at point provides a random generation estimate, it may have inflated the outcomes. The results of the study related to DFV should be viewed conservatively.

In the literature, acculturation has been described as a significant predictor of dietary trends. The current study found that acculturation and gender significantly contributed to

the classification of DFV consumption. Highly acculturated individuals were 6 times less likely (S.E. 0.319) to meet the recommended daily intake for fruits and vegetables. The strength of the association with DFV and acculturation rests on the power of a single measure of language, completing the survey in either English or Spanish, to define the acculturation construct. The proponents of language preference as a proxy for acculturation cite that language explains most of the variance between acculturation scales, making it a highly valuable overall measure. Singularly, however, language of preference for completing the survey has drawbacks. Spanish only speaking individuals may feel threatened or uncomfortable answering personal questions over the telephone. There is potential that Spanish only speaking individuals opted out of the study creating an uneven proportion of observations. Too little variability between groups could negatively impact the generalizability of the results.

The mean distribution for DFV by gender ranged from 4.13 for men to 4.36 for women (SD 2.3 to 2.5, respectively). A high proportion of respondents reported an 8th grade education or less (women = 38.6%, men = 37.6%). The connection between education and BMI was non-significant in the regression model 1, yet the regression coefficients suggests those with 9th grade or higher education were 33% more likely to maintain adequate body weight. Targeted health programming to promote fruit and vegetable consumption and to educate on the benefits of maintaining normal weight (BMI <25) may be warranted. Health promotion may be most beneficial if targeted to lower acculturated and lesser educated members of the population.

Daily consumption of fruit and vegetables has been suggested as a protective factor in maintaining healthy body weight and for providing adequate nutrition. More research is

needed to understand the association of DFV to acculturation for Hispanic Nevadans living in the Las Vegas metropolitan area. Both men and women in the sample demonstrated low consumption of DFV. While the study did not demonstrate a significant relationship with BMI and DFV, research suggests the relationship exists. Should the association hold true in the current sample, will the trend of overweightedness continue to rise in the Las Vegas Hispanic population? Intervention strategies related specifically to diet in Hispanic populations living in the Las Vegas metropolitan area may benefit the general nutrition and increase protective factors for chronic health conditions.

The low measure of chronic health conditions within the HA populations, even though there are general indicators to suggest chronic conditions may exist, is concerning. Little is truly known about the phenomenon known as the Hispanic Paradox – only that it appears to be real. Explanations for the Hispanic Paradox run the gambit from migration at a younger age, greater healthiness at migration, a general younger age of the population in the U.S., a lack of healthcare seeking behaviors, to social support that reduces stressors with a potential negative impact on health. Regardless of the explanation, public health cannot just accept the Hispanic Paradox as a fortunate occurrence in the population. Public health may be best served by investigating the potential impact of inadequate diet and/or overweightedness as it has potential for poor health outcomes in the current or future generations of the Hispanic Americans.

It is important to know the true nature of underlying health conditions and health status to effectively advocate policy change and/or implementation strategies for any population. This may be of particular importance for a group projected to be one-quarter of the U.S. population within the next forty years.

APPENDIX A

PROJECT LITERATURE REVIEW WITH DATA SOURCES

NHANES ¹	HHANES ²	Other Research Study Sources
Beydoun & Wang, 2009	Fernandez et al., 2003	Abraido-Lanza, Chao & Florez, 2005 <i>Nat'l Health Interview Survey-Multiple Cause of Death (NHIS)</i>
Bersamin, Hanni & Winkleby, 2008	Kuczmarski, Kuczmarski & Najjar, 1995	Barcnas et al., 2007 <i>Mano a Mano – Univ. of Texas, MD Anderson</i>
Craig & Adams, 2008		Bermudez, Falcon & Tucker, 2000 <i>Massachusetts Hispanic Elders Study (MAHES)</i>
Flegal, Carroll, Ogden, & Johnson, 2006		Bowie, Joon, Cho, & Rodriguez, 2007 <i>California Health Interview Survey (Mexican & Central American)</i>
Gillium & Sempos, 2005		Ervin, 2008 <i>Healthy Eating Index tool</i>
Ogden et al., 2006		Gregory-Mercado et. al, 2007 <i>WISEWOMAN, Arizona & BRFSS</i>
Sundquist & Winkleby, 2000		Hummer et al., 2000 <i>Nat'l Health Interview Survey - Multiple Cause of Death</i>
		Li et al., 2000 <i>BRFSS</i>
		Lin, Bermudez & Tucker, 2003 <i>Massachusetts Hispanic Elders Study</i>
		Lin, Rogot, Johnson, Sorlie & Arias, 2003 - <i>Nat'l Longitudina Mortality Study</i>
		Monroe et al., 2003 <i>LA Multiethnic Cohort Study</i>
		Murtaugh et al., 2007 <i>Utah 4 Corner Breast Cancer</i>
		Neuhouser, Thompson, Coronado & Solomon, 2004 - <i>Yakima Valley WA fruit and vegetable survey</i>
		Singh & Siahpush, 2002 <i>Nat'l Longitudinal Mortality Study</i>

¹ NHANES – National Health and Nutrition Examination Survey that surveys by personal interview and through physical assessment, conducted by the CDC's National Center of Health Statistics

² HHANES – Hispanic Health and Nutrition Examination Survey of Puerto Rican, Mexican, and Cuban descendants is a probability sample to estimate underrepresented populations.

APPENDIX B

SURVEY QUESTIONS ANALYZED IN THE STUDY

VARIABLE	QUESTION NUMBER	SURVEY QUESTION
Acculturation	Introductory statements	Respondent given the option to respond to the survey in either English or Spanish.
Acculturation	Introductory statements	Do you describe yourself as Hispanic?
Age	Q15DEM	What is your age? (coded in years)
Marital Status	Q17DEM	Are you: Divorced, Widowed, Separated, Never married, Member of an unmarried couple, Refuse
Education	Q19DEM	What is the highest grade or year of school you completed? (coded as years) If asked for clarification, Interviewer read: Never attended school or only attended kindergarten Grades 1 through 8 (Elementary) Grades 9 through 11 (Some High School) Grade 12 or GRE (High School Graduate) College 1 to 3 years (Some College or Technical School) College 4 years or more (College graduate) Refuse
Employment	Q20DEM	Are you: (Interviewer read list): Employed for wages Self-Employed Out of work for more than 1 year Out of work for less than 1 year Homemaker Student Retired Unable to work Refuse
BMI	Q21DEM	About how much do you weigh without shoes?
BMI	Q22DEM	About how tall are you without shoes?
Fruit Consumption	Q53NUT	The next questions are about the foods that you usually eat. Please tell me how often you eat these foods. How often do you eat fruits?
Vegetable Consumption	Q54NUT	The next questions are about the foods that you usually eat. Please tell me how often you eat these foods. How often do you eat fruits?

APPENDIX C

INITIAL DATASET EXPLORATION: BMI, DFV, ACCULTURATION, MARITAL STATUS, EMPLOYMENT, EDUCATION AND AGE

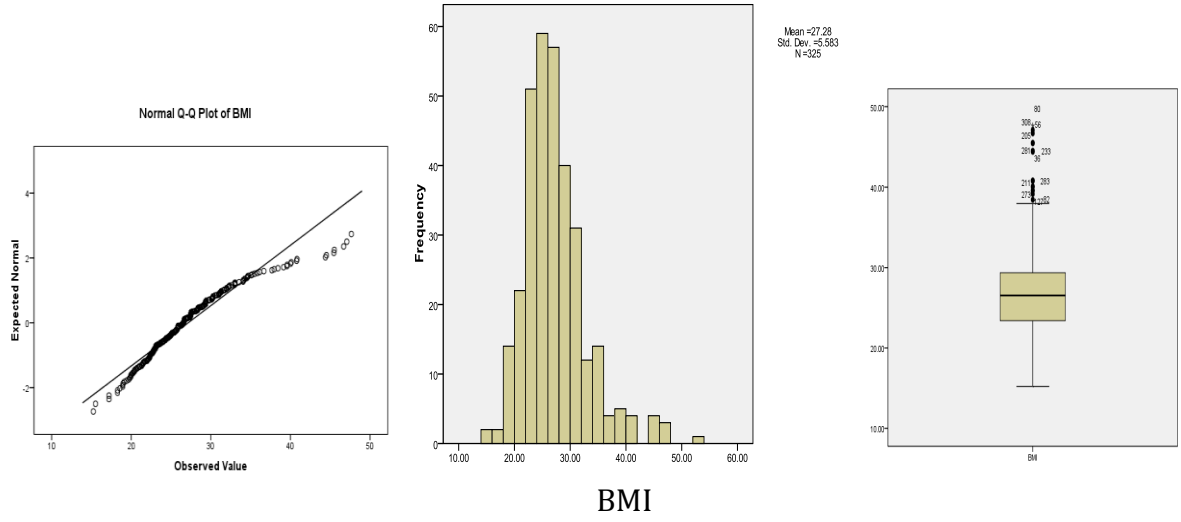
Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	24.9979	30.2113	27.2787	1.28030	326
Std. Predicted Value	-1.782	2.293	.001	1.001	326
Standard Error of Predicted Value	.411	1.279	.666	.143	326
Adjusted Predicted Value	24.9061	30.4550	27.2888	1.28599	323
Residual	-12.45586	24.93604	-.00745	5.43571	323
Std. Residual	-2.278	4.560	-.001	.994	323
Stud. Residual	-2.319	4.597	-.002	1.002	323
Deleted Residual	-12.90917	25.33521	-.01024	5.52363	323
Stud. Deleted Residual	-2.335	4.750	.000	1.010	323
Mahalanobis Distance	.819	16.616	3.992	2.383	326
Cook's Distance	.000	.068	.003	.008	323
Centered Leverage Value	.003	.052	.012	.007	326

^a Dependent Variable: BMI
 Calculated in PASW 17.0

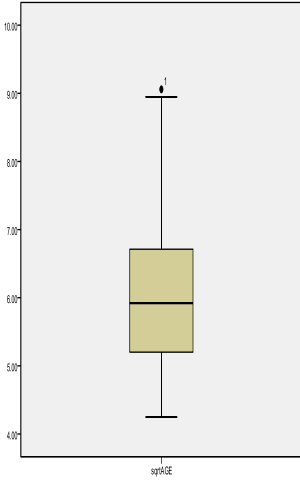
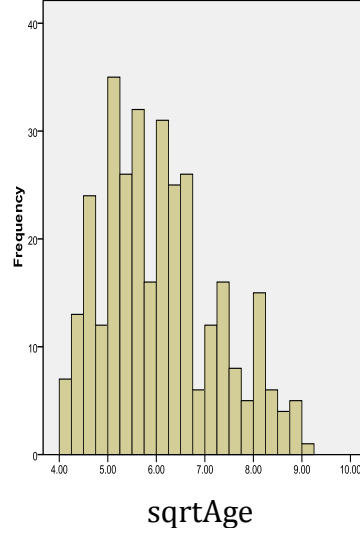
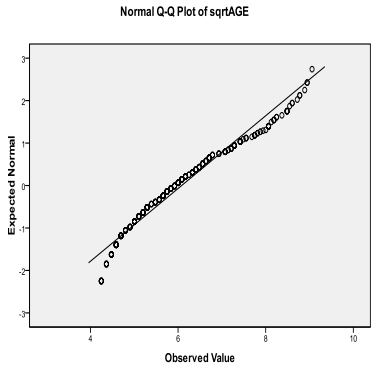
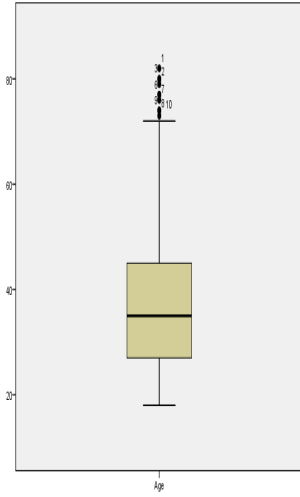
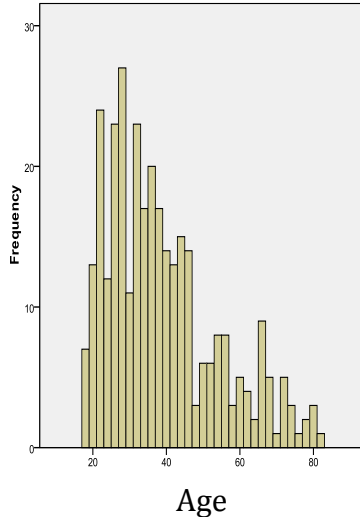
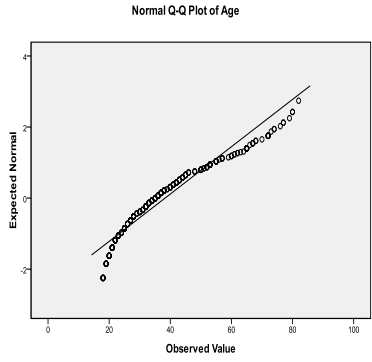
APPENDIX D

VISUAL COMPARISON OF BMI



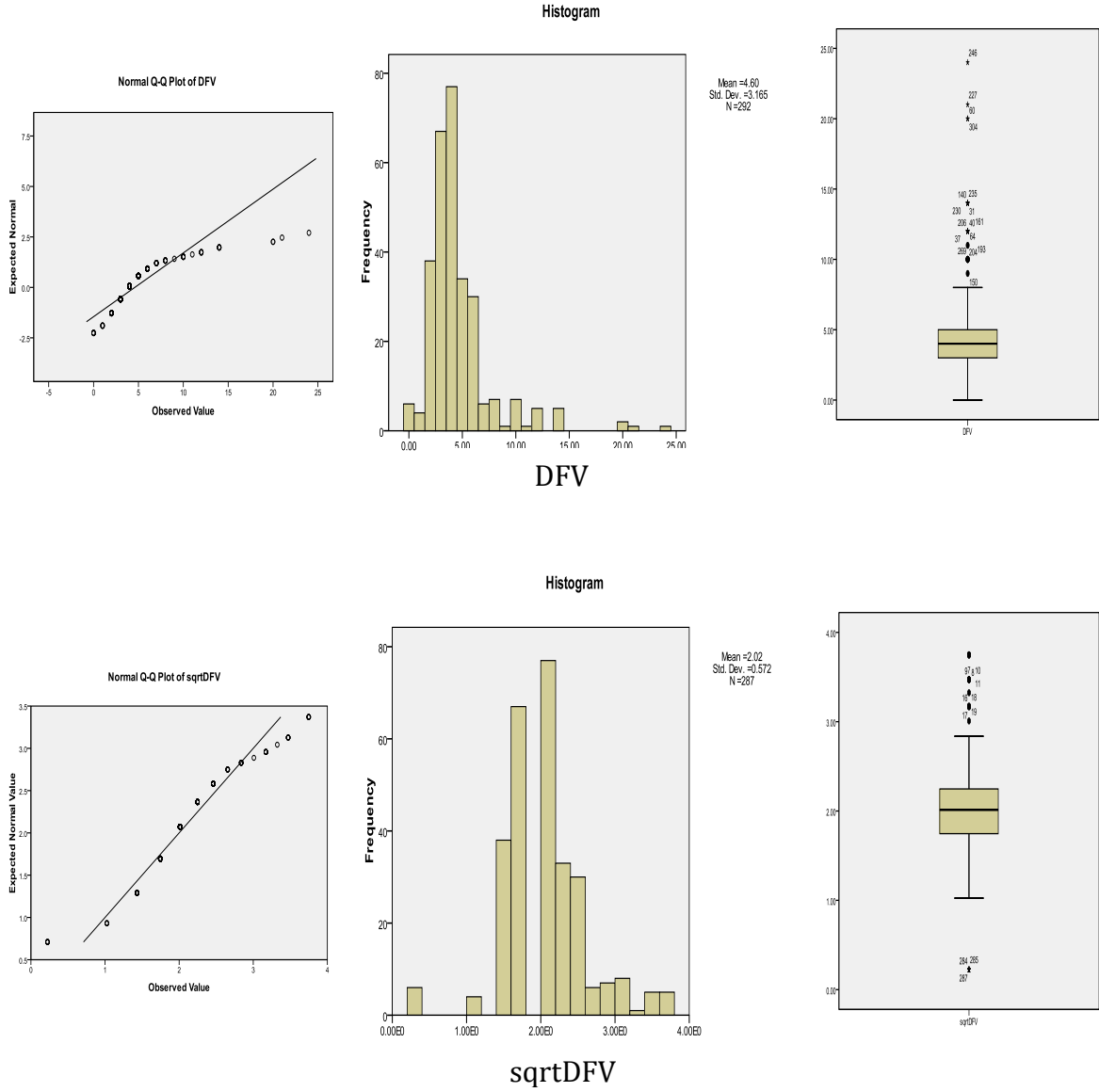
APPENDIX E

VISUAL COMPARISON OF AGE AND THE VARIABLE TRANSFORMATION SQRTAGE



APPENDIX F

VISUAL COMPARISON OF DFV AND THE VARIABLE TRANSFORMATION SQRTDFV



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Bolstad, A. (October 2009). Internationally Educated Nurses Participate in Research. *Nevada State Board of Nursing News*.

Presentations:

Xu, Y., Shen, J. and **Bolstad, A.** (April, 2010). Effects of Socio-cultural Workshops in a Communication Study of International Nurses. Western Institute of Nursing Symposium April 15, 2010

Bolstad, A., Colosimo, R. Using Standardized Patients in a Communication Study of International Nurses. Western Institute of Nursing Symposium April 15, 2010

Bolstad, A., Covelli, M., & Kelly, A. (April, 2010). Lessons Learned from a Communication Study of International Nurses. Western Institute of Nursing Symposium April 15, 2010

Poster Presentations:

Xu, Y., Shen, J., **Bolstad, A.**, Colosimo, R., & Covelli, M. Effects of a Short-term Linguistic Class on Reduction of Phonological Errors in International Nurses. Poster presented at the American Organization of Nurse Executives at the 43rd Annual Meeting and Exposition on April 10, 2010 in Indianapolis, Indiana.

Xu, Y., Shen, J., **Bolstad, A.**, Nassur A. Effects of a 10-Week Linguistic Class on the Reducation of Phonological Errors in International Nurses. Poster presented at UNLV Interdisciplinary Day on April 16, 2009 in Las Vegas, NV.

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Association of Body Mass Index and Fruit and Vegetable Consumption in a Sample Las Vegas Hispanic Population

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