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REGIONAL DIFFERENCES AND ASSOCIATIONS WITH OBESITY-RELATED FACTORS IN OVERWEIGHT AND OBESE U.S. SOUTHERN ELDERLY PEOPLE

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ABSTRACT OF THESIS

REGIONAL DIFFERENCES AND ASSOCIATIONS WITH OBESITY-RELATED FACTORS IN OVERWEIGHT AND OBESE U.S. SOUTHERN ELDERLY PEOPLE

The growing prevalence of overweight and obesity among United States (U.S.) elderly people today is a health concern. Higher incidences of obesity and obesity-related health conditions and mortality exist in the southern area of the U.S. Understanding obesity in relation to obesity-related factors in this population is crucial. The purpose of this study was to identify regional differences and associations between obesity and obesity-related factors in Southern U.S. elderly people, as defined by the U.S. Census Bureau, using data from the 2005 Behavioral Risk Factor Surveillance System (BRFSS), an existing telephone health survey administered by the Centers for Disease Control and Prevention (CDC). Through frequency tests, chi-square tests, and a multinomial logistic regression, the results revealed no regional difference in weight status among U.S. elderly people. However, multinomial logistic regression indicated some consistent associations with weight status among Southern U.S. elderly people. Males, Blacks and married elderly people, along with those diagnosed with high cholesterol, diabetes, and hypertension were associated with both overweight and obesity. Associations found between Southern U.S. elderly people who were overweight or obese and obesity-related factors support the need to continue to encourage elderly people living in the South to control their weight.

KEYWORDS: Overweight, obesity, the U.S. South, elderly people, BRFSS

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THESIS

Akemi Sakamoto

The Graduate School

University of Kentucky

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REGIONAL DIFFERENCES AND ASSOCIATIONS WITH OBESITY-RELATED FACTORS IN OVERWEIGHT AND OBESE U.S. SOUTHERN ELDERLY PEOPLE

THESIS

A thesis submitted in partial fulfillment of the
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By

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Chapter One: Introduction

The obesity epidemic among elderly people is a major concern. In 2003-04, 74% of men and 69% of women 60 years of age or older were reported to be overweight or obese (Body Mass Index [BMI] ≥25) (Ogden et al., 2006). Although the prevalence of obesity among adults 60 years of age or older in the U. S. is lower compared to adults 20-60 years of age, the data of previous population surveys indicate that obesity has become more prevalent among elderly people (Mokdad et al., 2003; Mokdad et al., 1999). In 1991, 14.7% of U.S. adults 60–69 years of age were obese (BMI ≥30), and 11.4% of those 70 years of age or older were obese (Mokdad et al., 1999). In 2005, the prevalence of obesity in these age groups had risen to 28.1% and 18.3% respectively (Centers for Disease Control and Prevention [CDC], 2006b).

The rapid increase in the elderly population will have an effect on the obesity epidemic (Villareal, Apovian, Kushner, & Klein, 2005). The number of persons 65 years of age and older will double, from 35 million in 2000 to more than 80 million by 2050 (Knickman & Snell, 2002). As the prevalence of overweight and obesity is rapidly growing in populations (CDC, 2006b; Mokdad et al., 2003), obesity among elderly people is also increasing. It is estimated that approximately 20.9 million Americans 60 years of age or older will be obese in 2010 (Arterburn, Crane, & Sullivan, 2004).

Overweight and obesity are major contributors to many preventable causes of death (U.S. Department of Health and Human Services, 2001). Overweight and obesity are directly associated with incidence of chronic diseases such as diabetes, coronary heart disease (CHD), hypertension, other health conditions and disabilities (Haslam & James, 2005; Mokdad et al., 2003; National Heart Lung and Blood Institute [NHLBI], 1998;

Weil et al., 2002; World Health Organization [WHO], 2000). In addition, particularly higher levels of obesity have been associated with increased mortality among elderly people (Flegal, Graubard, Williamson, & Gail, 2005; Heiat, Vaccarino, & Krumholz, 2001).

Numerous factors affect the epidemic of overweight and obesity. Specific obesity-related factors such as dietary patterns, demographics, socioeconomic status, and consumption of fruits and vegetables are reported as important health indicators of weight status (Kant & Graubard, 2005; NHLBI, 1998). Significant demographic differences in weight status have been reported. In the U.S., for example, obesity is more likely to be found in both Black elderly women and Hispanic elderly men than in other racial/ethnic groups (Freedman, Khan, Serdula, Galuska, & Dietz, 2002; Ogden et al., 2006).

Socioeconomic status such as income, education level, and poverty has been reported as health risks (Drewnowski & Specter, 2004; Lin, 2000; Smith et al., 1999; Xu, 2006). In the southern states in the U.S., where a higher prevalence of obesity (CDC, 2006b; Mokdad et al., 2001) and obesity-related health conditions (CDC, 2007c; CDC, 2007d; CDC, 2007e; Miniño, Heron, Murphy, & Kochankek, 2007; Mokdad et al., 2003) have been reported, there are also reported complex associations between factors that include low income, Black neighborhoods, and obesity (Block, Scribner, & DeSalvo, 2004; Robert & Reither, 2004).

Correlations may exist between the increasing epidemic of overweight and obesity and factors such as socio-demographics, dietary patterns, health conditions, and geographic location. Given the estimated growing prevalence of overweight and obese elderly people (Arterburn, Crane, & Sullivan, 2004), understanding obesity trends in

relation to obesity-related factors in specific regions of the U.S. where higher incidences of obesity exists is important.

Chapter Two: Literature Review

Obesity-Related Health Conditions

One of the major health conditions derived from obesity among elderly people is coronary heart disease (CHD) (NHLBI, 1998). CHD has continuously been the leading cause of death in the U.S., and CHD mortality mainly occurs in elderly people (Gorina, Hoyert, Lentzner, & Goulding, 2006; Miniño, Heron, Murphy, & Kochankek, 2007). Although a significant decrease in the U.S. death rates from CHD for elderly people was observed over the past few decades (Jemal, Ward, Hao, & Thun, 2005; Rosamond et al., 2007), the CHD death rate is still prevalent in elderly people and increases as ages increase (Gorina, Hoyert, Lentzner, & Goulding, 2006; Miniño, Heron, Murphy, & Kochankek, 2007). Particularly, a higher prevalence of mortality in the South has been observed. In 2004, a higher rate of death from CHD (222 to 300 per 100,000 U.S. population) was observed in the South, except Florida, Maryland, North Carolina and Virginia, compared to the U.S. average (217 per 100,000 U.S. population) (Miniño, Heron, Murphy, & Kochankek, 2007). As might be expected, the incidence of heart disease was also higher in the South. In 2005, 4.4% of U.S. adults reported a history of CHD or angina, 4.0% reported a history of myocardial infarction (MI), and 6.5% reported a history of one or more of these conditions. A higher prevalence of these reported conditions (7.0-10.4%) was found in many states in the South (CDC, 2007d).

Another major health condition from overweight and obesity is diabetes (Haslam & James, 2005; Mokdad et al., 2003; NHLBI, 1998; Weil et al., 2002; WHO, 2000). In 2002, diabetes was the sixth leading cause of death in the U.S. (CDC, 2005; Miniño, Heron, Murphy, & Kochankek, 2007). Over the past years, the number of people with

diabetes has increased; it nearly tripled between 1980 and 2005, with more than 7 % of the entire U.S. population (20.8 million) diagnosed with diabetes in 2005 (CDC, 2007a). In 2001, 15.1% of U.S. adults 60 to 69 years of age and 15.5% of those 70 years of age or older were diabetic (Mokdad et al., 2003). The prevalence of diabetes is different region by region. It appears, however, that more adults were diagnosed with diabetes in the South. In 2001, Alabama, Florida, and Mississippi were the three states with the highest prevalence of diabetes (>10%). In fact, most of the states in the South had a higher prevalence of diabetes (7.1-10.5%) compared to the national average (7.9%) (Mokdad et al., 2003).

Higher weight status associated with higher blood cholesterol (Mokdad et al., 2003; NHLBI, 1998) is another concern. Overweight and obesity result in higher blood LDL cholesterol and triglyceride levels and lower HDL cholesterol levels. Aging can also accelerate cholesterol levels (NHLBI, 1998). From 1991 to 2001, the prevalence of reported high cholesterol among U.S. adults gradually increased from 24.9% to 28.5% (CDC, 2004). In 2005, the national range of the estimated prevalence of high blood cholesterol was from 30.9% to 40.6%, and a higher prevalence of high cholesterol (35.2 - 40.6%) was found in many states in the South (CDC, 2007e).

Health conditions derived from obesity also include hypertension (Haslam & James, 2005; Mokdad et al., 2003; NHLBI, 1998; Weil et al., 2002; WHO, 2000). A direct association between weight status and hypertension has been found (NHLBI, 1998). The number of people with hypertension increases as age progresses: over two thirds of elderly people have hypertension (Fields et al., 2004; Rosamond et al., 2007). One study found that 85% of hypertension occurred in people with a BMI ≥25 (Kastarinen et al.,

2000). Other recent state-level data indicates that both high blood cholesterol and hypertension among U.S. adults are gradually increasing as if following the epidemic of obesity (CDC, 2004). The national range of the estimated prevalence of high blood cholesterol among U.S. adults in 2005 was from 19.2 to 34.8%. Also, a higher prevalence of hypertension was reported in many Southern states (26.6-34.8%) (CDC, 2007e).

Dietary Patterns among Overweight and Obese Elderly People

As Dietary Guidelines for Americans 2005 states, many Americans do not meet the recommended intakes for various nutrients while consuming excessive calories (U.S. Department of Agriculture [USDA], 2005). In 2005, about one third of U.S adults 18 years of age or older consumed fruit two or more times per day, and 27.2% ate vegetables three or more times per day (CDC, 2007b).

Researchers have examined the components that contribute to the increasing over-consumption of calories. A study of Nationwide Food Consumption Surveys (NFCS) found a large increase in total energy from salty snacks, soft drinks, and pizza over the past 20 years (Nielsen, Siega-Riz, & Popkin, 2002). Another NFCS study of reported that Americans' fat intake has increased over the past 30 years (Popkin, Siega-Riz, Haines, & Jahns, 2001). Also, a combination of bigger portion sizes and higher energy dense foods may have increased energy intake (Kant & Graubard, 2005; Young & Nestle, 2002). According to Young and Nestle (2002), portion sizes have increased since the 1970s. This indicates an increase in calorie intake parallel with the obesity epidemic (Young & Nestle, 2002). In addition, a cross-sectional study from the Third National Health and Nutrition Examination Survey (NHANES III) observed an association between high BMI

and high energy dense diets that consisted of higher intakes of energy, fat, and low nutrient dense foods, and lower consumption of fruits and vegetables (Kant & Graubard, 2005).

Among elderly people, a similar effect is observed. Elderly people who have a low nutrient dense dietary pattern (low consumption of fruits and vegetables) tend to become more obese, have low plasma vitamin B12 and low nutrient intake (Ledikwe, Smiciklas-Wright, Mitchell, Miller, & Jensen, 2004). Overweight and obese elderly women especially tend to be at higher nutritional risk. BMI among elderly women was associated with multiple clinical, environmental and nutritional risk indicators including a solitary lifestyle, high-level intakes of fat and saturated fat, and higher serum level of homocysteine concentration (Ledikwe et al., 2003). Mozaffarian et al (2003) examined how consumption of dietary fiber impacts the risk of cardiovascular diseases among the elderly population. They reported that higher consumption of dietary fiber from cereals was associated with lower risks of cardiovascular diseases among elderly people. Another study in long-term facilities found that elderly people may have lower nutritional risks when their dietary patterns are diverse, consuming a wide variety of fruits and vegetables (Bernstein, Tucker et al., 2002). The impact of consumption of fruits and vegetables in obese elderly people, therefore, needs to be seen as an indicator of obesity and obesity-related health conditions.

Although U.S. elderly people 65 years of age tend to consume more fruits and vegetables than younger adults under 65 years of age (Reeves & Rafferty, 2005; Serdula et al., 2004), many in this age group fail to meet the currently recommended guidelines for fruit and vegetable intake, consuming less than five times of fruits and vegetables per

day (CDC, 2007b; Reeves & Rafferty, 2005; Serdula et al., 2004). According to the USDA MyPyramid, 1.5 to 2 cups of fruits and 2 to 3.5 cups of vegetables, depending on the activity level, are recommended daily for elderly people (USDA, 2007). While only about 40% of Americans consumed an average of five or more half-cup servings of fruits and vegetables per a day in 1999-2000 (Guenther, Dodd, Reedy, & Krebs-Smith, 2006), Americans' consumption of fruits and vegetables has not increased over the past 10 years (Casagrande, Wang, Anderson, & Gary, 2007; Serdula et al., 2004). A recent study estimated that only 30% of U.S. adults 60 to 69 years of age and 35.2% of those 70 years of age or older consumed fruits and vegetables 5 or more times daily in 2000 (Mokdad et al., 2001). Another study reported that about 46% of U.S. adults 65 years of age or older consumed fruit two or more times per day, and 33.7% consumed vegetables three or more times per day in 2005 (CDC, 2007b).

Socio-Demographic Factors among Overweight and Obese Elderly People

Significant demographic differences in the prevalence of overweight and obesity are found by gender and race/ethnicity (Ogden et al., 2006). A study from the National Health and Nutrition Examination Survey (NHANES) reported that overweight or obesity among elderly people 60 years of age or older was more prevalent in men (74.1 to 74.4%) than in women (68.1 to 69.2%) in 1999-2004 (Ogden et al., 2006). This same study found that obesity was more prevalent in Black elderly women; 81.5-84.8% were overweight or obese, and 10.2% had a BMI of 40 or higher (Ogden et al., 2006). Moreover, the relationship between marital status and BMI among elderly people has been reported in a previous study using data from the 1992 Health Retirement Study (HRS) with cohorts 51-

61 years of age and the 1993 Study of Assets and Health Dynamics among the Oldest Old (AHEAD) with cohorts 70 years of age or older. The results revealed that widowed women were significantly obese while single men were underweight (Jeffery Sobal & Rauschenbach, 2003).

As socioeconomic status has been reported as a potent health risk (Ball & Crawford, 2005; Drewnowski & Specter, 2004; Lin, 2000; Smith et al., 1999; Xu, 2006), weight status may be influenced by lower levels of socioeconomic status such as poverty (Drewnowski & Specter, 2004). Ball and Crawford (2005) reviewed a number of previous studies that assessed the relationship between socioeconomic status and weight status. Associations with weight status were more consistent with occupational status than education level, while findings from several studies showed little consistency between income level and weight status (Ball & Crawford, 2005). In addition, racial disparities may affect the relationship of socioeconomic status and obesity; BMI among Black women may be inversely associated with individual socioeconomic status (James, Fowler-Brown, Raghunathan, & Hoewyk, 2006; Robert & Reither, 2004). Furthermore, socioeconomic status may determine dietary patterns. A previous study observed that higher consumption of potatoes, meat and fat and soft drinks was found among men with lower socioeconomic status (Hulshof, Brussaard, Kruizinga, Telman, & Lowik, 2003). Another study reported that women with lower socioeconomic status (specifically education level) consumed larger servings of chips, soft drinks, white bread, processed meats, whole milk dairy products, and sugar (Robinson et al., 2004).

Disparities in the Southern Region Versus the Other Three U.S. Regions

The prevalence of obesity in the U.S. differs by regions. As defined by the United States Census Bureau, the U.S. constitutes four distinct regions: Northeast (9 states), Midwest (12 states), South (17 states), and West (13 states) (U.S. Census Bureau, 2006). A higher prevalence of obesity has been observed in the South (CDC, 2006b; Mokdad et al., 2001). Specifically three states in the South, Louisiana, Mississippi, and West Virginia, are the highest in the nation for adult obesity; 30~34% of the adult population in these states are obese (BMI ≥30) (CDC, 2006b).

In addition to the higher prevalence of obesity, obesity-related health conditions such as CHD, diabetes, high cholesterol, and hypertension (CDC, 2007c; CDC, 2007d; CDC, 2007e; Miniño, Heron, Murphy, & Kochankek, 2007; Mokdad et al., 2003), and obesity-related mortality (Miniño, Heron, Murphy, & Kochankek, 2007) have been observed in the South.

A lower level of health conditions affected by lower socioeconomic status has been observed in the South (Franzini, Caughy, Spears, & Esquer, 2005; Lin, 2000; Massing et al., 2004; Xu, 2006). The South has a greater number of Blacks, which results in more regional disparities in health outcomes due to race (Bertoni et al., 2005). Previous studies report that lower income levels and lower self-rated health status were linked to each other, especially in the South (Franzini, Caughy, Spears, & Esquer, 2005; Xu, 2006). Stronger inverse associations between income level and mortality from cardiovascular diseases including CHD and stroke were reported in the South than the other U.S. regions (Massing et al., 2004). Also, a higher prevalence of elderly disability, including lower mobility or self-care limitation, was observed in southeastern states (Lin,

2000). In the Mississippi Delta, substandard health conditions are more prevalent in areas with lower socioeconomic status (Smith et al., 1999). Furthermore, rural women in the South show the highest rates of obesity and lower socioeconomic status (income and education level) than those from urban and suburban areas and tend to rate their health condition as poor compared to urban and suburban women (Ramsey & Glenn, 2002). Obese elderly people in rural Appalachia tended to report poorer self-rated health conditions and longer days of poor physical health compared to non-obese elderly people (Goins, Spencer, & Krummel, 2003).

Along with socioeconomic status, geographic and regional differences may also affect dietary patterns. A previous study reported that food insecurity and poverty are linked to inadequate diets in the Mississippi Delta (Champagne et al., 2007). In another study using the 1995-1996 cross-sectional survey from the Bogalusa Heart Study, it was reported that individuals from Louisiana who were 20 to 38 years of age with higher education levels consumed more servings of healthful foods such as breads and cereals, dairy products, fruits, 100% fruit juices, and vegetables (Deshmukh-Taskar, Nicklas, Yang, & Berenson, 2007). In rural areas of the South, low income households tended to have less access to fruits and vegetables, while a higher number of servings of fruits and vegetables were observed in subgroups with higher household income and higher levels of education (Krebs-Smith & Kantor, 2001).

Chapter Three: Hypothesis and Purpose

Based on the review of previous works, it may be anticipated that the effects of geographic and socio-demographic factors may be related to obesity and obesity-related factors in elderly people living in the South. Studies are scarce regarding these relationships. Hence, it is important to understand emerging obesity issues with regard to obesity-related factors in the South, where not only the higher incidence of obesity (CDC, 2006b), but also obesity-related health conditions (CDC, 2007c; CDC, 2007d; CDC, 2007e; Miniño, Heron, Murphy, & Kochankek, 2007; Mokdad et al., 2003) and lower socioeconomic status exist (Lin, 2000; Massing et al., 2004; Smith et al., 1999; Xu, 2006). Given these health and social disparities in the South and the estimated growing prevalence of overweight and obese people in the same region (Arterburn, Crane, & Sullivan, 2004), it is imperative to better understand where associations exist.

For the purpose of this study, Southern U.S. elderly people is defined according to the U.S. Census Bureau (2006) as individuals who live in the following 17 states: Alabama, Arkansas, Delaware, District of Colombia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia (U.S. Census Bureau, 2006).

With the focus on Southern U.S. elderly people, this study hypothesizes the following:

H1: Overweight and obesity are more prevalent in Southern U.S. elderly people than elderly people in the other three U.S. regions.

H2: Socio-demographic factors in Southern U.S. elderly people are different from those in the other three U.S. regions.

H3: Obesity-related health conditions (i.e., histories of CHD, diabetes, high blood cholesterol and hypertension) are more prevalent among Southern U.S. elderly people than they are among elderly people in the other three U.S. regions.

H4: Dietary patterns (consumption of fruits and vegetables) in Southern U.S. elderly people are less adequate than those in the other three U.S. regions.

H5: Obesity-related factors (i.e., socio-demographics, dietary patterns and histories of obesity-related health conditions) in Southern U.S. elderly people are associated with weight status.

As shown by the literature review, there are major obesity-related factors including dietary patterns (consumption of fruits and vegetables) and socio-demographic factors (gender, race/ethnicity, marital status, income and education levels), as well as certain health conditions (histories of CHD, diabetes, high blood cholesterol, and hypertension), that may characterize the region and have associations with obesity status in Southern U.S. elderly people. Given this, the purpose of this study was to examine regional differences and associations between weight status and obesity-related factors among elderly people in the South by using data from the 2005 Behavioral Risk Factor Surveillance System (BRFSS).

Chapter Four: Materials and Methods

Sample and Study Design

This study examined data from the 2005 BRFSS. The BRFSS, administered and supported by the Centers for Disease Control and Prevention (CDC), is a cross-sectional telephone survey to obtain a nationally representative sample of U.S. residents. It utilizes a random-digit-dialing telephone technique designed to reach individuals 18 years of age or older living in non-institutionalized locations and collects state-specific information on behavior-related risk factors associated with chronic diseases in the U.S. (CDC, 2006a). The BRFSS has been widely utilized to determine national and regional estimations and comparisons on behavioral risk factors (CDC, 2006a) and to measure the burden of diseases, as well as the impact of public health programs (Greenlund et al., 2005).

The data for this study was obtained from the 2005 BRFSS website (http://www.cdc.gov/brfss) and was analyzed of respondents who were 65 years of age or older and lived in the South based on the U.S. Census Bureau (2006). This targeted age was chosen based on the World Health Organization's definition of "an older or elderly person" (WHO, 2007). The total population of individuals in the 2005 BRFSS data who were 65 years of age or older was 86,088, of which 28,345 respondents were from the South. To determine if regional differences existed, 57,743 respondents in the Midwest, Northeast, and West regions of the U.S. were compared to the South.

The variables were selected to meet the objectives of this study. Fifteen variables were examined to assess associations with obesity: BMI classification, socio-demographic factors (gender, race/ethnicity, marital status, education and income level), consumptions of fruits and vegetables (carrots, fruit juice, fruits, green salad, and

vegetables), and obesity-related health conditions (history of CHD, diabetes, high blood cholesterol, and hypertension).

Variable Definitions

Weight Status. Weight status was determined using "calculated" BMI from the 2005 BRFSS data. Calculated BMI was determined by using respondents' reported weight and height and dividing the weight in kilograms by the square of height in meters. Based on BMI classification criteria, respondents whose BMI were 24.9 or less were classified as non-overweight/obese, respondents whose BMI was between 25 and 29.9 were classified as overweight; and respondents whose BMI was over 30 were obese (NHLBI, 1998). Based on previous studies, the non-overweight/obese category was created by combining the underweight (BMI <18.5) and normal weight (18.5≤ BMI <25) categories (Adams, Der Ananian, DuBose, Kirtland, & Ainsworth, 2003; CDC, 2006a; Serdula et al., 2004).

Socio-Demographics. The four socio-demographic variables were collapsed into fewer categories. Marital status was categorized into two categories: married and single. The income variable was grouped into three categories: less than $25,000, $25,000 to $49,999, and $50,000 or more per year. Education levels were collapsed into four categories: did not graduate from high school, high school graduate, attended college or technical school, and college or technical school graduate. Finally, race/ethnicity was categorized into four categories: White, Black, Hispanic, and other races.

Obesity-Related Health Conditions. Variables selected for self-reported history of obesity related health conditions included CHD, angina, diabetes, high blood cholesterol,

and hypertension. Data on history of CHD was obtained from the BRFSS survey question: “Have you ever been told by a doctor, nurse, or other health professional that you have angina or coronary heart disease?” The same type of question was used for the other three variables: diabetes, high blood cholesterol or hypertension. The responses for each of these questions were coded as "Yes," or "No.”

Consumption of Fruits and Vegetables. To assess the relationship between dietary patterns and obesity, the data on consumption of fruit juices, fruits, green salad, and other vegetables were selected. In the BRFSS, respondents were asked to self-report how often they consumed fruit juices, fruits, green salad, and carrots. Also, respondents were asked the question: “Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?” The variables were collapsed into 11 categories according to frequency of consumption: never, 1 serving or more per year (range includes from 1 to 99 servings), 1 serving per month, 2 servings per month, 3 or more servings per month (range includes from 3 to 99 servings), 1 serving per week, 2 servings per week, 3 or more servings per week (range includes from 3 to 99 servings), 1 serving per day, 2 servings per day, and 3 or more servings per day (range includes from 3 to 99 servings).

Statistical Analysis

The SPSS statistical software program (version 14, SPSS Inc, Chicago, IL) was used to perform all analyses. Along with weight status, descriptive statistics were computed on obesity-related factors, including socio-demographics, health conditions, and consumption of fruits and vegetables. Frequency analyses were used to observe data distributions in each variable. Chi-square tests were conducted to determine whether

regional differences in weight status and obesity-related factors among elderly people were found between the South and the other three U.S. regions and whether obesity-related factors in Southern U.S. elderly people differed by weight status. Due to the use of multiple nominal variables to classify weight status, multinomial logistic regression was conducted to examine complex associations with categorized weight status and obesity-related factors (socio-demographics, health conditions, and consumption of fruits and vegetables) among Southern U.S. elderly people.

Chapter Five: Results

Description of Study Population

Excluding missing data on weight status, a total of 27,208 individuals 65 years of age or older in 17 Southern states composed the study population. The total number of respondents varied for each variable as a result of some respondents not answering a particular question. Table 1 shows the demographic and socioeconomic descriptive characteristics. About fifty-seven percent of the sample population was 65 to 74 years of age, 35% was 75 to 84 years of age, and about 8% was 85 years of age or older. Among the Southern population, 9,563 respondents were male (35.1%) and 17,645 respondents were female (64.9%) with the mean age of 74.0±6.6 years. The majority of the respondents were White (83.6%), while other respondents were Black (9.7%), Hispanic (2.6%) and other race/ethnicities (4.1%). Education levels of the respondents were diverse: one third of the respondents were high school graduates, 23.2% did not complete high school, 21.3% attended college or technical school, and 21.6% had graduated from college or technical school. Half of the sample population (52.2%) had an annual household income "less than $25,000" while 29.7% had an income of "$25,000 to $50,000", and 18.1% had an income of "$50,000 or more".

Table 1. Descriptive Characteristics of Weight Status and Socio-Demographics among Southern U.S. Elderly People 65 Years of Age or Older (n=27,208)a

Characteristic	n	%
Body Mass Index (BMI)[b]		
<25 (non-overweight/obese)	10,657	39.2
25 – 29.9 (overweight)	10,571	38.9
≥30 (obese)	5,980	22.0
Age		
65-74 years old	15,494	56.9
75-84 years old	9,628	35.4
85 years of age or older	2,086	7.7
Gender		
Male	9,563	35.1
Female	17,645	64.9
Race/Ethnicity		
White	22,378	83.6
Black	2,609	9.7
Hispanic	685	2.6
Other race/ethnicity	1,111	4.1
Education		
<High school	6,281	23.2
High school graduate	9,190	33.9
<College or technical school	5,762	21.3
College or technical school graduate	5,866	21.6
Marital Status		
Married	12,388	45.6
Single	14,774	54.4
Income Level		
< $25,000	10,719	52.2
$25,000 - $49,999	6,104	29.7
≥$50,000	3,725	18.1

[a]Total number varies due to exclusion of missing responses.
[b]Calculated as kg/m^2.

Weight Status

The weight status of the respondents is provided in Figure 1. Nearly two thirds of all respondents were overweight (38.9%, n=10,571) or obese (22.0 %, n=5,980). The mean BMI of the respondents was 26.7±5.2. The highest percentage of overweight and obese respondents was observed among individuals 65 to 74 years of age. The prevalence of overweight and obesity declined as age advanced. Two thirds of the respondents 65 to 74 years of age were overweight (40.0%) or obese (26.6%). More than half of the respondents 75 to 84 years of age were overweight (39%) or obese (17.3%). About forty percent of the respondents 85 years of age or older were overweight (29.6%) or obese (9.3%).

Figure 2 shows racial and ethnic differences in weight status. The highest percentage of respondents overweight or obese was observed among Blacks (72.5%). Among male respondents, Black males had the highest prevalence of obesity (26.2%). Whites, Hispanics, and other races had similar prevalence of obesity (20.1~23.3%). The highest occurrence of overweight was among Hispanic and White males (48.5% and 47.5% respectively), while Black males had the lowest occurrence of overweight (42.4%). Among female respondents, Black females had the highest percentage of obesity at 40%. Twenty-nine percent of Hispanic females were obese. The prevalence of overweight was similar throughout all race/ethnicity groups (33.4~34.5%).

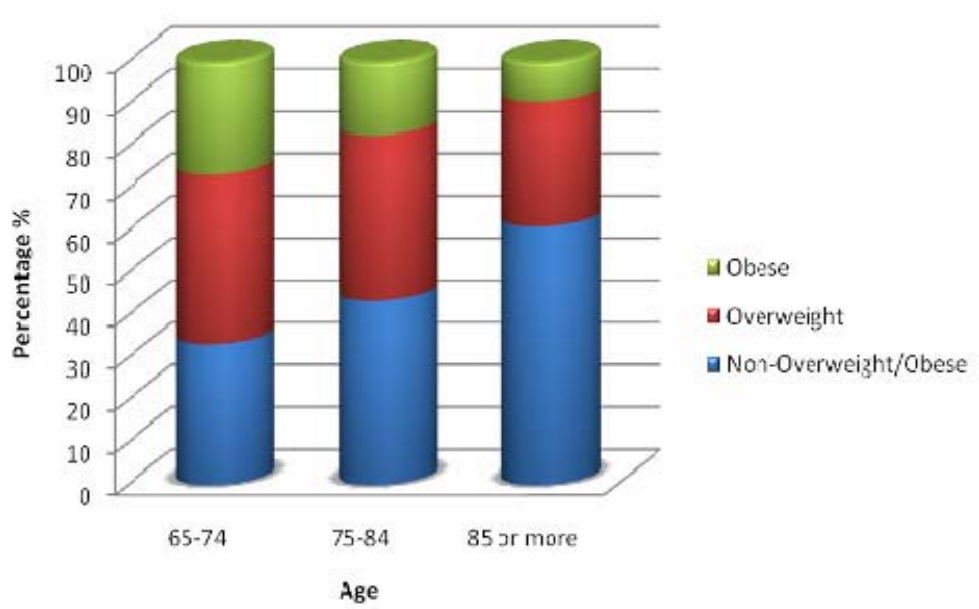

Figure 1. Weight Status among Southern U.S. Elderly People by Age Categories

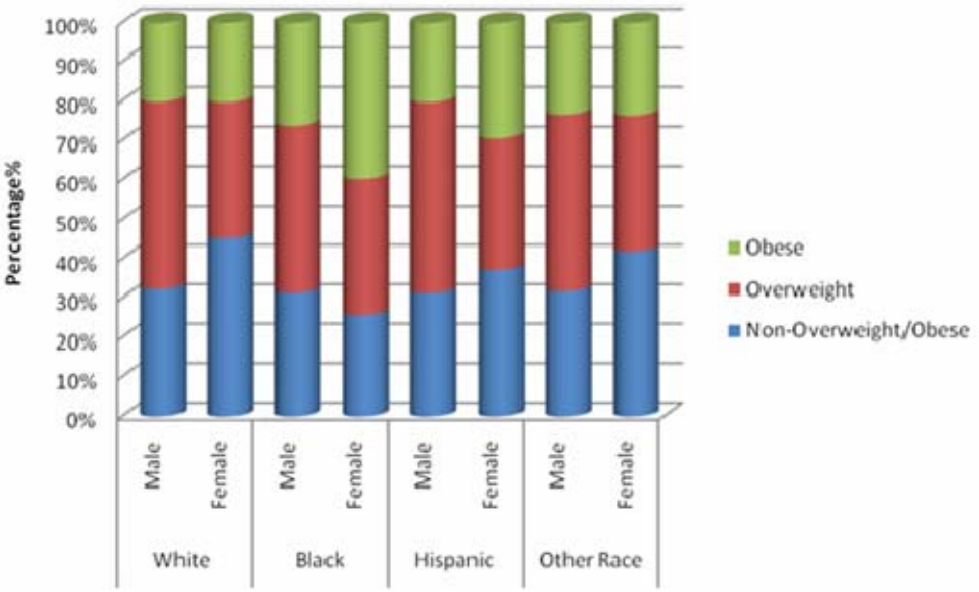

Figure 2. Weight Status among Race/Ethnicity in Southern U.S. Elderly People

Obesity-Related Health Conditions

Table 2 presents the frequency of obesity-related health conditions in Southern U.S. elderly people. CHD and diabetes were observed to be less prevalent than high cholesterol and hypertension. Thirteen percent of respondents had a history of CHD, and 19.7% of respondents had a history of diabetes. High cholesterol and hypertension were more prevalent at 52.1% and 57.9%, respectively.

Consumption of Fruits and Vegetables

As Table 3 shows, the frequency of consumption of fruits and vegetables varied among Southern U.S. elderly people. Approximately forty-three percent of respondents reported that they consumed 1 serving of fruit juice per day, and 40% of respondents consumed 1 serving of fruit per day. Consumption of vegetables was lower. Slightly more than one third of respondents consumed a serving of "other vegetable" (34.3%) and 20% consumed a serving of green salad once per day. Few (7.7%) reported consumption of carrots daily.

Table 2. Obesity-Related Health Conditions among Southern U.S. Elderly People[a]

Characteristic	n	%
Coronary Heart Disease		
Yes[b]	3,513	13.2
No	23,137	86.8
Diabetes		
Yes[b]	5,360	19.7
No	21,821	80.3
High Cholesterol		
Yes[b]	12,981	52.1
No	11,916	47.9
Hypertension		
Yes[b]	15,719	57.9
No	11,421	42.1

[a]Total number varies due to exclusion of missing responses.
[b]Respondents with history of obesity-related health conditions.

Table 3. Consumption of Fruits and Vegetables among Southern U.S. Elderly People[a]

	Fruit Juice (n=25,820)	Fruits (n=25,739)	Green Salad (n=25,775)	Carrots (n=25,094)	Other Vegetable (n=25,692)
	% Response				
Never	14.4	2.6	7.1	12.5	0.8
1 serving or more per year	1.8	0.7	0.8	2.3	0.1
1 serving per month	4.2	2.3	3.4	9.8	0.2
2 servings per month	2.5	2.3	3.4	9.2	0.4
3 servings or more per month	2.4	2.3	2.9	5.2	1.0
1 serving per week	6.3	6.4	11.1	19.4	1.9
2 servings per week	6.6	9.3	14.4	14.6	3.9
3 servings or more per week	13.5	21.0	34.7	18.4	14.8
1 serving per day	43.2	39.0	20.1	7.7	34.3
2 servings per day	3.3	9.0	1.5	0.5	30.5
3 servings or more per day	1.7	5.1	0.5	0.4	12.1

[a]Total number varies due to missing responses.

The South Versus the Other Three U.S. Regions

Weight Status. A higher prevalence of Southern U.S. elderly people who were overweight or obese versus the other three regions of the U.S. was not found. Figure 3 shows the distribution of weight status by U.S. regions. Chi-square tests indicate significant differences between the four U.S. regions (χ^2=107.724, P<0.001) with the Midwest having the highest prevalence of overweight and obesity (63.3%) and the West having the lowest prevalence of overweight and obesity (58.7%). In addition, as Table 4 shows, no significant difference was found between the South and the other three U.S. regions in weight status (χ^2=5.174, P=0.075).

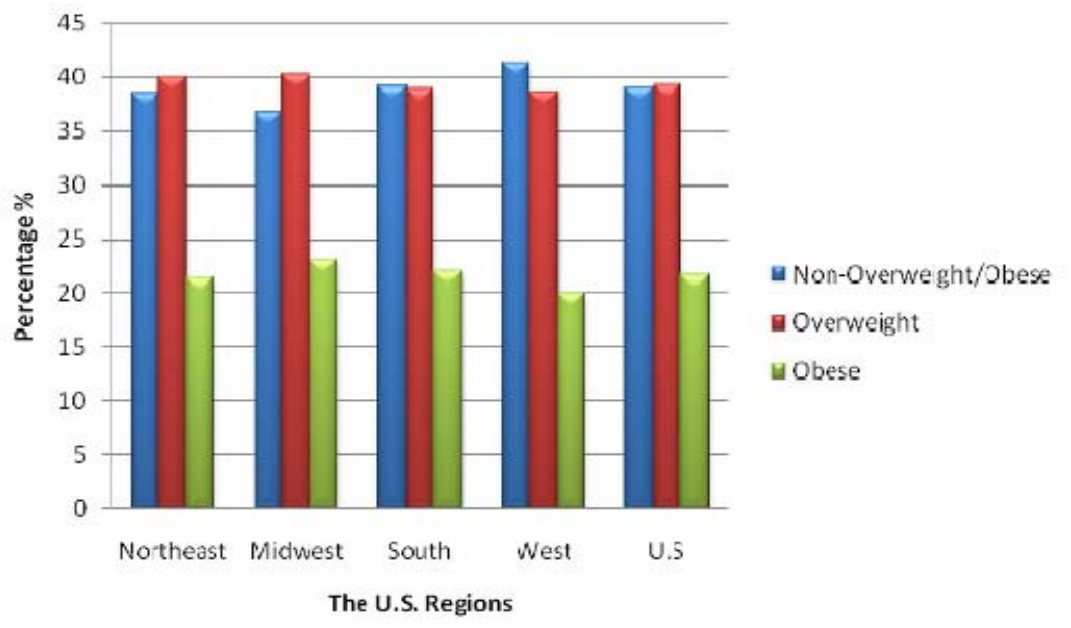

Figure 3. Weight Status among U.S. Elderly People by U.S. Regions

Table 4. Comparison in Weight Status, Socio-Demographics and Obesity-Related Health Conditions of Elderly People between the U.S. South and Other Three U.S. Regions[a]

Characteristic	South (n=27,208)	Other Regions (n=55,672)	χ^2	*Df*[b]	*P* value
	% Response				
Body Mass Index (BMI)[c]			5.174	2	0.075(NS[d])
<25 (non-overweight/obese)	39.2	39.0			
25 – 29.9 (overweight)	38.9	39.6			
≥30 (obese)	22.0	21.4			
Age			145.522	2	<0.001
65-74 years old	56.9	53.0			
75-84 years old	35.4	37.5			
85 years of age or older	7.7	9.5			
Gender			18.649	1	<0.001
Male	35.1	36.7			
Female	64.9	63.3			
Race/Ethnicity			1551.496	3	<0.001
White	83.6	89.5			
Black	9.7	3.2			
Hispanic	2.6	2.8			
Other race/ethnicity	4.1	4.5			
Education			1114.707	3	<0.001
<High School	23.2	13.9			
High School Graduate	33.9	38.0			
<College or Technical School	21.3	23.5			
College/Technical School Graduate	21.6	24.5			
Marital Status			1.996	1	0.158(NS)
Married	45.6	46.1			
Single	54.4	53.9			
Income Level			163.409	2	<0.001
< $25,000	52.2	47.3			
$25,000 - $49,999	29.7	34.5			
≥$50,000	18.1	18.2			
Obesity-Related Health Conditions[e]					
Coronary heart disease	13.2	13.0	0.603	1	0.437(NS)
Diabetes	19.7	18.0	36.452	1	<0.001
High cholesterol	52.1	51.2	5.558	1	0.018
Hypertension	57.9	54.6	81.592	1	<0.001

[a]Missing responses are not included.
[b]*df*=degrees of freedom.
[c]Calculated as kg/m^2.
[d]NS=not significant.
[e]Respondents with history of obesity-related health conditions.

Socio-demographics. Chi-square tests were used to determine if differences existed in the socio-demographic status of Southern elderly people compared to elderly people in the other three U.S. regions (see Table 4). These tests indicated significant differences in age, gender, sex, race/ethnicity, education level, and income level variables. No significant difference was found in marital status.

The study population of respondents between 65 to 74 years of age was larger in the South than the other three U.S. regions, while the percentage of individuals older than 74 years of age was lower (χ^2=145.552, P<0.001). Among gender distribution, the South had a higher distribution of females than the other U.S. regions (χ^2=18.649, P<0.001). A higher population of Blacks was also observed in the South, while the prevalence of other race/ethnicity groups was lower than the other three U.S. regions (χ^2=1551.496, P<0.001). The education level in the South was found to be lower than in the other three U.S. regions. The prevalence of respondents who did not graduate from high school was higher in the South than those in the other three U.S. regions and the prevalence of respondents with more than high school education was lower (χ^2=1114.707, P<0.001). Furthermore, the South had the lowest income level of all U.S. regions.

Obesity-Related Health Conditions. The prevalence of obesity-related health conditions differed between the South and the other three U.S. regions (Table 1). Diabetes (χ^2=36.452, P<0.001), high cholesterol (χ^2=5.558, P=0.018) and hypertension (χ^2=81.592, P<0.001) were more prevalent in the South than in the other U.S. regions. No significant regional difference was found for CHD (χ^2=0.063, P=437).

Consumption of Fruits and Vegetables. Table 5 compares the consumption of fruits and vegetables between elderly respondents from the South and the other three U.S. regions. Regional differences were found in the five variables for consumption of fruits and vegetables: fruit juice (χ^2=134.108, P<0.001), fruits (χ^2=1079.326, P<0.001), green salads (χ^2=915.825, P<0.001), carrots (χ^2=1103.620, P<0.001), and other vegetables (χ^2=1128.095, P<0.001). Although frequencies are similar, daily consumption of these variables (1, 2, and 3 servings or more per day) were slightly lower in the South than in the other three U.S. regions. Only consumption of other vegetables was found to be higher in the South (5%).

Table 5. Comparison in Consumption of Fruits and Vegetables of Elderly People between the U.S. South and Other Three U.S. Regions[a]

Characteristic	South (n=27,208) % Response	Other Regions (n=55,672) % Response	χ^2	*Df*[b]	*P* value
Fruit Juice			134.108	10	<0.001
Never	14.4	12.9			
1 serving or more per year	1.8	1.7			
1 serving per month	4.2	4.0			
2 servings per month	2.5	2.6			
3 servings or more per month	2.4	2.6			
1 serving per week	6.3	5.9			
2 servings per week	6.6	6.7			
3 servings or more per week	13.5	12.9			
1 serving per day	43.2	44.1			
2 servings per day	3.3	4.7			
3 servings or more per day	1.7	1.7			
Fruits			1079.326	10	<0.001
Never	2.6	1.9			
1 serving or more per year	0.7	0.5			
1 serving per month	2.3	1.7			
2 servings per month	2.3	1.6			
3 servings or more per month	2.3	2.2			
1 serving per week	6.4	5.2			
2 servings per week	9.3	7.8			
3 servings or more per week	21.0	19.0			
1 serving per day	39.0	36.5			
2 servings per day	9.0	15.6			
3 servings or more per day	5.1	8.1			
Green Salad			915.825	10	<0.001
Never	7.1	5.5			
1 serving or more per year	0.8	0.6			
1 serving per month	3.4	2.2			
2 servings per month	3.4	2.1			
3 servings or more per month	2.9	3.1			
1 serving per week	11.1	8.7			
2 servings per week	14.4	12.0			
3 servings or more per week	34.7	35.5			
1 serving per day	20.1	27.2			
2 servings per day	1.5	2.5			
3 servings or more per day	0.5	0.5			

[a]Missing responses are not included.
[b]*df*=degrees of freedom.

Table 5. Comparison in Consumption of Fruits and Vegetables of Elderly People between the U.S. South and Other Three U.S. Regions[a] (Continued)

Characteristic	South (n=27,208) % Response	Other Regions (n=55,672) % Response	χ^2	Df[b]	P value
Carrots			1103.620	10	<0.001
Never	12.5	6.7			
1 serving or more per year	2.3	1.6			
1 serving per month	9.8	7.4			
2 servings per month	9.2	8.3			
3 servings or more per month	5.2	5.7			
1 serving per week	19.4	21.3			
2 servings per week	14.6	16.7			
3 servings or more per week	18.4	21.8			
1 serving per day	7.7	9.3			
2 servings per day	0.5	0.8			
3 servings or more per day	0.4	0.3			
Other Vegetables			1128.095	10	<0.001
Never	0.8	1.2			
1 serving or more per year	0.1	0.1			
1 serving per month	0.2	0.3			
2 servings per month	0.4	0.5			
3 servings or more per month	1.0	1.6			
1 serving per week	1.9	2.3			
2 servings per week	3.9	4.6			
3 servings or more per week	14.8	17.4			
1 serving per day	34.3	41.2			
2 servings per day	30.5	22.9			
3 servings or more per day	12.1	7.9			

[a]Missing responses are not included.
[b]*df*=degrees of freedom.

Obesity-Related Factors by Weight Status in Southern Elderly People

Socio-Demographics. Socio-demographic characteristics of Southern elderly respondents by weight status were analyzed (see Table 6). Socio-demographics status differed by weight status for sex (χ^2=442.705, P<0.001), race/ethnicity (χ^2=374.197, P<0.001), education level (χ^2=237.112, P<0.001), marital status (χ^2=196.719), and income level (χ^2=120.281, P<0.001). Particularly, Blacks and Hispanics had higher BMI. Weight status increased with the number of respondents who did not graduate from high school and with the number of respondents who had the lowest income level (less than $25,000). Twenty-nine percent of those with less than a high school education and 58.3% of those with an income level of $25,000 per year or less were obese.

Obesity-Related Heath Conditions. Findings in Table 6 indicate that significant associations were found between weight status and the four obesity related health conditions: CHD (χ^2=65.992, P<0.001), diabetes (χ^2=1430.314, P<0.001), high cholesterol (χ^2= 204.015, P<0.001), and hypertension (χ^2= 817.366, P<0.001). All obesity-related health conditions increased as weight status increased. In particular, diabetes was 1.7 times more prevalent in overweight respondents and more than twice as prevalent in obese respondents as it was in non-overweight/obese respondents. Also, hypertension was 1.2 times more prevalent in overweight respondents and nearly 1.5 times more prevalent in obese respondents compared to non-overweight/obese respondents.

Table 6. Socio-Demographics and Obesity-Related Health Conditions among Southern U.S. Elderly People by Weight Status[a]

Characteristic	Total (n=27,208)	Non-Overweight/Obese (n=10,657)	Overweight (n=10,571)	Obese (n=5,980)	χ^2	*Df*[b]	*P* value
	% Response						
Gender					442.705	2	<0.001
Male	35.1	29.0	42.5	33.1			
Female	64.9	71.0	57.5	66.9			
Race/Ethnicity					374.197	6	<0.001
White	83.6	86.9	84.1	76.7			
Black	9.7	6.8	9.2	15.8			
Hispanic	2.6	2.3	2.5	3.1			
Other race/ethnicity	4.1	4.0	4.1	4.4			
Education Level					237.112	6	<0.001
<High school	23.2	21.1	21.9	29.1			
High school graduate	33.9	33.3	34.1	34.6			
<College or technical school	21.3	22.0	21.1	20.1			
College or technical school graduate	21.6	23.6	22.9	16.1			
Marital Status					196.719	2	<0.001
Married	45.6	41.2	50.7	44.4			
Single	54.4	58.8	49.3	55.6			
Income Level					120.281	4	<0.001
< $25,000	52.2	51.7	49.0	58.3			
$25,000 - $49,999	29.7	29.4	31.1	27.7			
≥$50,000	18.1	18.8	19.9	14.0			
Obesity-Related Health Conditions[c]							
CHD	13.2	11.5	13.3	16.0	65.992	2	<0.001
Diabetes	19.7	11.3	19.3	35.6	1430.314	2	<0.001
High cholesterol	52.1	47.0	53.6	58.6	204.015	2	<0.001
Hypertension	57.9	49.0	59.2	71.6	817.366	2	<0.001

[a]Missing response are not included.
[b]*df*=degrees of freedom.
[c]Respondents who have history of obesity-related health conditions.

Consumption of Fruits and Vegetables. Chi-square tests found significant associations between weight status and the fruits and vegetables variables in Southern elderly respondents: fruit juice (χ^2=129.478, P<0.001), fruits (χ^2=95.152, P<0.001), green salads (χ^2=153.980, P<0.001), carrots (χ^2=103.186, P<0.001), and other vegetables (χ^2=57.165, P<0.001). A gradual decline in the frequency in consumption of fruits and vegetables was observed as weight status increased (see Table 7).

Table 7. Consumption of Fruits and Vegetables among Southern U.S. Elderly People by Weight Status[a]

Characteristic	Total	Non-Overweight/Obese	Overweight	Obese	χ^2	*Df*[b]	*P* value
	% Response						
Fruit Juice	(n=25,820)	(n=10,088)	(n=10,054)	(n=5,678)	129.478	20	<0.001
Never	14.4	14.4	13.7	15.6			
1 serving or more per year	1.8	1.8	1.7	1.8			
1 serving per month	4.2	3.7	4.1	5.3			
2 servings per month	2.5	2.3	2.7	2.7			
3 servings or more per month	2.4	1.9	2.5	3.0			
1 serving per week	6.3	5.8	6.5	7.0			
2 servings per week	6.6	6.0	6.9	7.2			
3 servings or more per week	13.5	13.0	13.6	14.3			
1 serving per day	43.2	45.8	43.5	38.1			
2 servings per day	3.3	3.4	3.2	3.3			
3 servings or more per day	1.7	1.8	1.7	1.5			
Fruits	(n=25,739)	(n=10,028)	(n=10,048)	(n=5,663)	95.152	20	<0.001
Never	2.6	2.9	2.5	2.4			
1 serving or more per year	0.7	0.7	0.7	0.8			
1 serving per month	2.3	2.2	2.2	2.7			
2 servings per month	2.3	2.2	2.2	2.5			
3 servings or more per month	2.3	1.9	2.3	3.2			
1 serving per week	6.4	6.3	6.5	6.6			
2 servings per week	9.3	8.4	9.3	11.0			
3 servings or more per week	21.0	20.2	21.6	21.2			
1 serving per day	39.0	40.1	39.2	36.6			
2 servings per day	9.0	9.3	8.8	8.6			
3 servings or more per day	5.1	5.7	4.8	4.5			

[a]Missing responses are not included.
[b]*df*=degrees of freedom.

Table 7. Consumption of Fruits and Vegetables among Southern U.S. Elderly People by Weight Status[a] (Continued)

Characteristic	Total	Non-Overweight/Obese	Overweight	Obese	χ^2	*Df*[b]	*P* value
	% Response						
Green Salad	(n=25,775)	(n=10,061)	(n=10,054)	(n=5,660)	153.980	20	<0.001
Never	7.1	7.8	6.4	7.0			
1 serving or more per year	0.8	0.8	0.7	1.1			
1 serving per month	3.4	3.5	3.3	3.7			
2 servings per month	3.4	3.1	3.2	4.1			
3 servings or more per month	2.9	2.4	3.0	3.7			
1 serving per week	11.1	10.9	10.7	12.3			
2 servings per week	14.4	13.6	14.5	15.7			
3 servings or more per week	34.7	33.8	36.2	33.9			
1 serving per day	20.1	22.2	20.2	16.3			
2 servings per day	1.5	1.5	1.5	1.7			
3 servings or more per day	0.5	0.4	0.5	0.6			
Carrots	(n=25,094)	(n=9,772)	(n=9,812)	(n=5,510)	103.186	20	<0.001
Never	12.5	12.0	12.2	14.2			
1 serving or more per year	2.3	2.3	2.1	2.7			
1 serving per month	9.8	9.5	9.6	10.7			
2 servings per month	9.2	8.6	9.6	9.5			
3 servings or more per month	5.2	5.0	5.3	5.5			
1 serving per week	19.4	18.6	20.3	19.2			
2 servings per week	14.6	14.6	14.9	13.9			
3 servings or more per week	18.4	19.5	17.9	17.2			
1 serving per day	7.7	9.0	7.2	6.1			
2 servings per day	0.5	0.6	0.5	0.6			
3 servings or more per day	0.4	0.4	0.4	0.4			

[a]Missing responses are not included.
[b]*df*=degrees of freedom.

Table 7. Consumption of Fruits and Vegetables among Southern U.S. Elderly People by Weight Status[a] (Continued)

Characteristic	Total	Non-Overweight/Obese	Overweight	Obese	χ^2	*Df*[b]	*P* value
	% Response						
Other Vegetables	(n=25,692)	(n=10,045)	(n=10,000)	(n=5,647)	57.165	20	<0.001
Never	0.8	1.0	0.7	0.8			
1 serving or more per year	0.1	0.1	0.0	0.2			
1 serving per month	0.2	0.3	0.2	0.2			
2 servings per month	0.4	0.3	0.4	0.4			
3 servings or more per month	1.0	0.8	0.9	1.4			
1 serving per week	1.9	1.7	1.8	2.4			
2 servings per week	3.9	3.6	4.0	4.0			
3 servings or more per week	14.8	14.4	15.0	15.3			
1 serving per day	34.3	34.6	34.3	33.6			
2 servings per day	30.5	30.8	30.1	30.6			
3 servings or more per day	12.1	12.4	12.5	11.0			

[a]Missing responses are not included.
[b]*df*=degrees of freedom.

Associations between Obesity-Related Factors and Weight Status in Southern Elderly People

Socio-Demographics. Table 8 provides the results of the multinomial logistic regression analysis of respondents in the South. Findings indicate that demographic characteristics of Southern U.S. elderly people can be associated with both overweight and obesity status. Elderly male respondents were about 1.8 times more likely to be overweight ($P<0.001$) and 1.2 times more likely to be obese compared to females ($P<0.001$). Race/ethnicity had a significant association with overweight and obesity. Compared to Whites, Black respondents were more likely to be overweight and obese with odd ratios (ORs) of 1.405 ($P<0.001$) and 1.998 ($P<0.001$), respectively. Hispanic respondents were 1.37 times more likely to be obese ($P=0.022$), whereas there was no significant association of being Hispanic with the overweight status. As with gender and ethnicity, marital status was associated with overweight and obese status. Married respondents in the South were almost 1.2 times more likely to be overweight or obese than non-married respondents ($P<0.001$ for both). Only high school graduates were significantly more likely to be overweight compared to college or technical school graduates (OR=1.203; $P<0.001$), while all education levels ("did not graduate high school" (OR=1.410, $P<0.001$), "high school graduate" (OR=1.390, $P<0.001$), and "attend college or technical school" (OR=1.305, $P<0.001$) had significant ORs in obese status. In addition, this study did not find any significant association between weight status and income level.

Table 8. Association between Weight Status and Obesity-Related Factors among U.S. Southern Elderly People as measured by Odds Ratios (ORs) in Multinomial Logistic Regression Model

Characteristic	Overweight[b] OR (95% Confidence Interval)	*P* value	Obese[b] OR (95% Confidence Interval)	*P* value
Gender				
Male	1.820 (1.678, 1.973)	<0.001*	1.214 (1.100, 1.341)	<0.001*
Female[a]				
Race/Ethnicity				
White[a]				
Black	1.405 (1.223, 1.614)	<0.001*	1.998 (1.723, 2.316)	<0.001*
Hispanic	1.120 (0.882, 1.421)	0.354	1.366 (1.045, 1.784)	0.022**
Other race/ethnicity	1.039 (0.865, 1.247)	0.686	1.177 (0.953, 1.454)	0.131
Education				
<High school	1.130 (0.994, 1.285)	0.061	1.410 (1.210, 1.644)	<0.001*
High school graduate	1.203 (1.085, 1.335)	<0.001*	1.390 (1.221, 1.583)	<0.001*
<College or technical school	1.076 (0.967, 1.197)	0.181	1.305 (1.142, 1.492)	<0.001*
College or technical school graduate[a]				
Marital Status				
Married	1.241 (1.144, 1.345)	<0.001*	1.216 (1.103, 1.340)	<0.001*
Single[a]				
Income Level				
< $25,000	1.050 (0.934, 1.180)	0.417	1.150 (0.994, 1.330)	0.060
$25,000 - $49,999	1.048 (0.943, 1.165)	0.388	1.081 (0.945, 1.237)	0.257
≥$50,000[a]				

[a]Reference Category

[b]Non-overweight/obese weight was the reference category of the dependent variable, weight status, in the multinomial logistic regression model.

*Significant difference at P<0.001

**Significant difference at P<0.05

Table 8. Association between Weight Status and Obesity-Related Factors among U.S. Southern Elderly People as measured by Odds Ratios (ORs) in Multinomial Logistic Regression Model (Continued)

Characteristic	Overweight[b] OR (95% Confidence Interval)	*P* value	Obese[b] OR (95% Confidence Interval)	*P* value
Coronary Heart Disease				
Yes	0.950 (0.853, 1.058)	0.348	1.081 (0.956, 1.222)	0.213
No[a]				
Diabetes				
Yes	1.674 (1.506, 1.861)	<0.001*	3.542 (3.173, 3.954)	<0.001*
No[a]				
High Cholesterol				
Yes	1.235 (1.148, 1.329)	<0.001*	1.303 (1.193, 1.424)	<0.001*
No[a]				
Hypertension				
Yes	1.461 (1.357, 1.574)	<0.001*	2.058 (1.875, 2.258)	<0.001*
No[a]				
Consumption of Fruits & Vegetables				
Fruit juice	0.996 (0.984, 1.009)	0.550	0.984 (0.970, 0.998)	0.030**
Fruits	1.005 (0.985, 1.025)	0.625	0.985 (0.962, 1.008)	0.201
Green salad	1.022 (1.003, 1.041)	0.022**	1.019 (0.997, 1.041)	0.094
Carrots	0.983 (0.967, 0.998)	0.032**	0.972 (0.954, 0.991)	0.003*
Other vegetables	1.820 (0.987, 1.042)	0.326	1.004 (0.972, 1.036)	0.826

[a]Reference Category
[b]Non-overweight/obese weight was the reference category of the dependent variable, weight status, in the multinomial logistic regression model.
*Significant difference at P<0.001
**Significant difference at P<0.05

Obesity-Related Health Conditions. Positive associations were found between weight status and three of the four obesity-related health conditions. Histories of being diagnosed as diabetic (OR=1.674 overweight; OR=3.542 obese; $P<0.001$ for both), having high cholesterol (OR=1.235 overweight; 1.303 obese; $P<0.001$ for both) and having hypertension (OR=1.461 overweight; 2.058 obese; $P<0.001$ for both) had positive associations with overweight and obese status, respectively. Respondents who had been diagnosed with those three obesity-related health conditions were more likely to be overweight and obese compared to respondents who had no history of these health conditions. However, CHD did not have a significant association with weight status ($P=0.348$ overweight; $P=0.213$ obesity) in this study.

Consumption of Fruits and Vegetables. Multinomial logistic regression test found that some consumption of fruit and vegetables had significant associations with weight status. Consumption of fruit juice had a weak negative association with obesity (OR=0.984, $P=0.030$), and an insignificant association with overweight status ($P=0.550$). Consumption of green salad had a slightly positive association with overweight status (OR=1.022, $P=0.022$) and insignificant association with obesity ($P=0.094$). An increase in consumption of carrots was negatively associated with both overweight (OR=0.983, $P=0.032$) and obese (OR=0.972, $P=0.003$) status. No significant associations were observed in consumption of fruits ($P=0.623$ overweight; $P=0.201$ obesity) and other vegetables ($P=0.326$ overweight; $P=0.826$ obesity). Overall, findings indicate that consumption of fruits and vegetables did not show strong significant associations with weight status in elderly people.

Chapter Six: Discussion

The Characteristics and Trends in Southern U.S. Elderly People

The results of this examination of the 2005 BRFSS revealed that there were no significant differences in elderly weight status in the South compared to the other three U.S. regions. This finding does not support Hypothesis 1: overweight and obesity elderly people are more prevalent in the South than in the other three U.S. regions. Also, this study does not support an earlier study of adult population (18 years of age and older) that found that the prevalence of overweight or obese individuals was more likely found in the South (CDC, 2006b). However, it is worth noting the scarcity of studies in the literature on weight status in Southern elderly people.

Meanwhile, the results of other aspects of this study's regional comparison mimic the characteristics of the South presented in earlier studies. This study observed that the South had a greater proportion of Blacks and the largest number of elderly population compared to the other three U.S. regions. These demographic characteristics are consistent with the previous census report (U.S. Census Bureau, 2001). Moreover, a greater proportion of respondents with lower socioeconomic status in the South was also found in this study and represents a regional characteristic that has been observed as a potent health risk for Southern U.S. elderly people (Lin, 2000; Smith et al., 1999; Xu, 2006). Regarding the significant differences on most of socio-demographic variables in this study, these findings support Hypothesis 2 that socio-demographic factors in Southern U.S. elderly people are different from those in the other three U.S. regions.

Furthermore, this study found a slightly larger prevalence of three obesity-related health conditions (diabetes, high cholesterol and hypertension) in Southern U.S. elderly

people than elderly people in the other three U.S. regions. This finding supports previous studies that have found a higher prevalence of diabetes (Mokdad et al., 2003), high cholesterol (CDC, 2007e) and hypertension (CDC, 2007c) in the South. Only CHD did not have a significant regional difference, which is inconsistent with previous studies of entire adult populations (18 years of age and older) that found a higher incidence of CHD in the South (CDC, 2007d; Miniño, Heron, Murphy, & Kochankek, 2007).

Slightly lower consumption of fruit juice, fruits, green salad, and carrots were observed whereas consumption of "other vegetable" was shown to be higher in Southern U.S. elderly people than in elderly people in the other three U.S. regions. This finding is similar to another BRFSS 2005 report on adults 18 years of age or older that observed a tendency of lower consumption of fruits but slightly higher consumption of vegetables in many Southern states (CDC, 2007b). Also, this supports a previous study in the Lower Mississippi Delta (Delta) of Louisiana, Arkansas, and Mississippi finding a 20% lower intake of fruits and vegetables in the Delta compared to the overall U.S. population (Champagne et al., 2004). Moreover, this finding may suggest ethnic disparities in food consumption. A previous cross-sectional study in Louisiana where there is a larger population of Blacks reported that food consumption varied by race/ethnicity and that Blacks with lower income levels in the same area had less adequate dietary patterns than Whites (Deshmukh-Taskar, Nicklas, Yang, & Berenson, 2007). Given the higher prevalence of food insecurity and poverty in the South (Champagne et al., 2007) and less access to fruits and vegetables in lower income households in rural areas of the South (Krebs-Smith & Kantor, 2001), the South may have stronger demographic and geographic factors affecting these racial/ethnic differences in food consumption.

Associations between Weight Status and Obesity-Related Factors in Southern U.S. Elderly People

When examining associations between weight status and gender, male respondents were more likely to be overweight and obese than females in the South. This finding also confirms Ogden et al.'s 1999-2004 study reporting a higher prevalence of overweight or obesity among men (74.1 to 74.4%) than among women (68.1 to 69.2%) in the population 60 years of age or older (Ogden et al., 2006). The finding may be supported by a previous study indicating that elderly females tend to lose more weight than elderly males (Newman et al., 2001). Another study stating that overweight and obese elderly women tend to be at a higher nutritional risk (Ledikwe et al., 2003) also supports this finding. Thus, considering these previous reports, this study suggests that gender differences may affect weight status in later life.

In this study, only Black elderly people showed a consistent and significant association with higher weight status, while only Hispanics had a significant association with obesity weight status. These associations between Blacks and higher BMI can be supported by previous reports of a higher prevalence of overweight and obesity among Blacks (Freedman, Khan, Serdula, Galuska, & Dietz, 2002; Ogden et al., 2006) and regional health disparities due to race in the South (Bertoni et al., 2005).

This study further found that married respondents were more likely to be overweight or obese. This finding is consistent with a previous study reporting a modestly higher prevalence of overweight (BMI ≥25) among married adults compared to those with another marital status (Schoenborn, Adams, & Barnes, 2002). Previous studies also support this finding. Eng et al (2005) observed that BMI decreased in men who

become divorced or widowed. A study of a National Health and Nutrition Epidemiological Follow-up Survey (NHEFS) reports that single women who married after the baseline survey had more weight gain during about 10 years than women married at both baseline and follow-up surveys, while men who remained divorced/separated men or became widowed had more weight loss than men married at both baseline and follow-up surveys (Sobal, Rauschenbach, & Frongillo, 2003). Similarly, another study found that widowed women had a significantly higher risk of becoming obese, while divorced/separated/never-married men were more likely to become underweight (Sobal & Rauschenbach, 2003). McDonald et al (2000) argued that elderly single men lacked experience and skill in shopping and cooking and have less social and family support for food than women. While changes in family structures were found to lead to weight gain or weight loss (Sobal, Rauschenbach, & Frongillo, 2003), married family structure may encourage marital members to eat and facilitate their food consumption (Sobal, Bove, & Rauschenbach, 2002). This study did not examine the combination of gender and marital status on weight status. This study's findings regarding an association between marital status and weight status supports these previous studies. This study implies that a relationship between family and social support involving food lends itself to higher weight in elderly married men compared to elderly single men.

Obesity in Southern U.S. elderly people was significantly more prevalent as education level decreased, whereas no consistent association with overweight status and education level was found in this study. This association between obesity and education level may support a previous study of the 2000 BRFSS data which found that the highest

prevalence of obesity was in adults who did not graduate from high school (Freedman, Khan, Serdula, Galuska, & Dietz, 2002). This finding also supports a previous study that found rural Southern women with lower education levels were more obese (Ramsey & Glenn, 2002). Additionally, this finding also supports Ball and Crawford's findings (2005) that education level as an indicator of socioeconomic status has some equivocal association with weight status. In contrast, another study examining education level and weight status influences (Schnohr et al., 2004) indicated that education level did not affect weight status. The present study concluded that associations between education level and the incidence of overweight and obesity were inconsistent.

As with the finding on education level, no association between income level and weight status was found in this study. This finding does not support previous studies of socioeconomic disparities and health status in the South: specifically, that income level may affect CHD mortality (Massing et al., 2004), health status (Franzini, Caughy, Spears, & Esquer, 2005; Smith et al., 1999; Xu, 2006), elderly disability (Lin, 2000), and rural women's health and obesity (Ramsey & Glenn, 2002). However, this study supports Ball and Crawford's finding of an inconsistent association between income level and weight status (Ball & Crawford, 2005). Given the inconsistent results in education and income level, the need for further investigation in this area is suggested.

This study shows significant associations between weight status and history of diabetes, high cholesterol, and hypertension in Southern elderly people. A higher incidence of diabetes (Mokdad et al., 2003), high cholesterol (CDC, 2007e) and hypertension (CDC, 2007c) has been reported in the South in previous studies. This

study's finding suggests that the prevalence of several obesity-related health conditions coexist in parallel with obesity in Southern U.S. elderly people.

Contrary to the Hypothesis 3, only CHD was not associated with weight status in Southern U.S. elderly people in this study. Moreover, this study found that 66.6% of the study population 65 to 74 years of age was overweight or obese. However, the percentage of overweight and obese individuals was found to decrease to 56.3% after 75 years of age or older and then to 38.9% at 85 years of age or older. These findings may indicate that the incidence of death associated with weight status in Southern elderly people may be occurring at an earlier age (before age 75). This can be supported by a previous study reporting the higher mortality risk from obesity among adults 18 years of age or older (Flegal, Graubard, Williamson, & Gail, 2005; Fontaine, Redden, Wang, Westfall, & Allison, 2003; Peeters et al., 2003). The reported number and percentage of individuals younger than 65 years of age in the U.S. who have died from CHD also supports this finding: 5,054 deaths before 35 years of age (0.8% of all ages who died from CHD); 114,094 deaths among individuals 35-64 years of age (17.5%) in 2004 (Miniño, Heron, Murphy, & Kochankek, 2007). In addition, these findings can be explained by the fact that mortality from CHD is more acute and often results in fatality (Miniño, Heron, Murphy, & Kochankek, 2007) and weight loss may be more frequent than weight gain among elderly people (Newman et al., 2001).

Along with understanding associations between weight status and obesity-related health conditions, analysis on consumption of fruits and vegetables by Southern elderly people may not support Hypotheses 4 and 5. This study does not confirm a previous finding that elderly people with low consumption of fruits and vegetables tend to become

more obese (Ledikwe, Smiciklas-Wright, Mitchell, Miller, & Jensen, 2004). However, the finding of this study with regard to the consumption of green salad and fruit juice may be related to significant positive associations between BMI and high energy dense diets (Kant & Graubard, 2005; Ledikwe, Smiciklas-Wright, Mitchell, Miller, & Jensen, 2004). Given that consumption of juice with higher sugar calories has been linked to body weight gain (Berkey, Rockett, Field, Gillman, & Colditz, 2004; Bray, Nielsen, & Popkin, 2004; Malik, Schulze, & Hu, 2006) and dressing accompanying salad typically has higher calories from fat, it may suggests that elderly people in this study reporting salad and fruit juice consumption may have been including high fat dressings with their salad and juices with high sugar concentration. Moreover, the other finding regarding consumption of carrots in this study may be supported by the significant inverse associations found between serum carotenoids and obesity in neighborhood deprivation (Stimpson, Nash, Ju, & Eschbach, 2007). Although consumption of fruits and vegetables is an important indicator of weight status (Kant & Graubard, 2005; NHLBI, 1998), the weak and inconsistent associations between consumption of fruits and vegetables and weight status found in this study indicate a complex issue between dietary patterns and other factors on weight status in the elderly population. With no clear evidence to support this inference currently available, further inquiries are needed to elucidate the complex relationship among these factors.

Limitations

Finally, limitations of this study need to be addressed. First, since BRFSS is a telephone survey, it does not include in the sampling households who do not have a

telephone or households only with cell phone (CDC, 2007e). It is estimated that 1.7% of U.S. households did not have any telephone service and 6.7% had wireless service in 2005 (Blumberg, Luke, & Cynamon, 2006). While this is a small percentage of the U.S. population, this method of gathering data tends to exclude those who are socially isolated. Second, the self-reported data could have bias leaning toward underreporting weight and overreporting height (Niedhammer, Bugel, Bonenfant, Goldberg, & Leclerc, 2000; Smith et al., 1999; Visscher, Viet, Kroesbergen, & Seidell, 2006). Particularly, the lower number of BMI data calculated from self-reported data compared to those from measured data was observed in elderly people (Kuczmarski, Kuczmarski, & Najjar, 2001). Furthermore, the BRFSS data does not reveal years passed after respondents were diagnosed with diseases and health conditions. Thus, it is difficult to simply make causal relationships between current weight status and past histories of obesity-related health conditions. Also, the BRFSS does not have detailed methods of measuring consumption of fruits and vegetables, resulting in possible underestimations of those consumption, compared to questions that ask respondents to provide specific portion sizes (Bensley, Van Eenwyk, & Bruemmer, 2003). Finally, the BRFSS excludes institutionalized people such as elderly people in long-term care facilities. According to National Center for Health Statistics (2004), 1,469,500 elderly Americans 65 years of age or older (43.3 per 1,000 population) were nursing home residents in 1999. This study does not represent the entire elderly population and cannot consider possible impact of controlled dietary practices on overweight and obese conditions.

Chapter Seven: Conclusion

This study suggests that a complex interaction of issues surrounding the obesity epidemic result in the regional characteristics and relationships found between weight status and several obesity-related factors in Southern U.S. elderly people. Initially, this study found that Black, married, or male elderly people in the South were significantly likely to be overweight and obese. These associations support a need to focus efforts on these groups for weight management. However, this study's results, while providing additional insights about the weight status and dietary patterns of the Southern elderly population, show certain inconsistencies. On the practical level, despite complex factors, this study supports efforts to promote adequate diets by increasing consumption of fruits and vegetables in order to encourage healthful weight management and disease control in elderly people. Intervention studies prove that elderly people can increase their consumption of fruits and vegetables (Bernstein, Nelson et al., 2002; Dixon, Mullins, Wakefield, & Hill, 2004; Greene et al., 2004). Studies also recommend promoting diets that include adequate consumption of fruits and vegetables, which can serve to prevent and reduce overweight and obesity (Davis, Miller, & Mitchell, 2004; Rolls, Ello-Martin, & Tohill, 2004; Tohill, Seymour, Serdula, Kettle-Khan, & Rolls, 2004). In addition, careful practices for intervention are essential. Functional declines in daily living activities are observed among not only overweight or obese elderly people (Blaum, Xue, Michelon, Semba, & Fried, 2005), but also all elderly people with weight loss (Jensen & Friedmann, 2002). Nutrition and health promotion programs at federal, state, and local levels for elderly people should be customized and implemented to meet diverse needs of elderly people (American Dietetic Association [ADA], 2000). In order to improve elderly

people's health status as well as weight management, further research is needed to clarify the complex relationship between weight status and obesity-related factors such as socio-demographics, dietary patterns, and health conditions in elderly people. Given that overweight or obese elderly people may have lower quality of life than those who are of normal weight status (Groessl, Kaplan, Barrett-Connor, & Ganiats, 2004), it is urgent to develop a better understanding of factors that improve health status in overweight or obese elderly people.

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