

CORRELATES FOR METABOLIC SYNDROME
AMONG EMPLOYEES AT A
SOUTHEASTERN UNIVERSITY

by

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A DISSERTATION

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ABSTRACT

Presently, it is estimated that thirty-four percent of Americans, over the age of twenty years, have a combination of risk factors known as metabolic syndrome. OBJECTIVES: This study examined the relationship of the risk factors for metabolic syndrome and multiple lifestyle variables. METHODS: Data was collected on 1358 employees from a southeastern university that participated in a wellness program. After controlling for missing variables, 1156 employee records were used to identify the relationship between risk factors for metabolic syndrome and lifestyle variables. Metabolic syndrome risk factors were analyzed along with covariates of demographics and self –reported overall physical health status. RESULTS: Significant relationships were identified to explain lifestyle variables and the cluster of risk factors in metabolic syndrome. CONCLUSIONS: These findings suggest that metabolic syndrome is associated with the modifiable risk factors of sleep and physical activity. Metabolic syndrome is also predictive of poor self-reported overall physical health status. Some findings from this study support previous research efforts, while some are unique to this southeastern population. The findings from this research will translate into health promotion activities aimed at decreasing risks of metabolic syndrome in individuals that are most susceptible.

DEDICATION

This dissertation is dedicated to my family. To my husband, Brent, thank you for your continued support and encouragement. I promise-no more school! To my children Tyler, Turner and Kate, thank you for you for being my inspiration. I pray that you always DREAM BIG and remember that you can do anything you set your mind to do. The sky is the limit!

This work is also dedicated to my parents, Perry and Gayle Turner. You are my lifelong example of unconditional love and support. I am so thankful that I am your daughter and hope that I can be the example to my children that you have always been to me. Your encouragement, not only through this process, but in each step of my life has meant more to me than simple words could ever express.

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LIST OF ABBREVIATIONS AND SYMBOLS

< Less than
= Equal to
≥ Greater than or less than

AHA/NHLBI American Heart Association and the National Heart, Lung and Blood Institute

ICD-9 International Classification of Disease

WHO World Health Organization

NCEP/ATP National Cholesterol Education Expert Panel on Detection, Evaluation and Treatment
of High Blood Cholesterol in Adults Adult Treatment Panel

IDF International Diabetes Federation

NHANES National Health and Nutrition Examination Survey

SHIELD Study to Help Improve Early evaluation and management risk factors Leading to
Diabetes

CHD Coronary Heart Disease

US U.S.

OHPW Office of Health Promotion and Wellness

LIST OF DEFINITIONS

Definitions of the following terms were operationalized for this study:

Blood pressure: The force of blood pushing against the walls of the arteries as the heart pumps blood. Normal blood pressure is considered to be a systolic of 120 over a diastolic of 80. For the purposes of this study, elevated blood pressure in regard to metabolic syndrome is a systolic blood pressure greater than or equal to 130mmHg or a diastolic blood pressure greater than or equal to 85mmHg (National Heart, Lung and Blood Institute, 2011).

Cardiovascular disease: The condition in which heart and blood vessel disease leads to a heart attack, stroke, heart arrhythmias, valvular heart problems or heart failure. These conditions are primarily caused by arteriosclerosis which is plaque that builds up inside arteries which supply blood to the heart and body (National Heart Lung and Blood Institute, 2011).

Diabetes mellitus-Type 2: The most common form of diabetes in which the body does not produce enough insulin or the cells of the body ignore the insulin that is produced. Insulin is necessary for the body to be able to use glucose for energy (Huether & McCance, 2008). Type 2 diabetes is the type of diabetes referred to in this study and an individual that is on blood glucose lowering medications or has a fasting glucose level greater than or equal to 100mg/dl is considered to have diabetes (National Heart Lung and Blood Institute, 2011).

Dyslipidemia: High levels of fat in the blood are dyslipidemia (Huether & McCance, 2008).

High levels of triglycerides or cholesterol are considered dyslipidemia in this study.

Triglycerides greater than or equal to 150mg/dl are considered dyslipidemia for this study.

Also, high density protein cholesterol less than 40mg/dl for men and less than 50mg/dl for women or taking cholesterol lowering medication are also considered dyslipidemia for this study (National Heart Lung and Blood Institute, 2011).

Fasting glucose: The glucose level in the blood after at least eight hours of fasting (Anderson & Anderson, 1990). Fasting plasma glucose levels greater than or equal to 100mg/dL is the benchmark for metabolic syndrome in this study.

Health related quality of life: The aspects of life that can be clearly shown to affect health—being either physical or mental (Idler & Benyamin, 1997).

High-density protein (HDL): Otherwise known as the good cholesterol. These lipoproteins circulate in the blood picking up excess cholesterol and taking it to the liver where it is broken down (Anderson & Anderson, 1990). HDL cholesterol of less than 40mg/dl for men and 50mg/dl in women are the ideal HDL levels. Anything greater than these is considered a positive risk factor for metabolic syndrome in this study.

Hypertension: The term used to describe a prolonged elevation in blood pressure (Story, 2011). A systolic blood pressure greater than or equal to 130 mm Hg and a diastolic blood pressure greater than or equal to 85 is considered a hypertensive risk factor for metabolic syndrome in this study.

Insulin: Protein hormone secreted by the beta cells that functions in carbohydrate and fat metabolism by increasing the cells utilization of glucose (Huether & McCance, 2008).

Insulin resistance: When the body is producing insulin but the cells do not respond appropriately to the insulin (Anderson & Anderson, 1990).

Metabolic syndrome: A condition of unknown cause that presents with symptoms of insulin resistance, obesity, hypertension, dyslipidemia, and systemic inflammation (Huether & McCance, 2008). The definition for metabolic syndrome that is operationalized in this study was developed by the American Heart Association and National Heart and Lung Blood Institute. Three of the five of the following risk factors are needed for diagnosis: waist circumference greater than or equal to 102 cm or 40 inches in men and greater than or equal to 88 cm or 35 inches in women, triglycerides greater than or equal to 150 mg/dl, high-density protein (HDL) cholesterol less than 40 mg/dl for men or less than 50mg/dl for women or taking cholesterol medication, blood pressure greater than or equal to systolic of 130 and diastolic of 85 mmHg or on blood pressure medication, fasting glucose greater than or equal to 100mg/dl or on glucose medication.

Obesity: An overweight adult who has a basic metabolic profile greater than 30 is considered obese (Centers for Disease Control, 2011).

Stroke: When a blood vessel that supplies the brain tissue is blocked or bursts. Once this happens the brain cannot get the blood supply that it needs and begins to die (Huether & McCance, 2008).

Triglycerides: Fat in the blood stream. Normal triglyceride levels are less than 150 mg/dL (Story, 2011). The operational definition for metabolic syndrome risks utilized in this study is triglyceride levels greater than or equal to 150mg/dl.

Waist circumference: Measurement obtained around the abdominal cavity directly above the upper hip bone (Anderson & Anderson, 1990). The operational definition for metabolic syndrome risks utilized in this study is a waist circumference measured at the upper hip bone of greater than or equal to 102 cm or 40 inches in men and greater than or equal to 88 cm or 35 inches in women.

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CHAPTER 1

INTRODUCTION

The concept of the metabolic syndrome was first explained by a Swedish physician, Kylin, in the 1920s. In 1936, H.P. Himsworth recognized the defects of insulin and the harmful effect on body systems. In 1988, Gerald Reaven called the cluster of metabolic risk factors “syndrome X” (Rountree, 2010) and at this point the medical community began to take notice (Eckel, Grundy, & Zimmet, 2005). Reaven identified the metabolic risk factors as predisposing individuals to cardiovascular disease, diabetes mellitus and stroke (Franco et al., 2009). Over the years, other terms have been used to describe the cluster of risk factors such as “the insulin resistance syndrome” and the “deadly quartet” (Eckel, Grundy, & Zimmett, 2005). The diagnostic criteria that form the basis for metabolic syndrome are common abnormalities and when combined together form a web like interaction that increases morbidity and mortality (Rountree, 2010). The risk factors include dyslipidemia, obesity, hypertension, and insulin resistance.

Syndrome X is now known as metabolic syndrome. Presently, it is estimated that 34 percent of Americans, over the age of 20 years, have a combination of these risk factors and therefore have metabolic syndrome (Ervin, 2009). In some areas of the U.S., such as those with a large number of American Indians, metabolic syndrome affects 50 percent of the population (Sinclair, Bogart, Buchwald, & Henderson, 2011). Over two thirds of adolescents have been shown to have at least one metabolic abnormality that will track into adulthood leading to the

development of metabolic syndrome in later years (De Ferranti et al., 2004). Moreover, in the past two decades, an alarming increase in the number of people with metabolic syndrome has been identified worldwide (Ford, Giles, & Mokdad, 2004). This striking increase in the number of individuals directly correlates with the epidemic of obesity and diabetes that we have seen over the same time period (Roger et al., 2011).

Individuals that have the constellation of risk factors known as metabolic syndrome have been shown to have higher morbidity and mortality rates resulting from cardiovascular disease and type 2 diabetes than those who do not have metabolic syndrome (Lewis et al., 2008). Cardiovascular disease and type 2 diabetes are two of the leading causes of death in the U.S. (Lloyd-Jones et al., 2010). The 2006 death rate from cardiovascular disease in the U.S. was 262.5 deaths per 100,000. In particular, Alabama ranks second in death rates with an average 326.9 people per 100,000 for cardiovascular disease, second only to Mississippi at 349.7 deaths per 100,000 (Agency for Healthcare Research and Quality, 2011).

In regard to diabetes in southeastern states, the picture is very similar. Based on the Behavioral Risk Factor Surveillance System from 2010, Alabama has a 13.2 % statewide incidence of diabetes compared to the national incidence of 8.7%. Similarly, Mississippi has a 12.4% incidence of diabetes (Centers for Disease Control, 2010). Alabama leads the nation in the number of individuals with diabetes (Kaiser Family Foundation, 2011). The latest known death rate associated with diabetes in Alabama was 20.6 per 100,000 in Caucasians and 52.0 per 100,000 in African Americans compared to the national rate of 19.9 per 100,000 in Caucasians and 40.5 per 100,000 in African Americans (Kaiser Family Foundation, 2011). When clustering

of cardiovascular and diabetic risk factors occurs as they do in metabolic syndrome, the prognosis is often worse (Malik et al., 2004).

The importance of diagnosing individuals with metabolic syndrome was recognized by the U.S. medical community and the National Center for Health Statistics when the International Classification of Disease (ICD-9) was established in 2001 for metabolic syndrome. The code that was assigned to metabolic syndrome and is currently being used is 277.7 (Reynolds, Muntner, & Fonseca, 2005). Diagnostic criteria have been developed by various organizations including the World Health Organization, the European Group for the Study of Insulin Resistance, the National Cholesterol Education Program-Third Adult Treatment Panel and the American Heart Association and National Heart, Lung and Blood Institute (AHA/NHLBI). All groups agree on the core components of metabolic syndrome but have different clinical criteria that identify individuals with the syndrome (Alberti, Zimmett, & Shaw, 2006).

Currently, the AHA/NHLBI definition is the most widely used in clinical practice due to the inclusion of individuals for diagnosis that are on medications for the treatment of hypertension, hyperlipidemia or hyperglycemia (Grundy et al., 2004). The AHA/NHLBI standard for metabolic syndrome risk criteria are based on: waist circumference (greater than or equal to 102 cm in men or 40 inches; greater than or equal to 88 cm in women or 35 inches), triglycerides (greater than or equal to 150 mg/dL), high-density protein also known as HDL cholesterol (less than 40 mg/dL for men or less than 50 mg/dL for women, or taking cholesterol medication), blood pressure (systolic greater than or equal to 130 mmHg or diastolic greater than or equal to 85 mmHg or taking blood pressure medication), and fasting glucose (greater than or

equal to 100 mg/dL or taking glucose medication (Grundy et al., 2004). An individual needs a minimum of three of these five criteria to receive the metabolic syndrome diagnosis.

Unfortunately, almost 50 million Americans meet the diagnostic criteria for metabolic syndrome (Roger et al., 2011; Ford, Giles, & Dietz, 2002). While the cases of metabolic syndrome are high, public knowledge of the disease is low (Lewis et al., 2008). In a longitudinal study entitled SHIELD, that evaluated the health knowledge, attitudes and behaviors of those at risk for diabetes, only 0.6% of the total sample (n=211,097) reported receiving a diagnosis of metabolic syndrome (Lewis et al., 2008). This percentage is in contrast to those that actually met diagnostic criteria for metabolic syndrome. Therefore, this is evidence that an urgent need exists to disseminate knowledge and awareness of the syndrome.

Not only does metabolic syndrome predispose individuals to early mortality due to diabetes or coronary vascular disease, metabolic syndrome is correlated with depression, poor health related quality of life, loneliness, socioeconomic status, and increased healthcare utilization costs. Metabolic syndrome and depression were studied by Miettola, Niskanen, Viinamaki, and Kumpusalo in 2008. The research found that Finnish participants with metabolic syndrome scored higher on items from the Beck Depression Inventory than participants without metabolic syndrome. The same study found that a decreased health related quality of life was associated with metabolic syndrome (Miettola, Niskanen, Viinamaki, Sintoneen, & Kumpusalo, 2008). In another study, Whisman (2010) found loneliness was also related to metabolic syndrome in a population of 3,211 adults. In this study, greater loneliness was associated with each additional risk factor of metabolic syndrome. Likewise, metabolic syndrome was associated with poor health related quality of life in an Iranian population. Using the Short Form

Health Survey (SF-36) health related quality of life was assessed. Women with metabolic syndrome showed significant differences in physical functioning, body pain and social functioning (Amiri, Hosseinpah, Rambod, Montazeri, & Fereidoun, 2010).

Metabolic syndrome has been directly linked to low socioeconomic status. In the Atherosclerosis Risk in Communities Study (ARIC), low lifelong socioeconomic status placed an individual at risk for developing metabolic syndrome (Chichlowska et al., 2009). These results were duplicated by Loucks, Rehkopf, Thurston, and Kawachi (2007), using NHANES data from 1999-2002. Correlation between lower socioeconomic position and high rates of metabolic syndrome in women was found (Loucks et al., 2007). Efforts to understand the association of low socioeconomic status may prove insightful to the reduction of metabolic syndrome.

Medical expenses associated with metabolic syndrome continue to increase health care cost utilization. Boudreau et al. (2009) compared health care cost in a diverse population of three health care delivery systems in the northwestern U.S.. Of the 170,648 enrollees of the health care plans, 98,091 had metabolic syndrome. This study found that those with metabolic syndrome had \$2,000.00 more per year in expenses annually than those without metabolic syndrome. This study also showed a 24% increase in health care utilization cost with each additional risk factor. The subjects with metabolic syndrome had more inpatient hospitalizations, primary care visits, and pharmacy expense in a two year period of time (Boudreau et al., 2009). While metabolic syndrome increases health care cost significantly, each individual metabolic syndrome component has been associated with higher cost, independent of the other components and without association of diabetes and cardiovascular disease (Nichols & Moler, 2011).

Purpose

The purpose of this research is to determine if there is significant differences in participants with metabolic syndrome and participants that do not meet the criteria for metabolic syndrome in relation to the modifiable risk factors of smoking, physical activity and sleep. Another goal of this research is to determine if the population of individuals classified as having metabolic syndrome, based on the AHA/NHLBI diagnostic criteria, has deficiencies in their self-reported overall feeling of health compared to individuals without metabolic syndrome. This study also seeks to identify if there are common demographic, psychosocial, or physical variables that predict metabolic syndrome. Finally, waist circumference and BMI will be compared to determine which one best predicts metabolic syndrome in this employee population.

Significance of the Study

This study will dissect the characteristics of an employee population at a southeastern university participating in wellness screenings to identify those with the diagnostic criteria of metabolic syndrome. Once the participants with the syndrome are determined, the study will then focus on the identification of possible clusters of individuals that have a higher risk of developing metabolic syndrome. Identification of subsets of the overall population will enable future program development that targets the needs of those individuals with an overall goal of decreasing metabolic risks. In addition, this will be the first known study to compare the presence of metabolic syndrome with self -reported perceived overall physical health in a southeastern population.

Within the U.S., much of the metabolic syndrome research has focused on the diagnostic factors associated with the syndrome. Little attention has been given to comparing the characteristics of individuals with and without metabolic syndrome. Identifying the characteristics of the individuals with metabolic syndrome will enable the development of health promotion strategies that target metabolic syndrome risks for specific groups. This is a vital initial step in an effort to increase the knowledge, attitudes and behaviors of individuals with metabolic syndrome.

Research Questions

- 1) Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to smoking, physical activity and sleep?
- 2) Are there significant differences in self-reported overall physical health status in participants who have metabolic syndrome and participants who do not have metabolic syndrome?
- 3) Are demographic, psychosocial or physical variables predictors of metabolic syndrome?
- 4) Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?

Limitations

There are several limitations to note in this study. The first limitation is that it utilizes data collected from wellness screenings. The screenings are conducted by numerous individuals

of the wellness staff. Due to the fact that different individuals collect the data, slight variability in measurements such as blood pressure, waist circumference, height and weight are possible.

The second limitation is that individuals that volunteer to participate in wellness screenings may differ from individuals that choose not to participate. Healthier individuals may be more likely to participate in wellness screenings. Sogaard, Selmer, Bjertness and Thelle (2004) found in the Oslo Health Study that self-selection, according to socio-demographic variables, had little impact on prevalence estimates, but unhealthy persons participated less in the research than healthy individuals.

Self-reported data is the third limitation to mention. Individuals may report information that is deemed socially acceptable to the researcher instead of their true medical situation (Cook & Campbell, 1979). Previous studies have been successful in relying on self-reported data and have shown it to be a reliable method to utilize (Bourgeois et al., 2007; Simpson et al., 2004). In regard to research in the area of metabolic syndrome identification, Schultz and Edington (2009) utilized self-reported data in secondary analysis.

A fourth limitation is that the data is cross-sectional. The nature of the design of this study does not provide a historical perspective. This study is primarily a prevalence study and cause and effect cannot necessarily be determined. Conclusions are drawn from results of the population at one particular time.

The final limitation to mention is in regard to blood work obtained for the study. Some of the participants in the initial screenings had blood obtained from venipuncture compared to other individuals that had finger sticks for blood collection. In a recent statement regarding

employee health screenings, the finger stick method was shown to be a reliable method for identifying individuals at risk. The finger stick method provides a basis for information regarding the next steps an individual needs to take regarding health (Pennington, 2010). Results are available to the employee at the health screening. Although the finger stick method for cholesterol and glucose measurements is certainly an acceptable method for identifying health risks, venipuncture is still the preferred method if blood values other than cholesterol or glucose level are needed. Venipuncture can also be used if there is concern over the finger stick results (Pennington, 2010).

Delimitations

This study will be delimited to employees of The University of Alabama that have voluntarily participated in wellness screenings conducted through the Office of Health Promotion and Wellness at The University of Alabama. In order to be included in the research, individuals must be at least 19 years of age. Screening information will be included only if they signed a written informed consent for their information to be used for research purposes.

CHAPTER 2

REVIEW OF LITERATURE

The primary purpose of this chapter is to present a systematic review of the literature pertinent to this study. The major topics of review are (1) a historical perspective of metabolic risk factor clustering and the evolution of metabolic syndrome; (2) the most commonly used definitions to identify individuals with metabolic syndrome; (3) metabolic syndrome as a precursor to chronic diseases; (4) the current national and international prevalence estimates of metabolic syndrome; (5) the benefits of prevention and treatment of metabolic syndrome in an employee population; (6) perceived health in those with metabolic syndrome; and (7) strengths, weaknesses, and recommendations for current and future research endeavors.

Metabolic Syndrome

First recognized in 1920 and then given a description in 1936 by H.P. Himsworth, metabolic syndrome was categorized as a defect of insulin. However, it was not named until Gerald Reaven referred to it as “syndrome X” in 1988 (Rountree, 2010). Other terms used to describe the cluster of risk factors have been “the insulin resistance syndrome” and the “deadly quartet” (Eckel, Grundy, & Zimmett, 2005). The World Health Organization (WHO), in 1998, recommended the development of a universal definition and changed the name from syndrome X to metabolic syndrome (Alberti, Zimmet, & Shaw, 2006). Presently, metabolic syndrome remains the term used to describe the clustering of risk factors that result in cardiovascular

disease and diabetes. Metabolic syndrome is a health care crisis of epidemic proportion that western industrialized societies are facing and it is imperative that it is addressed in order to preserve the health and wellbeing for generations to come (Falentin, 2010). With metabolic syndrome a major health concern in the American population, Alabama is not immune to the growing number of individuals with the syndrome. According to the Alabama Behavior Risk Factor Surveillance System, in 2009 approximately one third of adults over 20 years of age met the criteria for metabolic syndrome with a 30.9% obesity rate ($BMI >30$), with 12.3% having diabetes, 37.2% reporting hypertension, and 39.9% having a high blood cholesterol.

Just as there are a number of names that have been given to metabolic syndrome, there are also varying definitions. The four most common definitions used all have similar characteristics related to obesity, diabetes and cardiovascular disease. The World Health Organization (WHO), the Third Report of the National Cholesterol Education Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), the International Diabetes Federation (IDF) and the American Heart Association and National Heart and Lung and Blood Institute (AHA/NHLBI) have similar definitions of what parameters constitute the metabolic syndrome (See Table 1). The lack of a single uniform definition is both a strength and a limitation for its use in clinical practice and research (Tenenbaum & Fisman, 2011). The value is in the identification of morbidity and mortality with several operational definitions to target early intervention (Ardern & Janssen, 2007). However, with the various definitions, there has been argument that without one clear diagnostic definition it will be difficult to integrate identification of the syndrome into clinical practice (Reilly & Rader, 2003).

World Health Organization

The WHO proposed a definition of metabolic syndrome that includes specific criteria in 1998. The WHO's definition relies heavily on insulin resistance and requires insulin resistance as a component for diagnosis. The WHO lists as criteria for metabolic syndrome a diagnosis of diabetes mellitus (DM), impaired glucose tolerance, impaired fasting glucose or insulin resistance plus two or more of the following:

- Blood Pressure greater than or equal to 140/90 mmHG
- Triglycerides greater than or equal to 150 mg/dL and or a HDL for men less than 35 mg/dL and for women less than 39 mg/dL
- A waist hip ratio greater than .90 for men and greater than .85 for women and or a BMI greater than 30 kg/m²
- Microalbuminuria indicated by urinary albumin excretion of greater than or equal to 20 ug/minute or creatinine ratio greater than 30 mg/g

The WHO's definition is based on the assumption that insulin resistance or impaired glucose utilization is the common denominator in the syndrome and must be present for diagnosis as described in the criteria (Alberti, Zimmet, & Shaw, 2006).

National Cholesterol Education Panel and the Adult Treatment Panel

In 2001, the National Cholesterol Education Panel and the Adult Treatment Panel (NCEP/ATP) guidelines for metabolic syndrome were released and they focus more on

diagnosing metabolic syndrome in clinical practice. The NCEP/ATP guidelines state that metabolic syndrome can be diagnosed when a person has three of the five of the following characteristics:

- Fasting glucose greater than 100 mg/dL
- Blood Pressure greater than or equal to 130/85 mmHG
- Triglyceride level greater than or equal to 150 mg/dL
- HDL cholesterol level of less than 40 mg/dL for men and less than 50mg/dL for women
- Waist circumference greater than 102 cm for men and greater than 88cm for women

The NCEP/ATP definition utilizes waist circumference as the measure for obesity (Eckel, Grundy, & Zimmet, 2005).

International Diabetes Federation

The IDF guidelines, released in 2005, are similar to the WHO and the NCEP/ATP guidelines but primarily stress the role of insulin resistance and central obesity in relation to the metabolic syndrome. In addition, the IDF definition includes ethnic specific criteria for waist circumference measurements (Alberti, Zimmet, & Shaw, 2005). This ethnic specific criteria for central obesity often accounts for higher estimates of metabolic syndrome than other definitions (Ford, 2005b). The IDF guidelines include:

- Waist circumference greater than or equal to 94 cm in men and greater than or equal to 80 cm in women of European descent **and two** of the following:

- Triglyceride level greater than 150 mg/dL or on lipid lowering medications
- HDL cholesterol of less than 40 mg/dl for men and less than 50 mg/dL in women or on lipid lowering medications
- Systolic blood pressure greater than or equal to 130 mmHg or diastolic blood pressure greater than or equal to 85 mmHg or on blood pressure medications
- Fasting plasma glucose greater than or equal to 100 mg/dL or on medications to treat diabetes

American Heart Association and the National Heart, Lung, and Blood Institute

Currently, the American Heart Association and National Heart and Lung and Blood Institute (AHA/NHLBI) criteria are being used because they include blood pressure, cholesterol and blood sugar medications and they are much easier to follow in a healthcare setting. This standard has been very effective in risk determination (Shultz & Edington, 2009). The standards for metabolic syndrome risk criteria are based on an individual having at least three out of five of the following:

- Waist circumference greater than or equal to 102 cm or 40 inches in men and greater than or equal to 88 cm or 35 inches in women
- Triglycerides greater than or equal to 150 mg/dL
- High-density protein (HDL) cholesterol less than 40 mg/dL for men or less than 50 mg/dL for women or taking cholesterol medication
- Blood pressure greater than or equal to systolic of 130 mmHg and diastolic of 85 mmHg or on blood pressure medication

-Fasting glucose greater than or equal to 100 mg/dL or on glucose medication (Grundy et al., 2004).

The criteria utilized to determine if an individual has metabolic syndrome have evolved over time. Studies have been done to compare the relative accuracy of each set of criteria and all have been found to identify metabolic syndrome accurately (Eckel, Grundy, & Zimmet, 2005). While the definitions consistently identify metabolic syndrome, the difference lies in the percentage of the population with metabolic syndrome due to the differences in screening criteria (Alberti, Zimmet, & Shaw, 2006).

The AHA/ NHLBI definition tends to include a larger percentage of the population when it is being utilized based on the inclusion of individuals on pharmaceutical treatment. Also, some of the guidelines are easier to apply in a practice based clinic setting than others. Due to the fact that the AHA/NHLBI criteria are currently being utilized in clinical research and that these criteria include the individuals that are presently on medications, these will be utilized in this study to determine the population with metabolic syndrome (Day, 2007).

Table 1

Comparison of Commonly Used Definitions for the Metabolic Syndrome

Components	WHO (modified)	NCEP/ATP	IDF	AHA/NHLBI
Insulin Resistance	Present	_____	_____	_____
Impaired fasting glucose, or impaired glucose tolerance mg/dL, or medication	Type 2 DM, IFG or IGT	> 100	≥ 100 or on glucose lowering medications	≥ 100 or on glucose lowering medications
Waist Circumference or Waist Hip Ratio (WHR)	WHR > 0.9 for men and > 0.85 for women	> 102 cm for men > 88 cm for women	≥ 94 cm in men of European descent ≥ 80 cm in women of European descent	≥ 102 cm in men ≥ 88 cm in women
Body Mass Index kg/m ²	> 30	_____	_____	Or a BMI > 30
Blood Pressure (mmHg)	≥ 140/90	≥130/85	Systolic ≥ 130 Or Diastolic ≥ 85 or on blood pressure lowering medications	≥ 130/85 or on blood pressure lowering medications
Triglycerides (mg/dL)	≥ 150	≥ 150	≥ 150 or on lipid lowering medications	≥ 150
High Density Lipoproteins (mg/dL)	< 35 for men and < 39 for women	< 40 for men< 50 for women	< 40 for men < 50 in women or on lipid lowering medications	< 40 for men < 50 for women Or taking lipid lowering medications

Number of components for diagnosis	Must have Insulin Resistance or IFG or IGT Or Type 2 DM plus ≥ 2 others	≥ 3 of the components	Central obesity measured by waist circumference plus ≥ 2 other components.	≥ 3 of the following components
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Key: WHO=World Health Organization; NCEP/ATP= National Cholesterol Education Program/Adult Treatment Panel III; IDF=International Diabetes Federation; AHA/NHLBI=American Heart Association/National Heart, Lung, Blood Institute

Components of the AHA/NHLBI Definition

Waist circumference greater than or equal to 102 cm or 40 inches in men and greater than or equal to 88 cm or 35 inches in women. Central obesity, measured by waist circumference, is highly correlated with chronic disease and the risk for chronic disease (Lee, Bacha, & Arslanian, 2006). Waist circumference measurement is cost effective and non-invasive but is underutilized in the clinical setting (Smith & Haslam, 2007).

Triglycerides greater than or equal to 150 mg/dL. Triglycerides are a type of fat. Elevated triglycerides are a risk factor of coronary heart disease independent of any other risks. High triglyceride levels have been shown to significantly increase cardiovascular disease in men and women. In combination with high LDL cholesterol and low HDL cholesterol, elevated triglycerides can increase cardiovascular risks exponentially (Cullen, 2000). It is imperative that high triglyceride levels are addressed to decrease metabolic syndrome and cardiovascular disease.

High-density protein (HDL) cholesterol less than 40 mg/dL for men or less than 50mg/dl for women or taking cholesterol medication. HDL cholesterol is considered the “good cholesterol.” HDL cholesterol actually aids in the removal of harmful cholesterol from the body. The higher the HDL level, the more protection against cardiovascular disease (Huether & McCance, 2008).

Blood pressure greater than or equal to systolic of 130 mmHg and diastolic of 85 mmHg or on blood pressure medication. Blood pressure is the force of blood against the walls of the arteries and is recorded by two numbers. The systolic is the top number and indicates the pressure as the heart beats. The diastolic is the lower number and indicates the pressure as the heart relaxes between beats. An individual can have an elevated blood pressure without any symptoms. Over time, damage can be done to the heart, blood vessels and kidneys (Huether & McCance, 2008).

Fasting glucose greater than or equal to 100 mg/dL or on glucose medication. Glucose is the main source of energy used in the body. In order to utilize glucose in the body, insulin is needed to transport glucose in the cell. After meals, it is common for an elevation in glucose to occur. However, insulin is released to counterbalance this rise in glucose. When there is too much blood glucose circulating in the blood for a period of time, long term damage to the blood vessels, eyes, kidneys and nerves can occur (Huether & McCance, 2008).

Guidelines for Treatment

Primary management strategies for the metabolic syndrome are healthy lifestyle promotion through physical activity and dietary calorie restriction (Alberti, Zimmet, & Shaw,

2005; Gundy et al., 2005; Alberti et al., 2006). Marked clinical benefits for decreasing the risk of diabetes and resolving the metabolic syndrome have been shown in the Diabetes Prevention Program Research Group and the Finnish Diabetes prevention study when someone begins intensive lifestyle interventions (Orchard et al., 2005 ;Tuomilehto, Lindstrom, Eriksson, & Valle, 2001). In these studies, changes in diet and physical activity habits were initiated in an effort to change the lifestyle of the individual. The changes noted by the participants were effective in alleviating the metabolic risk factors and diabetes.

In a study conducted by Anderssen, Carroll, Urdal, and Holme (2007), the researchers examined the single and combined effects of a one-year diet and exercise intervention in individuals that met the diagnostic criteria for metabolic syndrome. In this randomized, controlled trial, individuals were in one of four groups: diet alone, exercise alone, a combination of diet and exercise or the control group. At the conclusion of the one-year trial, the diet and exercise group showed the most dramatic decrease in metabolic syndrome with 67.4 percent of this group no longer having metabolic syndrome. The second largest reduction in metabolic syndrome was in the diet only group with a 35.3 percent reduction. The exercise only group and the control group did not have significant decline in the metabolic syndrome. Therefore, a combination of dietary changes alongside an increase in physical activity is the most effective treatment.

With metabolic syndrome and the complex nature of the different diagnostic criteria that any group of individuals may have, it is helpful to understand the best treatment recommendations for each risk factor. Current recommendations for the treatment of low HDL levels or high triglyceride levels are a change in diet to include foods low in saturated fat and

cholesterol along with caloric restriction. Physical activity is also encouraged as part of the management. Recommendation is to participate in physical activity for at least 30 minutes a day five days a week. When these are not effective, medication management is then initiated (Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, 2001).

In regard to elevated blood pressure, weight loss and sodium restriction are the most important to address due to the propensity of the affected persons being overweight or obese. Therefore, moderate weight loss followed by drug therapy for blood pressure control is the current treatment recommendation (Wilson & Grundy, 2003).

Elevated glucose levels are extremely common in individuals with metabolic syndrome (Wilson & Grundy, 2003). With higher than normal glucose levels, the most recent studies have shown that while medication is effective, lifestyle changes have the most dramatic effect (Tuomilehto et al., 2001). A reduction in fat intake, an increase in fiber intake, and regular exercise have all been shown to decrease Type 2 diabetes risk factors when these lifestyle modifications are maintained (Wilson & Grundy, 2003).

In regard to the increased waist circumference associated with obesity, lifestyle modification and weight reduction are the most important areas in which to focus (Riccardi & Rivelles, 2000). When weight reduction occurs, often the other metabolic risks will be reduced due to increased weight being a common denominator in increased lipid levels, hypertension and high glucose levels.

Importance

While awareness of a problem does not always correlate with behavior change, it is agreed that awareness is often the first step in lifestyle modification (Zhu, St-Onge, Heshka, & Heymsfield, 2004). With metabolic syndrome, awareness has been shown to be a barrier (Frisman & Bertero, 2008). In data obtained from the 1999-2002 National Health and Nutrition Examination Survey (NHANES), the prevalence of metabolic syndrome was shown to be 25.9% in the adult population of the U.S. In the most recent report of NHANES data from 2003-2006, the prevalence was reported to be 34% of the adult population greater than twenty years of age (Ervin, 2009). The NHANES percentages are based off of data collected using clinical laboratory criteria. Interestingly, in a 2004 longitudinal population based survey entitled the Study to Help Improve Early Evaluation and Management Risk Factors Leading to Diabetes (SHIELD), only 0.6% of the overall population surveyed (211,097) self-reported a diagnosis of metabolic syndrome (Lewis et al., 2008). The discrepancy of individuals with three of the five diagnostic criteria for metabolic syndrome and individuals that self-report metabolic syndrome provides insight into the U.S. adults' awareness of metabolic syndrome. So the question is posed as to why there is such a high prevalence of metabolic syndrome in the U.S., yet individuals do not recognize the term metabolic syndrome or better yet know what it is.

While metabolic syndrome has been identified as a syndrome since the 1980s and the diagnostic variables are measured daily in clinical practice, there remains a disconnect with the number of Americans with the syndrome and the layperson knowledge of the disease. It is true that workable diagnostic criteria give clinicians an opportunity to assess risk; the assessment is worthless if the information is not communicated to the individual at risk. Knowledge of

metabolic syndrome is only the first step. Preventing coronary vascular disease and diabetes requires that the individual possess adequate knowledge as well as an understanding of the syndrome's risks and the implications on their long term health and wellness. Only with understanding comes a chance for the initiation of lifestyle modification (Barriga, Branco, Chedraui, Hidalgo, & Veas, 2008).

In the Shape of the Nation survey, one hundred primary care physicians were interviewed. Fifty-eight percent of the physicians recognized that abdominal obesity was a significant risk factor contributing to major diseases such as diabetes and coronary vascular disease; however, 45% reported never measuring waist circumference (Smith, 2007). This demonstrates the need to increase knowledge, not only in the general public, but also to health care providers that are at the forefront of disease prevention.

Increased waist circumference and BMI are often recognized as being two of the most common metabolic syndrome risks. It is important to note that individuals in the normal weight and BMI categories are often at risk for metabolic syndrome also. These individuals may have other metabolic risks but have a normal weight and normal BMI. It is imperative that in public health encounters, everyone should be screened for the cluster of symptoms that will predispose them to diabetes and coronary disease (Hadaegh, Bozorgmanesh, Safarkhani, Khalili, & Azizi, 2011).

With little reported research regarding knowledge of metabolic syndrome in the U.S. population, other than the SHIELD study, it is uncertain if knowledge of metabolic syndrome would change attitudes and behavior targeting lifestyle modification. The SHIELD study suggests that knowledge of metabolic syndrome is very limited in the U.S. Given that the

prevalence of metabolic syndrome is considerably higher than the self-reported results of the population, a gap in knowledge can be assumed (Smith, 2007). With this lack of knowledge and awareness of the syndrome, combined with the correlating risk of chronic disease, there is no question as to why one third of the American population is thought to have metabolic syndrome. Individual knowledge, attitudes and behavior play a large role in managing and preventing metabolic syndrome and chronic disease (Lewis et al., 2008).

Early identification of individuals with metabolic syndrome is vital to prevent progression to type 2 diabetes and cardiovascular disease (Scott, 2003). It is imperative to identify individuals at risk for the development of these chronic diseases. Identifying metabolic syndrome is a first step to intervene and decrease risk factors before chronic disease develops.

Comorbidities that Cluster in the Metabolic Syndrome

Cardiovascular Disease and Metabolic Syndrome

Cardiovascular disease is a disease of the heart and blood vessels that encompasses many problems which arise from atherosclerosis. Atherosclerosis occurs when plaque builds up on the walls of the arteries. The plaque then leads to an individual suffering from a heart attack, stroke, heart failure or life threatening heart arrhythmia (Huether & McCance, 2008). According to the American Heart Association, approximately every 25 seconds an American will have a coronary event, and approximately every minute, someone will die of a coronary event (Roger et al., 2011). Coronary heart disease caused 1 of every 6 deaths in the U.S. in 2007 (Roger et al., 2011). The state of Alabama has the highest age adjusted death rate from cardiovascular disease with 350 deaths per 100,000 related to a cardiovascular event (Center for Disease Control, 2011).

With the increasing prevalence of metabolic syndrome in the U.S., there is a parallel increase in the development of diabetes and cardiovascular disease. Individuals that have at least three of the five criteria for metabolic syndrome have a higher risk for mortality at a younger age (Ford, 2004). For example, if an individual has four of the five criteria or five of the five criteria for metabolic syndrome, there is a direct increase in mortality with each additional risk (McNeill et al., 2005). Likewise, with each additional component of the metabolic syndrome the healthcare cost increases at a rate of 24% (Roger et al., 2011). With this knowledge of the long-term complications due to the clustering of metabolic risk factors, it is imperative that individuals are identified and long-term health modifications addressed.

The most common risk factors for cardiovascular disease are hypertension, obesity and high cholesterol levels which are all diagnostic criteria for metabolic syndrome. Data from the National Health and Nutrition Examination Survey (NHANES) 2005–2008 indicates that 33.5% of U.S. adults 20 years of age have hypertension. The estimated prevalence of overweight and obesity in U.S. adults 20 years of age or older is 67.3%. An estimated 15% of adults 20 years of age or older have total serum cholesterol levels 240 mg/dL or higher (normal is less than 200 mg/dL). Cholesterol levels of 240 mg/dL or higher places an individual at twice the risk of coronary heart disease than an individual whose level is less than 200mg/dL (McNeil et al., 2005). Any one of these health problems alone places an individual at risk for a shortened life span. Similarly, a clustering of these problems, as in metabolic syndrome, places an individual in a very dangerous health situation.

An individual with metabolic syndrome is two to four times more likely to develop cardiovascular disease than an individual without metabolic syndrome, over a ten-year period of

time (Lakka et al., 2002). Many times an individual will have an elevation in one of the risk factors for several years prior to major disease development. This is when an interventional health strategy should be initiated. Early risk factor identification is necessary to avoid long-term health complications. Lifestyle modification and risk reduction on one metabolic risk factor can make the difference in someone avoiding cardiovascular disease (Klein, Klein, & Lee, 2002).

Metabolic syndrome has been shown to increase the risk of a significant cardiovascular event such as a myocardial infarction or stroke (Ninomiya et al., 2004; Gami et al., 2007; Isomaa et al., 2001). Research has also concluded that once an individual meets the diagnostic guidelines for metabolic syndrome, their cardiovascular disease risk increases significantly (Meigs et al., 2003). Metabolic syndrome is associated with twice the likelihood of development of congestive heart failure (Li, Ford, McGuire, & Mokdad, 2007). Regardless of the metabolic syndrome definition utilized in previous research, coronary events and cardiovascular disease are consistently seen at higher rates in those with metabolic syndrome. With each additional risk factor above the minimum of three, cardiovascular disease risk increases significantly (Dekker et al., 2005).

Diabetes and Metabolic Syndrome

Diabetes, more specifically type 2 diabetes, is when the body does not produce enough insulin or the cells of the body do not recognize and utilize the glucose effectively (Huether & McCance, 2008). Due to the fact that type 2 diabetes accounts for 90-95% of all diagnosed diabetes cases, this paper will be referring to type 2 diabetes when the term diabetes is used (Huether & McCance, 2008). Among U.S. residents older than 65 years of age, 26.9% had

diabetes in 2010 and in the age group of greater than 20 years of age the percentage of those affected by type 2 diabetes was 11.3% in 2010. Another staggering statistic in 2010 was that the age group of 45-64 years of age was the fastest growing population of newly diagnosed type 2 diabetics with 1.9 million diagnosed in 2010. Diabetes is the seventh leading cause of death in the U.S. and is preventable with lifestyle modification (Centers for Disease Control, 2011).

If an individual is found to have metabolic syndrome, the risk for diabetes increases five-fold (Alberti et al., 2009). In the Framingham Offspring Study, out of 4,000 participants, approximately 60% of the males and 45% of the females with metabolic syndrome at baseline developed type 2 diabetes over an eight-year period of time (Wilson, Agostineo, Parise, Sullivan, & Meigs, 2005). Likewise, in a population-based trial in Beaver Dam over a 7-year period of time, out of 4000 participants with metabolic syndrome, 17.9% developed diabetes at follow up (Klein, Klein, & Lee, 2002). Early identification of those that have glucose utilization impairment or insulin sensitization issues that are common in metabolic syndrome must be identified and lifestyle modification activities initiated.

With the diabetic population, many times blood glucose levels will be elevated long before diabetes is diagnosed. When this occurs, long-term damage to blood vessels, eyes, coronary circulation, the nervous system and the skin has occurred. If elevated blood glucose levels are identified earlier, significant health complications can be averted (Huether & McCance, 2008). Metabolic syndrome has been shown to be a stronger predictor of diabetes than coronary vascular disease (Resnick, Jones, Ruotolo, & Jaine, 2003) and diabetes can be avoided if identified in the pre-diabetes phase. Sattar et al. (2003) showed that as individuals collect additional components of metabolic syndrome, diabetes development is inevitable.

Ford (2005a) conducted a literature review of prospective studies from 1998-2004 to determine the risks for all-cause mortality, cardiovascular disease and diabetes associated with metabolic syndrome. In regard to diabetes, Ford identified that those with metabolic syndrome had a 30-52% increase in the incidence of diabetes. The development of diabetes occurred anywhere from three to thirteen years after metabolic syndrome was identified.

The development of diabetes as a result of the metabolic syndrome does not discriminate on gender or race. Diabetes development as a result of metabolic syndrome has been consistently seen in Caucaisan, African American, Hispanics, different Indian populations, as well as other countries outside of the U.S. (Resnick, Jones, Ruotolo, & Jain, 2003; Hanson, Imperatore, Bennett, & Knowler, 2002; Mozumdar & Liguori, 2011b). This is important due to the blended population of a University setting with a large and diverse faculty and staff.

Often in the clinical setting, an individual is identified as being at risk for the development of diabetes by an impaired glucose tolerance test or a fasting glucose test that is elevated. Lorenzo et al. (2003) showed that while these clinical studies detect individuals at risk for diabetes, screening for the metabolic syndrome and identifying metabolic syndrome is more prognostic in identifying individuals on a trajectory of developing type 2 diabetes. In individuals that develop type 2 diabetes, the average time that they have had metabolic syndrome prior to type 2 diabetes development was averaged to be eight years. Lifestyle interventions, when initiated in this window of time, can ameliorate the development of type 2 diabetes (Wilson et al., 2005).

Metabolic Syndrome Risk Factor Clustering

Utilizing the AHA/NHLBI definition for metabolic syndrome, an individual needs at least three of the five risks to have metabolic syndrome. It has been shown that the clustering of these risk factors predisposes individuals to chronic diseases but also decreases their lifespan. For each addition of a risk factor, four out of five or five out of five, the lifespan decreases with each additional risk factor (Satter et al., 2003). Once diabetes develops along with metabolic syndrome, the prevalence of coronary heart disease markedly increases from a rate of 37% disease development without diabetes to 55% increase in disease development (Alexander, Landman, Teutsch, & Haffner, 2003).

Metabolic Syndrome and other disease processes

While the major disease risks associated with metabolic syndrome are coronary heart disease and diabetes, metabolic syndrome has been linked to depression, chronic kidney disease and stress (Akbaraly et al., 2009). Depressive symptoms were determined based on responses to four questions from the General Health Questionnaire: “thinking of yourself as a worthless person,” “felt life is entirely hopeless,” “felt life isn’t worth living” and “found at times you could not do anything because your nerves were too bad.” Of the 5,232 participants, 547 had metabolic syndrome. In the individuals with metabolic syndrome, the risk factors of central obesity, high triglyceride levels and low HDL levels were the most common in individuals with depressive symptoms. In this particular population of middle aged adults, there was no difference in depressive symptoms in males and females with metabolic syndrome (Akbaraly et al., 2009). However, other studies have shown the depressive symptoms primarily linked to women with metabolic syndrome (Raikkoneen, Matthews, & Kuller, 2002). Stress also plays a

part in the development of metabolic syndrome. It has been shown that an individual with a high stress work environment is two times as likely to have metabolic syndrome as those that had a low stress work environment (Chandola, Bruner, & Marmot, 2006).

Metabolic syndrome has been shown to be an independent risk factor in the development of chronic kidney disease (Chen et al., 2004). This is a likely result due to the high association with diabetes and chronic kidney disease (American Diabetes Association, 2012).

Psychosocial and Physical Considerations with Metabolic Syndrome

Metabolic Syndrome and Quality of Life

Quality of life and self-perception of health have been shown to be vitally important and an individual's health cannot adequately be assessed without determining how they rate their overall health. It has been shown to be a representation of health status and mortality (Idler & Benyamini, 1997). A small amount of research has been done on the effect of metabolic syndrome on quality of life. In post-menopausal Ecuadorian women, impairment of quality of life was found to be associated with all of the risks factors of metabolic syndrome. Specifically, abdominal obesity played a central role in decreasing the quality of life (Chedraui, Hidalgo, Chavez, Morocho, Alvarado, & Huc, 2007).

Each metabolic syndrome risk factor has been inversely associated with health-related quality of life. In an Iranian population that assessed health-related quality of life with the Short Health Form (SF-36), results showed that women with metabolic syndrome had poorer health-related quality of life with each additional metabolic syndrome risk factor (Amiri et al., 2009).

In the only known study of metabolic syndrome and quality of life in a U.S. population, findings were very similar. Researchers concluded that individuals with metabolic syndrome had a reduced health related quality of life compared to individuals without metabolic syndrome (Ford & Li, 2008).

Most of the published research linking metabolic syndrome to depression, cognitive impairment and a low health related quality of life has been conducted in countries outside of the U.S. For this reason, it is important to add to the literature and determine if these findings are consistent in populations throughout the U.S. (Roriz-Cruz et al., 2007).

Metabolic Syndrome and Dietary Intake

Dietary intake of carbohydrates has been associated with insulin resistance which is a precursor to diabetes. A high carbohydrate intake is thought to be an antecedent to metabolic syndrome. However, a diet that consists of several servings of whole grains per day that limits refined grains leads to lower abdominal fat levels (McKeown, Meigs, Liu, Saltzman, Wilson, & Jacques, 2004). Individuals can reduce the risk of developing metabolic syndrome and also reverse metabolic syndrome by increasing their whole grain intake (McKeown, 2004).

Diets high in fat content have been shown to increase triglyceride levels and lower HDL levels, both of which are included in metabolic syndrome. Diets that contain high cholesterol foods have been shown to increase the risk of cardiovascular disease. Research has shown that an individual with these eating habits have a higher risk for developing metabolic syndrome (Shin, Lim, Sung, Shin, & Kim, 2009). In the Oslo Health Study, a high intake of fatty foods,

soft drinks, and excessive amounts of processed foods created a low dietary index which correlated with metabolic syndrome (Hostmark, 2010).

Specific dietary recommendations repeated in the literature which decrease the risk of developing metabolic syndrome are fruits and vegetables, whole grains, legumes, fish, dairy products and nuts (Abete, Goyenchea, Zulet, & Martinez, 2011). Many recommendations note that a diet based on the Mediterranean style of eating can be a powerful weapon in the fight against metabolic syndrome. In addition to the foods mentioned, the Mediterranean diet includes healthy oils such as olive oil (Biali, 2012).

Milk intake has been a controversial point in the prevalence of many components of the metabolic syndrome (Scholz-Ahrens & Schrezenmeir, 2006). Many studies related to milk consumption and metabolic syndrome do not differentiate between types of milk products that are consumed. The limited literature available has shown that an increased intake in milk has an inverse relationship with metabolic syndrome (Elwood, Pickering, & Fehily, 2007). In a study of Korean overweight adults who frequently consumed milk, there was a protective effect against the components of metabolic syndrome but it was stronger for some of the components than others. The strongest effect was seen in the blood pressure, waist circumference and triglyceride components (Kwon et al., 2010). In a review of literature on milk consumption and the metabolic syndrome by Pfeuffer and Schrezenmeir (2006), it showed that dairy consumption was inversely associated with one or more of the components of metabolic syndrome. They noted that the extent of the benefits is not clear but that small effects exerted over a lifetime could be beneficial. Also to note from this literature review is that the consumption of dairy products had an association with lowered intake of sweetened soda drinks and other healthy eating habits.

More research is needed to identify a specific dietary recommendation for reducing metabolic syndrome risks (Riccardi & Rivelles, 2000).

Metabolic Syndrome and Physical Activity

Trends toward decreased physical activity and an increased sedentary lifestyle over the past decades have contributed to the epidemic of metabolic syndrome. Physical activity has been shown to improve blood pressure, improve cholesterol levels and equalize blood sugar regulation (Krauss et al., 2002). Regular physical activity also promotes weight control and abdominal obesity (Rennie , McCarthy, Yazdgerdi, Marmot, & Brunner, 2003). With this in mind, when decreasing metabolic syndrome risks, physical activity is thought to be an important variable to consider.

Physical activity has been shown to reduce metabolic syndrome risk factors, while the lack of physical activity has been shown to increase the risk of developing metabolic syndrome (Mozumdar & Liguori, 2011a). If someone has a sedentary lifestyle and does not engage in occupational related physical activity or leisure time physical activity, they have an increased vulnerability to developing metabolic syndrome.

Within the university setting, there are various categories of employees. There are some employees that engage in a large amount of job related physical activity while others are confined to a desk or computer all day. With this variation, it is important to assess if there is a higher rate of metabolic syndrome in either employee group. In an occupational study of women who have moderate to heavy working occupations, it was shown that they had substantial protection from the development of metabolic syndrome. However, if someone has low

occupational physical activity a substantial amount of leisure time physical activity is needed to reduce metabolic syndrome risks (Laaksonen et al., 2002).

Santos, Ebrahim, and Barros (2007) showed that increased physical activity decreases metabolic syndrome risks. Another study showed that individuals that did not exercise were 1.7 times more likely to develop metabolic syndrome than those who exercised regularly (Lee et al., 2004).

Weight control is closely related to physical activity. Regular physical activity has been shown to prevent excessive weight gain (Zhu, St-Onge, Heshka, & Heymsfield, 2004). Physical activity was protective against metabolic syndrome independent of weight loss (Ross et al., 2000). Most commonly, weight loss is recommended first and then physical activity recommended as a method of weight loss when speaking in reference to decreasing metabolic syndrome risks (Pan & Pratt, 2008). The literature does give conflicting information as to whether weight control, physical activity or a combination of both is the most important.

Metabolic Syndrome and Smoking

Smoking has long been a widely accepted risk factor for cardiovascular disease (Frati, Iniestra, & Ariza, 1996). With this knowledge, smoking should predispose an individual to metabolic syndrome due to the fact that long-term smoking lowers the protective HDL cholesterol, increases LDL cholesterol and increases triglycerides. Logically, metabolic syndrome risks would be expected to increase with smoking (Cena, Fonte, & Turconi, 2011).

Weitzman et al. (2005) demonstrated a strong correlation between metabolic syndrome and tobacco smoke. Results showed that exposure to tobacco smoke, either active or passive, is

associated with a fourfold increase in the risk of metabolic syndrome in individuals that are overweight. Kawada, Otsuka, & Inagakai (2010) completed a one year study that compared current smokers with non-smokers and ex-smokers. The only group that had significantly increased risk of metabolic syndrome was current smokers. The ex-smokers had no greater risk than individuals that had never smoked. A similar study done in an Asian population of 4,000 adults demonstrated that individuals that smoked at least twenty packs a year, were twice as likely to develop metabolic syndrome than non-smokers (Lee et al., 2004).

There have been other studies that showed no association in smoking and the development of metabolic syndrome. Santos, Ebrahim, & Barros (2007) studied smoking and metabolic syndrome in a Portuguese population of 2,000 men and women. They found that smoking did not increase metabolic syndrome risk. In fact, in women who smoked up to ten cigarettes per day, there was a significantly lower risk of metabolic syndrome compared to non-smokers. Though this is not a consistent finding in the research, a possible explanation for these results is the inverse relationship with smoking and obesity (Santos & Barros, 2004).

Metabolic Syndrome and Alcohol Consumption

Alcohol has been shown to have some protective effect against metabolic syndrome when consumed in moderation (Alkerwi et al., 2009). In a 2010 study of 6,172 individuals, Clerc et al. concluded that individuals that consume a low to moderate amount of alcohol experienced a statistically significant decline in the risk of metabolic syndrome compared with non-drinkers. The low-risk drinkers all showed statistically significant lower waist circumference, triglycerides, blood pressure, fasting glucose and number of metabolic criteria compared to non-

drinkers and very high-risk drinkers. In this particular study, the type of alcohol did not matter in regard to results discussed.

In studies done in Portuguese and Korean populations, no statistical significance in alcohol consumption and the metabolic syndrome was noted (Lee et al., 2004; Santos, Ebrahim, & Barros, 2007). In a similar study in a Korean population, high risk alcohol consumption was shown to be strongly associated with metabolic syndrome (Lee et al., 2010).

Metabolic Syndrome and Sleep

Sleep is an essential part of our daily living and sleep disturbances have been shown to interfere with our biological and physiological processes in the human body (Lam & Ip, 2010). Lack of sleep has been shown to increase risk of hypertension, increase body weight and change glucose metabolism (Cappuccio, Stranges, & Kandala, 2007). Each of these will increase risk factors for metabolic syndrome and a number of chronic diseases.

In a study done in the U.S. by Hall et al. (2008), metabolic syndrome risk was higher in those that got less than six hours of sleep. In this study, the ideal amount of sleep that had the most benefit was seven to eight hours. In a Korean based population study, both short and long sleep durations were positively associated with metabolic syndrome (Choi et al., 2001). Findings from a study in an Iranian population, sleep duration less than 5 hours was positively associated with metabolic syndrome while sleep duration greater than nine hours was protective against metabolic syndrome (Najafian, Toghianifar, Mohammadifard, & Nouri, 2011). Other studies have found that difficulty falling asleep, unrefreshing sleep and loud snoring all predict the development of metabolic syndrome in adults (Troxel et al., 2010). In addition, obstructive

sleep apnea has been shown to predispose individuals to the development of metabolic syndrome (Kono et al., 2007).

These studies suggest that sleep duration is a significant correlate of the metabolic syndrome. While there is conflicting evidence about the amount of sleep needed to protect against metabolic syndrome, it is clear that it is important to evaluate sleep duration. Sleep duration can be considered a modifiable risk factor and if addressed, metabolic syndrome may be avoided (Troxel et al., 2010). It is important to continue to investigate sleep duration in different populations.

Metabolic Syndrome and Waist Circumference or Body Mass Index

Body mass index has been utilized to identify overweight and obesity in adults and is recognized internationally (World Health Organization, 1997). More recently, increased waist circumference and excess body fat in the abdominal region have been directly associated with cardiovascular disease.

Most studies agree that waist circumference is a better indicator in determining health risks and the AHA/NHLBI considers waist circumference as one of the five risks for determining metabolic syndrome. However, waist circumference is not measured as frequently as body mass index is calculated in the U.S. (Smith & Haslam, 2007). In areas outside of the U.S., waist circumference is the preferred method of assessing overweight and obesity. It is considered the best measurement due to the ease in attaining the numbers without having to calculate anything as you do in body mass index.

Shen et al. (2006) found the superior method for measuring health risk was waist circumference followed by BMI. Ardern, Katzmarzyk, Janssen and Ross in a 2003 study and Zhu et al. (2004) showed that waist circumference in addition to BMI is superior to BMI or waist circumference alone in determining cardiovascular risk. Similar findings were seen in children by Moreno et al. (2002). The researchers found that waist circumference was the best predictor of metabolic syndrome when compared to BMI and skinfold ratio (Moreno et al., 2002).

Metabolic Syndrome and Educational Attainment

Lower educational level can be associated with lower socioeconomic status. Socioeconomic status has been used to predict higher risk for chronic disease conditions such as diabetes. Likewise, lower educational attainment has been shown to be predictive of metabolic syndrome (Lee et al., 2005). In a study done by Loucks et al. (2007), education level was shown to be inversely related to metabolic syndrome in women. Interestingly, the relationship was not the same in men (Loucks et al., 2007). This study utilized NHANES data from the years of 1988-1994.

Themes of the Literature

The majority of focus of the published literature has been on trying to determine which definition provides the best indicator of the population with metabolic syndrome. Unfortunately, this has been a barrier in the progression of disease awareness and prevention due to the lack of agreement on a set of parameters to define the disease. The clinical practice definitions such as the AHA/NHLBI and the ATP III and the research definitions such as the WHO and the IDF

definition are similar in characteristics. However, the definitions that are more research focused are very difficult to translate in a clinical setting and therefore are not used in the day to day practices of identifying individuals at risk. All have been found to be reliable definitions for identifying metabolic syndrome (Grundy et al., 2005). Some definitions identify a larger population of individuals than others but the overall goal is to identify metabolic syndrome. All of these definitions identify metabolic syndrome when utilized.

The literature has been very clear on the linkage of metabolic syndrome to diabetes and cardiovascular disease. It has shown how an individual with the defined characteristics of metabolic syndrome is at a much higher risk of development of these chronic diseases. The literature has used large samples of the population to show the association, as well as smaller more focused groups such as the PIMA Indian population. The association of metabolic syndrome has been shown to be a precursor in disease development in a variety of research such as randomized clinical trials, prospective cohort design studies, cross-sectional studies, longitudinal studies and secondary data results of national data sets.

Another theme threaded throughout the literature is the need to modify risk factors that predispose individuals to metabolic syndrome. There are multiple risk factors that are attributed to the development of metabolic syndrome. Age, sex and family history all are non-modifiable risk factors that have been shown to predispose individuals to metabolic syndrome. Smoking, lack of physical activity, sleeping habits, dietary habits and stress are all modifiable risks that are prevalent throughout the literature. It is clear that there are many factors that translate into the development of the metabolic syndrome and clinicians need a strategy to decrease risks. In order

to take less of a “shotgun” approach, research must try and identify the most effective modifiable risks to target.

A clear and concise model that is easily used in everyday clinical practice is needed. With the overwhelming prevalence of metabolic syndrome in our population and the lack of awareness and diagnosis, it is clear that much work is warranted in this area. It is imperative that metabolic syndrome is addressed and attention is given to enabling individuals to decrease their metabolic risks.

CHAPTER 3

METHODS

This study sought to provide a better understanding of the prevalence of metabolic syndrome in employees that participated in wellness screenings offered by the WellBama program at The University of Alabama. In addition, it pursued common characteristics of the population of individuals with metabolic syndrome and how these individuals perceived their overall health compared to those that were not classified as having metabolic syndrome. Furthermore, the association between the employee's metabolic risks, demographic, physical and psychosocial characteristics was determined. The study employed secondary analysis of WellBama data collected from faculty and staff at The University of Alabama. This section includes a discussion of participants, a description of WellBama, variables of interest and data analysis.

Purpose

The purpose of this research was to determine if significant differences exist in participants with metabolic syndrome and participants who did not meet the criteria for metabolic syndrome. Modifiable risk factors of tobacco use, physical activity and sleep were examined for their relationship with metabolic syndrome in employees at a southeastern university that participated in a wellness screening. In addition, this research was conducted to determine if the population of individuals classified as having metabolic syndrome based on the

AHA/NHLBI diagnostic criteria had poorer scores in their self-reported overall feeling of health compared to participants who did not have metabolic syndrome. Another purpose of this study was to identify demographic, psychosocial or physical variables that predicted metabolic syndrome. Finally, waist circumference and BMI were compared to determine if one was superior in predicting metabolic syndrome in this employee population.

In accordance with The University of Alabama policies, the proposed study was submitted to the Institutional Review Board and approved for research with human participants.
(See Appendix A)

Research Questions

In order to examine the aspects of metabolic syndrome in this employee population, the following research questions were evaluated utilizing the SPSS® software version 19:

- 1) Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to tobacco use, physical activity and amount of sleep?
- 2) Are there significant differences in self-reported overall physical health status in participants who have metabolic syndrome and participants that do not have metabolic syndrome?
- 3) Are demographic, psychosocial or physical variables predictors of metabolic syndrome?
- 4) Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?

Table 2

Statistical Analysis Used With Each Research Question

<u>Research Questions</u>	<u>Statistical Analysis</u>
Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to tobacco use, physical activity and amount of sleep?	Descriptive Statistics, t-tests, MANOVA
Are there significant differences in self-reported overall physical health status in participants who have metabolic syndrome and participants that do not have metabolic syndrome?	Descriptive Statistics, ANOVA
Are demographic, psychosocial or physical variables predictors of metabolic syndrome?	Descriptive Statistics, Stepwise Regression
Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?	Descriptive Statistics, Stepwise Regression

Participants

The University of Alabama established the Office of Health Promotion and Wellness (OHPW) in 2007. This office conducts continuous support programs to encourage healthy lifestyle behavior change. WellBama is just one of the many programs offered through the OHPW. The OHPW provides many resources and opportunities for employees to achieve their health goals.

The WellBama program was developed by OHPW at The University of Alabama in 2009. The overall goal of the WellBama program is to promote and advance the health and well-being of the employees at the University of Alabama (Carter, Kelley, Alexander, & Holmes, 2011). The WellBama program is a collaborative effort with the OHPW, the Capstone College of Nursing, the College of Community Health Sciences and the Division of Financial Affairs. In the program's initial year, 763 employees participated in health screenings that the WellBama program offered. Recruitment for the WellBama program was done through promotional flyers and postcards distributed throughout the university (Carter, Kelley, Alexander, & Holmes, 2011).

The sample for this study met the following conditions: 1) adult men and women 19 years of age or older and 2) attended a WellBama screening which included a blood sample. The participants to be included in this study voluntarily participated in the 2009, 2010 or 2011 WellBama screenings. The total sample from 2009-2011, after excluding those that did not meet criteria or did not sign an informed consent to participate in research, was 1156 employees.

Assessment Instrument

The WellBama screening instrument was composed of two items. The first item was the club score sheet and it was completed by the individual screening the participant. On this score sheet biometric data was entered. Biometrics measured were height, weight, waist circumference, body mass index and blood pressure. Finger sticks or venipuncture were done to measure blood glucose levels, triglycerides, total cholesterol, low-density lipoprotein cholesterol and high density lipoprotein cholesterol. In addition, blood pressure, cholesterol or glucose medications were recorded on the WellBama score sheet by participant's self-report. (See Club Score Sheet Appendix B)

Once the screening was completed, the participant was placed into a health status category depending on their biometric data, lab values and assessment data including family history, current medications, tobacco use and exercise status. The risk categories were crimson (very low risk), gold (low risk), silver (moderate risk), and bronze (high risk). These categories were developed by the OHPW based on national guidelines from the American Heart Association, National Heart, Lung and Blood Institute, National Institutes of Health/National Institute of Diabetes and Digestive Kidney Disease and the National Cholesterol Education Program (Carter, Kelley, Alexander, & Holmes, 2011).

The second item was the WellBama profile. This is where individuals rated their overall physical health and other variables related to their health profile. These data collection items were adapted from guidelines by the Centers for Disease Control Healthier Worksite Initiative and the University of Michigan's Health Management Resource Center. The Health Risk Initiative program's goal was to improve the health and well-being of employees. Based on this

initiative, the Centers for Disease Control shared their strategies and made recommendations for other employers to follow. Program activities were based upon planning, needs assessment, implementation and evaluation (Centers for Disease Control, 2010). The health risk profile that the WellBama program used was modeled on the recommendations made by this initiative and it utilized questions from multiple health risk appraisals. The questions were chosen by the Office of Health Promotion and Wellness based on which were the most revealing and beneficial in regard to the employee population being screened (R.Kelly, personal communication, June 19, 2012). (See WellBama profile Appendix C).

Data Collection

Data was analyzed from employees who voluntarily completed an annual WellBama screening appointment. All employees were eligible to be screened annually at no costs. All employees were provided with an informed consent describing the use of non-identifiable data for research purposes. All information collected was kept confidential in accordance with the Public Health Service Act and the Privacy Act of 1974 (NCHS –Department of Human Services).

An individual that attended a WellBama screening went through a systematic screening process within different colleges and divisions across campus. Participants checked in, read and signed the WellBama informed consent, completed pertinent information on the WellBama club score form, filled out the health risk appraisal and completed a research form. Biometric screenings were done (height, weight, BMI, waist circumference and blood pressure measurements) and entered on the WellBama club score sheet. Fasting laboratory values were obtained via finger stick method. Triglycerides, total cholesterol, low-density lipoprotein

cholesterol, high-density lipoprotein cholesterol and glucose levels were all tested. After all the information was recorded on the appropriate forms, the employee was placed in a health status category.

At this point, the employee was given the opportunity to review their status and values with a health care professional. During this health coaching, employees were advised on what risk category they were placed in based on screening criteria. Health improvement goals were discussed and selected. Employees with critical values were referred to their health care practitioner immediately for follow up. The employee then received the original wellness score and tip sheets they received during health coaching. (See event checklist)

Participants who attended WellBama were screened by a WellBama team member or a fourth semester nursing student and nursing faculty member. Screening team members underwent training via an online video presentation and there was a step-by-step procedure that each screener followed. Standardized measurements directly associated with metabolic syndrome were recorded on the club score sheet by the screener. These measures included blood pressure and the use of blood pressure medications, lipid and triglyceride levels and the use of lipid lowering medications, glucose levels and the use of glucose lowering medications, waist circumference and body mass index.

Dependent Measures: The Metabolic Syndrome

The dependent variable in this study was a positive diagnosis of metabolic syndrome based on the AHA/NHLBI criteria (Grundy et al., 2005). The AHA/NHLBI definition was modified from the NCEP criteria in 2005 to include individuals that are currently on blood

pressure lowering, cholesterol lowering or blood sugar lowering medications. The AHA/NHLBI definition is considered to be the most up-to-date definition (Grundy et al., 2005) and is traditionally used in practice-based settings due to its easy translation into clinical practice (Grundy et al., 2005; Hanson, Imperatore, Bennet, & Knowler, 2002).

The AHA/NHLBI definition requires three of the following five risk factors to be present for diagnosis of the metabolic syndrome: waist circumference (greater than or equal to 102 cm in men or 40 inches, greater than or equal to 88 cm in women or 35 inches, triglycerides (greater than or equal to 150 mg/dL), high-density protein also known as HDL cholesterol (less than 40 mg/dL for men or less than 50mg/dL for women, or taking cholesterol medication), blood pressure (systolic greater than or equal to 130 mmHg or diastolic greater than or equal to 85 mmHg or taking blood pressure medication), and fasting glucose (greater than or equal to 100 mg/dL or taking glucose medication) (Grundy et. al., 2004). An individual needs a minimum of three of these five criteria to receive the metabolic syndrome diagnosis.

Table 3

AHA/NHLBI Criteria for Metabolic Syndrome (3 of the 5)

Waist Circumference	≥ 40 inches in men (102cm) ≥ 35 inches in women (88cm)
Triglycerides	≥ 150 mg/dL
HDL cholesterol	≤ 40 mg/dL for men ≤ 50 mg/dL for women Or on cholesterol medication
Blood pressure	Systolic ≥ 130 mmHg Or Diastolic ≥ 85 mmHg Or on blood pressure medication
Fasting glucose	≥ 100 mg/dL Or on glucose medication

Independent measures

A variety of variables were utilized as independent factors in this study. Coding for independent measures was taken from the WellBama data dictionary that was updated on June 18, 2010 by the OHPW.

Age

Age was based on self-reported information. Participants placed their date of birth on the WellBama score sheet. Age was reported as an average in years. Age was calculated based on self-reported date of birth and entered as a whole number.

Gender/Race

Race was based on self-reported information. Race was categorized as Caucasian (Non-Hispanic origin), Black (Non-Hispanic origin), Hispanic, Asian or Pacific Islander, American Indian/Alaskan Native or Other. Coding for gender was 0 for male and 1 for female. Coding for race/origin was Other=0, White (Non-Hispanic origin) =1, Black (Non-Hispanic origin) =2, Hispanic=3.

Education

Education was divided into five categories on the WellBama profile: Some high school or less, high school graduate, some college, college graduate or post graduate or professional degree. Coding for education was post graduate or professional degree, college graduate=1, some college=2, high school graduate=3, and some high school or less=4.

Income

Household income was divided into five categories on the WellBama profile: Less than \$35,000, \$35,000-\$49,999, \$50,000-\$74,999, \$75,000-\$99,000, or \$100,000 or more. The individual answered the expected household income for the year. Coding that was used was \$100,000 or more=4, \$75,000-\$99,000=3, \$50,000-\$74,999=2, \$35,000-\$49,999=1, and less than \$35,000=0.

Family History

A self-reported family history of high blood pressure, heart problems, diabetes or high cholesterol was examined. Individuals marked if they had a family history (brother, sister, mother, father or grandparent) with high blood pressure, heart problems, diabetes or high cholesterol. Coding for high blood pressure used was yes=2, no=1, and I'm not sure=0. Coding for heart problems used was yes=2, no=1, and I'm not sure=0. Coding for diabetes used was yes=2, no=1, and I'm not sure=0. Coding for high cholesterol was yes=2, no=1, and I'm not sure=0.

Occupational Classification

Participants were classified as faculty, staff, or professional staff based on information reported by the participant and reported by the university's job classification system. It has been shown that the prevalence of metabolic syndrome varies in different categories of occupational activity and it often depends on the gender of the individual (Sanchez-Chaparro et al., 2008). Studies have shown that female workers that were considered blue collar workers have a higher

prevalence of metabolic syndrome as compared to white collar workers with the lowest prevalence in general managers and administrators; conversely, male workers in this same study showed a similar prevalence of metabolic syndrome in blue and white collar workers (Sanchez-Chaparro et al., 2008). Coding used was faculty=2, staff=1, and professional staff=0.

Self-Perception of Overall Physical Health

Self- perception of overall physical health was determined using a question that asked the participant to describe their overall physical health and rank it excellent, good, fair or poor. Burton, Chen, Schultz, and Edington (2008) in a well-documented study of an employee population utilized the same type question to assess overall physical health and this measure served as an indicator of quality of life. High risks were considered the answers of fair or poor and low risks were a good or excellent ranking. Self-rated health was also shown to be a reliable and valid way to assess general health and has a predictive power in regard to mortality in the elderly and the general population (Lundberg & Manderbacka, 1996). Coding was excellent=3, good=2, fair=1, and poor=0.

Diabetes

Self-reported responses to the question asking participants if they have ever been told they had diabetes were counted as a positive response for the presence of diabetes. The AHA/NHLBI criteria for classification of elevated blood glucose levels was used to determine if individuals met the metabolic syndrome criteria based on finger stick blood values obtained at screening or a self-report of taking glucose controlling medications. Some of the early blood

work done in 2009 was obtained by venipuncture. Coding used was never=4, in the past=3, currently have=2, taking medication=1, and under medical care=0.

Cardiovascular Disease

Self-reported responses to the question asking participants if they have ever been told they had heart problems were counted as a positive response for the presence of cardiovascular disease. Coding used was never=4, in the past=3, currently have=2, taking medication=1, and under medical care=0.

Elevated Cholesterol

Self-reported responses to the question asking participants if they have ever been told if they had high cholesterol was counted as a positive response for the presence of elevated cholesterol. The AHA/NHLBI criteria for classification of elevated blood cholesterol levels was used to determine if individuals met the metabolic syndrome criteria based on finger stick blood values obtained at screening or a self-report of taking cholesterol controlling medications. Coding used was never=4, in the past=3, currently have=2, taking medication=1, and under medical care=0.

High Blood Pressure/Hypertension

Self-reported responses to the question asking participants if they have ever been told they had high blood pressure were counted as a positive response for the presence of

hypertension. Coding used was never=4, in the past=3, currently have=2, taking medication=1, and under medical care=0.

Physical Activity

Physical activity was determined based on self-reported answers to the question regarding how many times the participant engaged in physical activity that made them breathe heavily and heart beat faster for at least twenty minutes each week. Responses to this question could have been less than one time per week, one or two times per week, three times per week, or four or more times per week. Coding was four or more times/week=3, three times/week=2, one to two times/week=1, and less than one time/week=0.

Smoking

Smoking history and current smoking practices were assessed based on self-reported history. The questions asked participants to describe their smoking habits (still smoke, used to smoke, or never smoked). Cigarette smoking habits were coded never smoked=3, used to smoke=2, and still smoke=1.

Sleep

Self-reported hours of sleep were assessed based on a twenty-four hour time period. Participants reported hours slept as nine hours or more, eight hours, seven hours, six hours or less. Coding for sleep was nine hours or more=3, eight hours=2, seven hours=1, and six hours or less=0.

Table 4

Research Questions as Related to the Dependent and Independent Variables of Interest

<u>Research Questions</u>	<u>Dependent Variable</u>	<u>Independent Variables of Interest as Related to Research Questions</u>
Are there significant differences in those with metabolic syndrome and those without metabolic syndrome in relation to tobacco use, physical activity, and sleep pattern?	Tobacco use Physical Activity Sleep	Metabolic Syndrome Status
Are there significant differences in self-reported overall physical health status in those that have metabolic syndrome and those that do not have metabolic syndrome?	Self-perception of overall physical health	Metabolic Syndrome Status
Are demographic, psychosocial or physical variables predictors of metabolic syndrome?	Metabolic Syndrome Status	Age Gender/Race Education Household Income Family History (High blood pressure or cardiovascular problems, elevated cholesterol, diabetes) Occupational Classification Personal medical history (High blood pressure or cardiovascular problems, elevated cholesterol, diabetes)
Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?	Metabolic Syndrome	Waist circumference Body Mass Index

The prevalence of metabolic syndrome among the participants was determined by the AHA/NHLBI criteria. Participants that had three of the five diagnostic criteria were classified as having metabolic syndrome.

Research Question 1

Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to smoking, physical activity and amount of sleep?

In order to determine if there were differences in participants that had metabolic syndrome and participants that did not have metabolic syndrome in relation to smoking, physical activity and sleep, descriptive statistics and multivariate analysis of variance (MANOVA) were performed. Smoking was determined based on self-reported cigarette smoking habits. Physical activity was determined based on self-reported engagement in physical activity during an average week. Sleep was determined based on the hours of sleep reported in a twenty-four hour period.

Research Question 2

Are there significant differences in self-reported overall physical health status in participants who have metabolic syndrome and participants who do not have metabolic syndrome?

In order to determine if self-rankings of physical health correlated with metabolic syndrome, participants ranked their overall physical health as excellent, good, fair or poor. Self-rated health has been used in a number of studies as a measure of general health and has been

shown to be a predictor of mortality (Idler & Benyami, 1997). The single item measure of self-rated health is increasingly being used as a measure of overall health status in the social and health services research (Jenkinson & McGee, 1998). Likewise, self-rated health has been shown to be a valid measure of health status in different ethnic groups as a valid measure for determining health status (Chandola & Jenkinson, 2000). Rianon & Rasu (2009) reported that in a population of Bangladeshi men, those that had metabolic syndrome also had the lowest self-reported health with the majority of the men ranking their health as poor. However, in a study done by Vetter et al. (2011), there was no association found between health-related quality of life and metabolic syndrome. Further research is needed in this area to determine how individuals within this study's population perceive their health and how it compares to their metabolic risk status. Descriptive statistics and analysis of variance were conducted.

Research Question 3

Are demographic, psychosocial or physical variables predictors of metabolic syndrome?

Older age has been shown to be a consistent risk factor in the development of metabolic syndrome (Kuk & Ardern, 2010). Gender differences have been shown to be abolished as individuals reach the age of 65 years. Up to the age of 65, women have higher metabolic syndrome risks, especially women who have increased abdominal obesity (Kuk & Ardern, 2010).

Occupational department will be classified based on the university classification of faculty, staff or professional staff. Differences in the prevalence of metabolic syndrome among occupational groups have been observed in other countries (Sanchez-Chaparro et al., 2008) and

in the U.S. utilizing NHANES data (Davila et al., 2010). Davila et al. (2010) found that in the 1999-2004 NHANES survey there was variability in the prevalence of metabolic syndrome by occupational status. Workers at greatest risk of metabolic syndrome were in the transportation/material moving sector (odds ratio of 1.70) and individuals in the executive, administrative and managerial occupational groups had much lower odds ratio (.89) (Davila et al., 2010). There is also discrepancy in the literature in regard to low socioeconomic status and the metabolic syndrome. Research has shown that low socioeconomic status is related to metabolic syndrome; however, it has been argued that this is largely due to behavioral factors and generally only seen in women (Ramsay, Whincup, Morris, Lennon, & Wannamethee, 2008). Another area shown to have a higher incidence of metabolic syndrome is shift workers. Karlsson, Knutsson, & Lindahl (2001) identified metabolic risks more commonly in those that worked evening or night shift. They found that obesity, high triglycerides and low HDL levels clustered in individuals that worked shifts other than day shift (Karlsson, Knutsson, & Lindahl, 2001). Stepwise regression was done to determine the strongest predictor variables for metabolic syndrome.

Research Question 4

Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?

There are different measures that have been used to estimate obesity in previous research. Some studies utilize body mass index (BMI) while others use waist circumference. Janssen, Katzmarzyk, and Ross (2004) have shown waist circumference to be more effective than BMI in identifying metabolic syndrome in individuals. However, BMI and waist circumference have

both been highly correlated in individuals with metabolic syndrome when comparisons of different definitions of metabolic syndrome have been explored (Skilton, Moulin, Sérusclat, Nony, & Bonnet, 2007; Gami et al., 2007; Lakka et al., 2002).

For this secondary data analysis, BMI and waist circumference were both available. Utilizing the AHA/NHLBI criteria, waist circumference was utilized for metabolic syndrome diagnosis. Due to the availability of both waist circumference and BMI, stepwise regression was used to determine if one was more predictive.

CHAPTER 4

RESULTS

The purpose of this study was to determine if significant differences exist in participants with metabolic syndrome and participants who did not meet the criteria for metabolic syndrome. Modifiable risk factors of tobacco use, physical activity and sleep were examined for their relationship with metabolic syndrome in employees at a southeastern university that participated in a wellness program. In addition, this study examined if the participants classified as having metabolic syndrome, based on the AHA/NHLBI diagnostic criteria, had poorer scores in their self-reported overall feeling of health compared to participants who did not have metabolic syndrome. Another purpose of this study was to identify demographic, psychosocial or physical variables that predicted metabolic syndrome. Finally, waist circumference and BMI were compared to determine if one was superior in predicting metabolic syndrome.

This chapter includes a description of the study sample, descriptive statistics of the study sample and univariate analysis of the independent variable metabolic syndrome with physical activity, smoking, sleep and self-reported overall health status. Stepwise regression was conducted with metabolic syndrome as the dependent variable to determine the best predictive model for metabolic syndrome in this sample.

Study Sample

The total sample included 464 men and 894 women for a total of 1358 participants who attended a WellBama screening during the years of 2009-2011. Of the 1358 participants

enrolled, the criteria for metabolic syndrome were evaluated for 1156. Two hundred and two, or 15 percent, were excluded due to missing data on one or more of the parameters for metabolic syndrome. Of the 1156 individuals, 353 were men and 803 were women. The average age of the individuals was 43 years of age and the study sample was comprised of more white (73.90%) than any other ethnicity. Table 5 presents the demographics of the sample.

Table 5

Demographics of the Study Sample

Demographics	n (%)
Age (years)	
19-29	172 (14.88%)
30-39	297 (25.69%)
40-49	295 (25.52%)
50-59	292 (25.26%)
60-69	85 (7.35%)
70 and above	15 (1.30%)
Gender	
Male	353 (30.00%)
Female	803 (70.00%)
Ethnicity	
Caucasian	854 (73.90%)
African American	217 (18.80%)
Asian	45 (3.90%)
Other	40 (3.40%)
N=1,156	

Table 6 presents additional characteristics of the study sample. Of the 466 participants who responded to the question regarding educational level, 65.00 percent had a college degree. Of the total 1156 participants, eighteen percent were faculty, 74.65 percent were staff and 7.02 percent were students, retired faculty or classified as on leave. Of the participants, 64.00 percent identified a family history of high blood pressure, 50.00 percent a family history of cardiovascular problems, 49.22 percent a family history of diabetes, and 51.30 percent a family history of high cholesterol.

Table 6

Characteristics of the Study Sample

	n (%)
Education	
Some HS or less	9 (0.78%)
HS graduate	68 (5.88%)
Some college	85 (7.35%)
College graduate	114 (9.86%)
Post graduate	190 (16.43%)
Did not respond	690 (59.69%)
Household Income	
<\$35,000	107 (9.26%)
\$35,000-\$49,999	79 (6.83%)
\$50,000-\$74,999	82 (7.09%)
\$75,000-\$99,000	68 (5.88%)
≥\$100,000	105 (9.08%)
Did not respond	715 (61.86%)
Family History	
High blood pressure	740 (64.00%)
Heart problems	577 (50.00%)
Diabetes	569 (49.22%)
High cholesterol	593 (51.30%)
Occupational Dept.	
Faculty	212 (18.33%)
Staff	863 (74.65%)
Other	81 (7.02%)

N=1156

Figure 1 presents each type risk factor for metabolic syndrome and the number of participants with that particular risk factor. Of the 1156 participants, 54 percent had an increased waist circumference. The second most common risk factor was a low HDL level. Forty-six percent of the participants had a lower than recommended HDL level. Figure 2 presents risk factor clustering. Twenty-four percent of participants had two risks for metabolic syndrome.

The lowest percentage of participants had all five metabolic syndrome risks with 4.3 percent falling in this category. Figure 3 shows that 37 percent of the overall 1156 participants had metabolic syndrome and that the remaining 63 percent did not have at least three of the five risk factors associated with metabolic syndrome.

Figure 1. Metabolic syndrome risk factor prevalence.

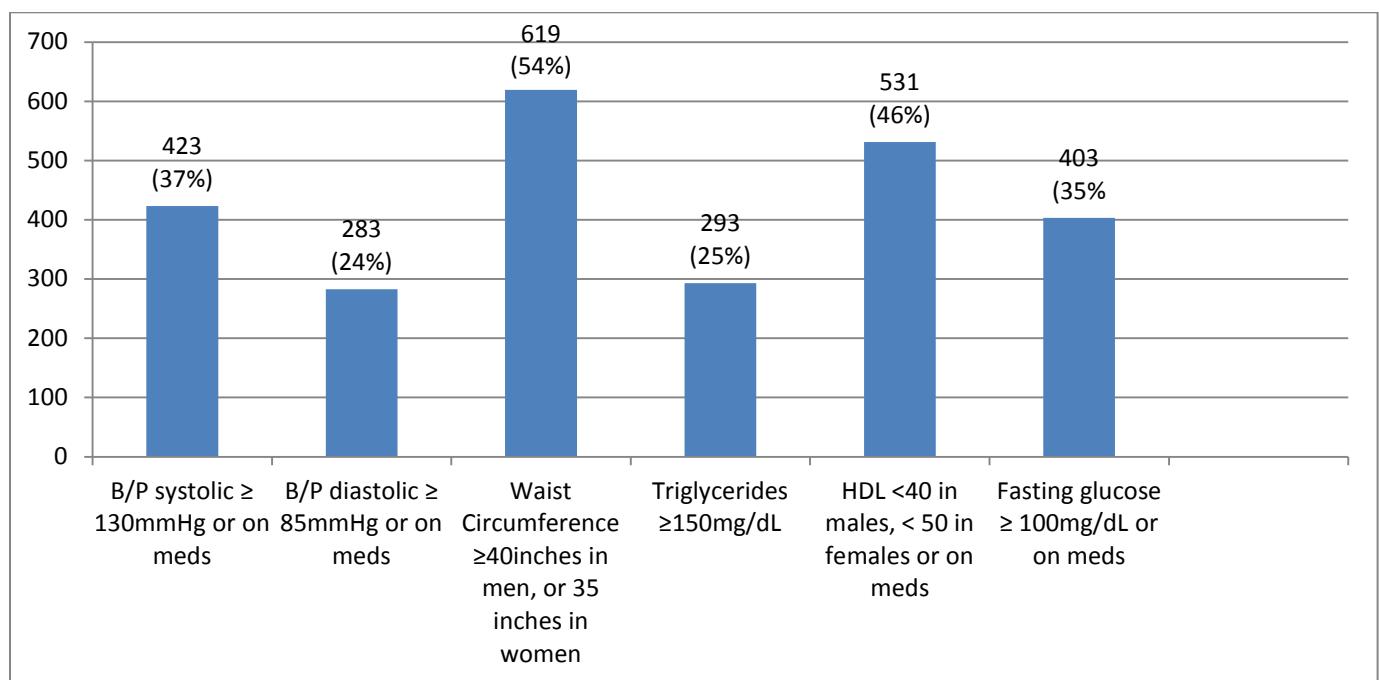


Figure 2. Breakdown of risk factor clustering.

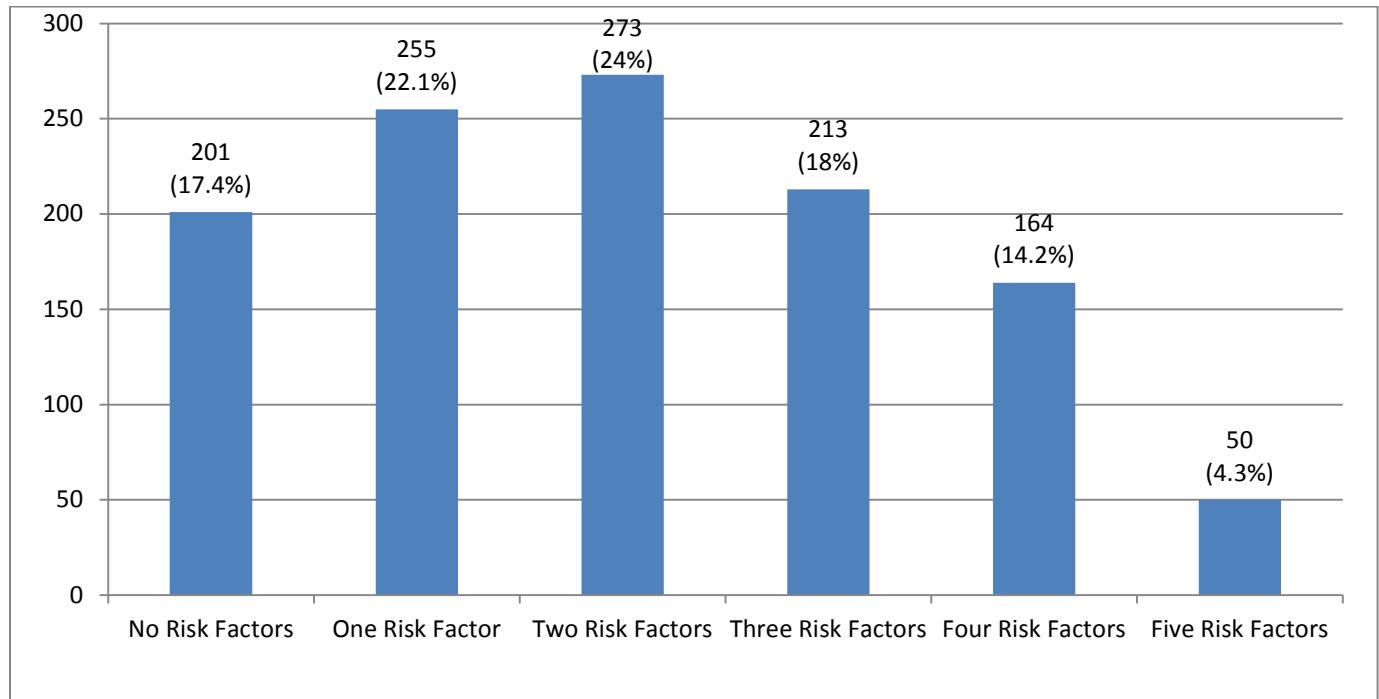


Figure 3. Metabolic syndrome percentage

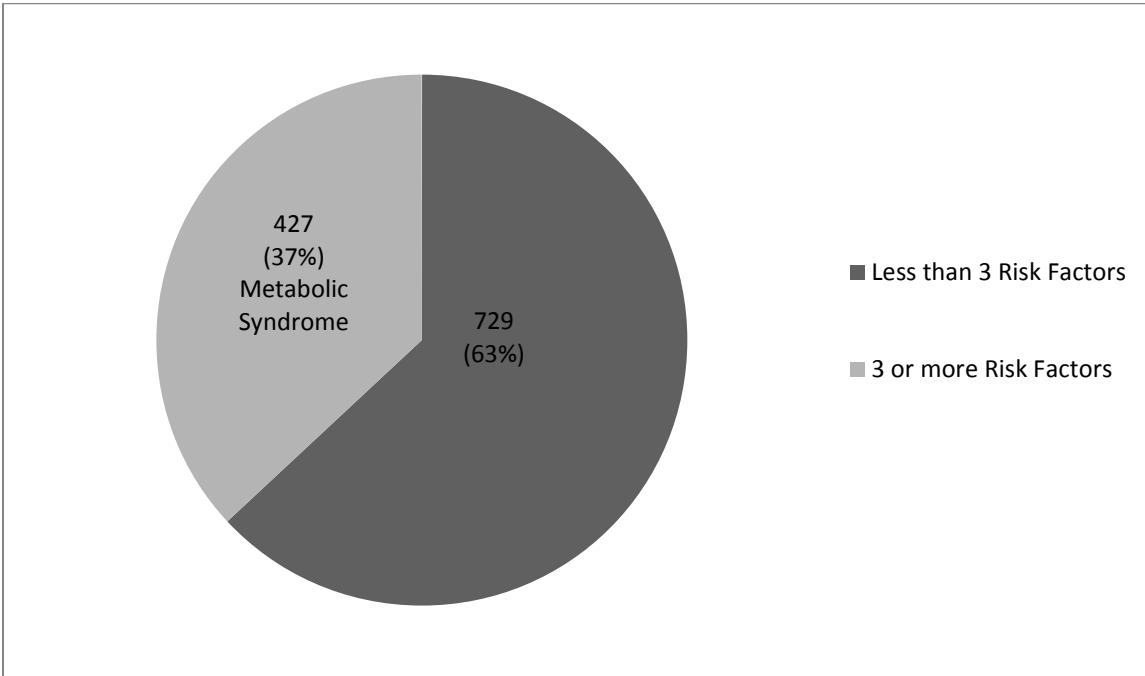


Table 7 presents the findings for the participants' perception of overall physical health.

Among participants who had metabolic syndrome, 9.84 percent described their overall physical health status as excellent and 55.50 percent described their overall physical health as good. The remaining participants with metabolic syndrome rated their overall physical health as fair (24.59 percent) or poor (3.28 percent). The remaining 6.79 percent did not answer regarding overall physical health status.

Table 7

Self-Reported Overall Physical Health in the Study Sample

	Metabolic syndrome (n=427)	No metabolic syndrome (n=729)
Excellent	42 (9.84%)	159 (21.81%)
Good	237 (55.50%)	435 (59.67%)
Fair	105 (24.59%)	78 (10.70%)
Poor	14 (3.28%)	6 (0.82%)
Missing	29 (6.79%)	51 (7.00%)

N=1156

Table 8 presents the responses of participants who had a history of diabetes. Among participants with metabolic syndrome, 50.59 percent reported no history or a past history of diabetes and 5.15 percent either currently had diabetes, were currently taking medication for diabetes or were under medical care for diabetes. The remaining 44.26 percent did not answer the question regarding their diabetes history.

Figure 4 shows that 67% percent of individuals with metabolic syndrome had an elevated glucose level as one of their risks for metabolic syndrome.

Table 8

Self-Reported Diabetes

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)
Never/ In the past	216 (50.59%)	399 (54.73%)
Diabetes/Meds	22 (5.15%)	0 (0.00%)
Missing Data	189 (44.26%)	330 (45.27%)
N=1156		

Figure 4. Metabolic syndrome and elevated glucose risk.

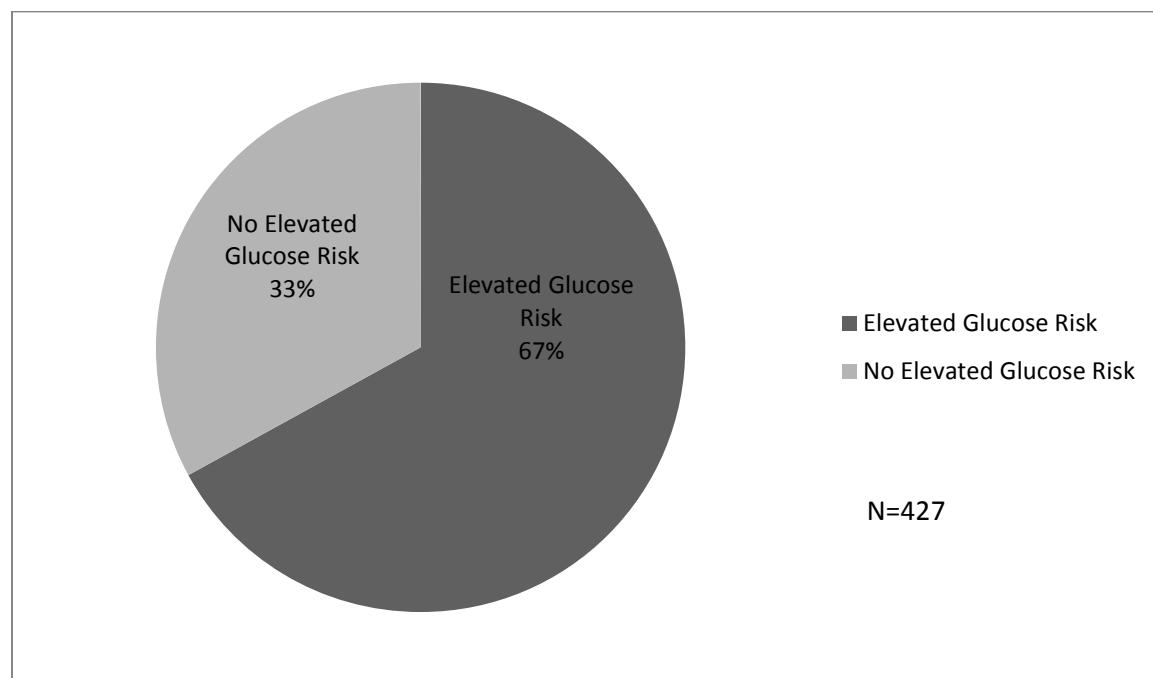


Table 9 presents the responses for a history of cardiovascular disease. Of participants with metabolic syndrome, 53.40 percent reported no history or a past history of cardiovascular

disease. In participants with metabolic syndrome, 2.11 percent currently had cardiovascular disease or were taking medications for cardiovascular disease. The remaining 44.49 percent did not answer regarding their history of cardiovascular disease.

Table 9

Self-Reported Cardiovascular Disease

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)
Never/In the past	228 (53.40%)	384(52.67%)
Cardiovascular Disease/Meds	9 (2.11%)	16 (2.20%)
Missing	190 (44.49%)	329 (45.13%)

N=1156

Table 10 presents the responses for a self-reported history of elevated cholesterol. Among participants with metabolic syndrome, 42.86 percent reported no history or a past history of high cholesterol with 12.88 percent stating they currently had high cholesterol or were taking medications for high cholesterol. There were 44.26 percent with metabolic syndrome that did not answer regarding a history of elevated cholesterol.

Figure 5 shows that 79% percent of the 427 individuals with metabolic syndrome had an elevated HDL level as one of their risks for metabolic syndrome. Figure 6 shows that 50% of the individuals with metabolic syndrome had an elevated triglyceride level as one of their risks of metabolic syndrome.

Table 10

Self-Reported Elevated Cholesterol

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)
Never	183 (42.86%)	353 (48.42%)
High cholesterol/Meds	55 (12.88%)	48 (6.58%)
Missing	189 (44.26%)	328 (45.00%)

N=1156

Figure 5. Metabolic syndrome and participants with the HDL risk

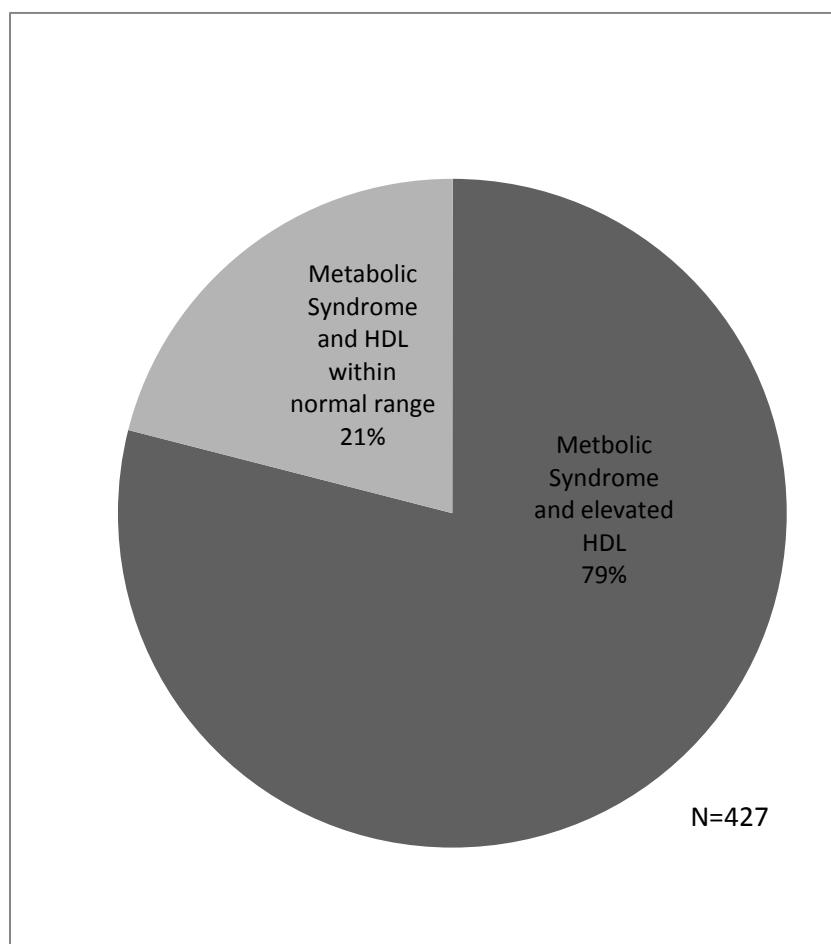


Figure 6. Metabolic syndrome and participants with the triglyceride risk.

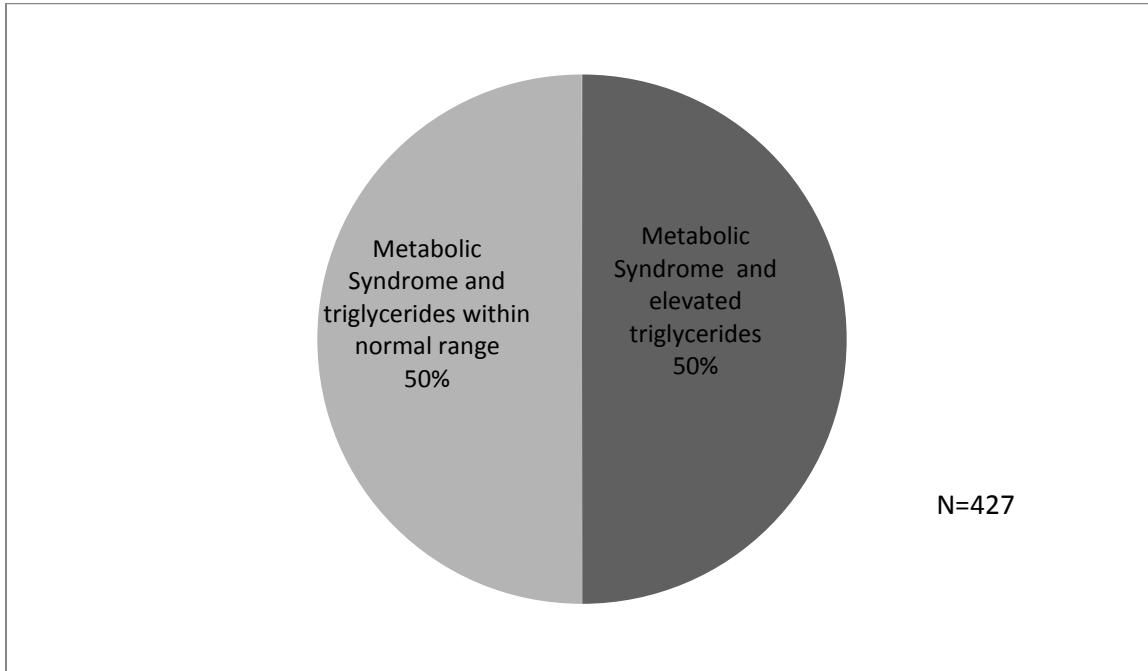


Table 11 presents responses about a history of high blood pressure or hypertension.

Among participants with a diagnosis of metabolic syndrome, 39.34 percent reported no previous history or a past history of hypertension, while 17.10 percent had high blood pressure or they were on medications for hypertension. The remaining 43.56 percent did not answer regarding a history of high blood pressure.

Figure 7 shows that 68% percent of the 427 individuals with metabolic syndrome had an elevated systolic blood pressure as one of their risk factors for metabolic syndrome.

Table 11

Self-Reported High Blood Pressure/Hypertension

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)
Never	168 (39.34%)	368 (50.48%)
Hypertension/Meds	73 (17.10%)	29 (3.98%)
Missing	186 (43.56%)	332 (45.54%)
N=1156		

Figure 7. Metabolic syndrome and systolic blood pressure risk.

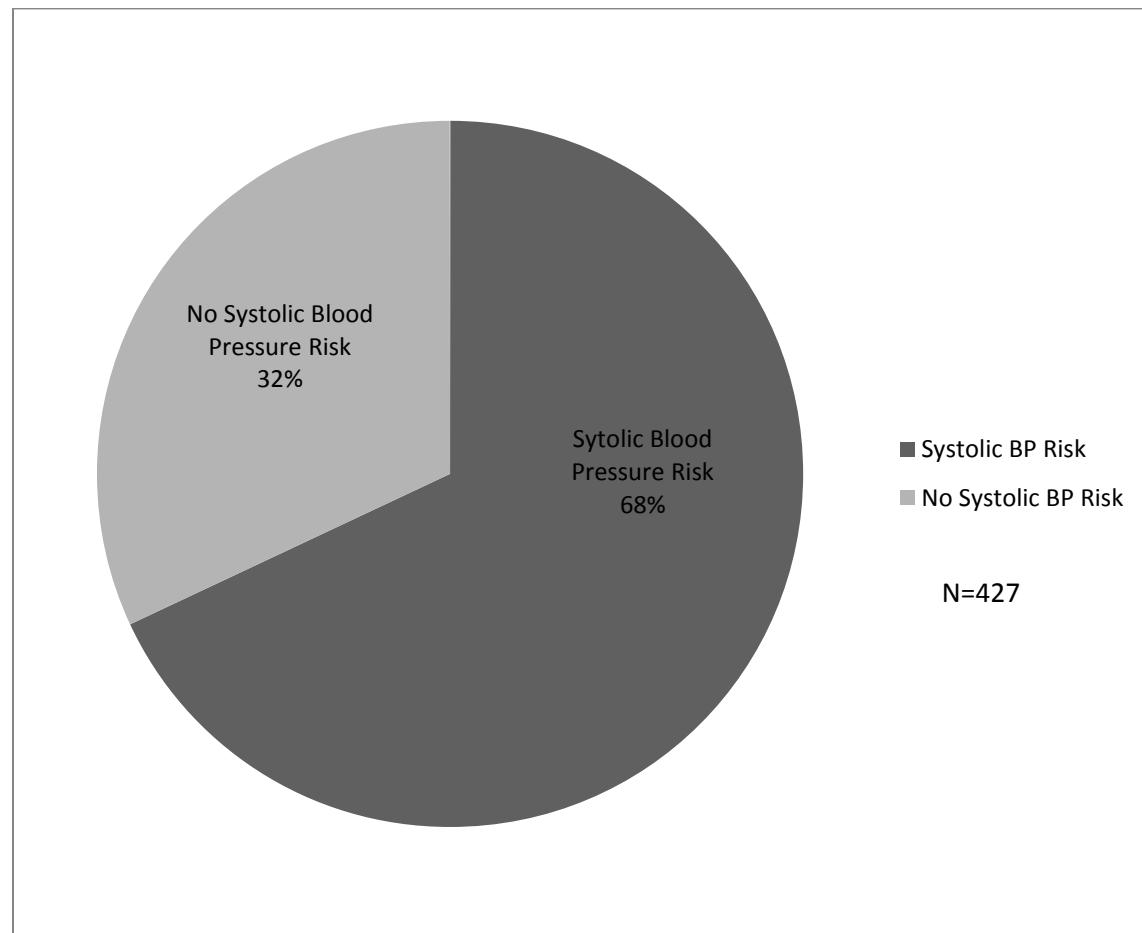


Table 12 presents data on the amount of self-reported exercise. Among participants with metabolic syndrome, only 16.86 percent exercised four or more times per week. Twenty-six percent of participants with metabolic syndrome did not exercise at all.

Figure 8 displays each risk group of metabolic syndrome (0 risk-5 risk) and the amount of self-reported physical activity of individuals. The percentage listed indicates the percentage of participants in that risk group, not the overall percentage.

Table 12

Self-Reported Exercise Frequency

	Metabolic syndrome (n=427)	No Metabolic Syndrome (n=729)
4 or more times/week	72 (16.86%)	213 (29.22%)
3 times/week	92 (21.55%)	160 (21.95%)
1-2 times/week	125 (29.27%)	187 (25.64%)
Less than 1 time/week	111 (26.00%)	122 (16.74%)
Missing	27 (6.32%)	47 (6.45%)
N=1156		

Figure 8. Metabolic syndrome risks and self-reported physical activity.

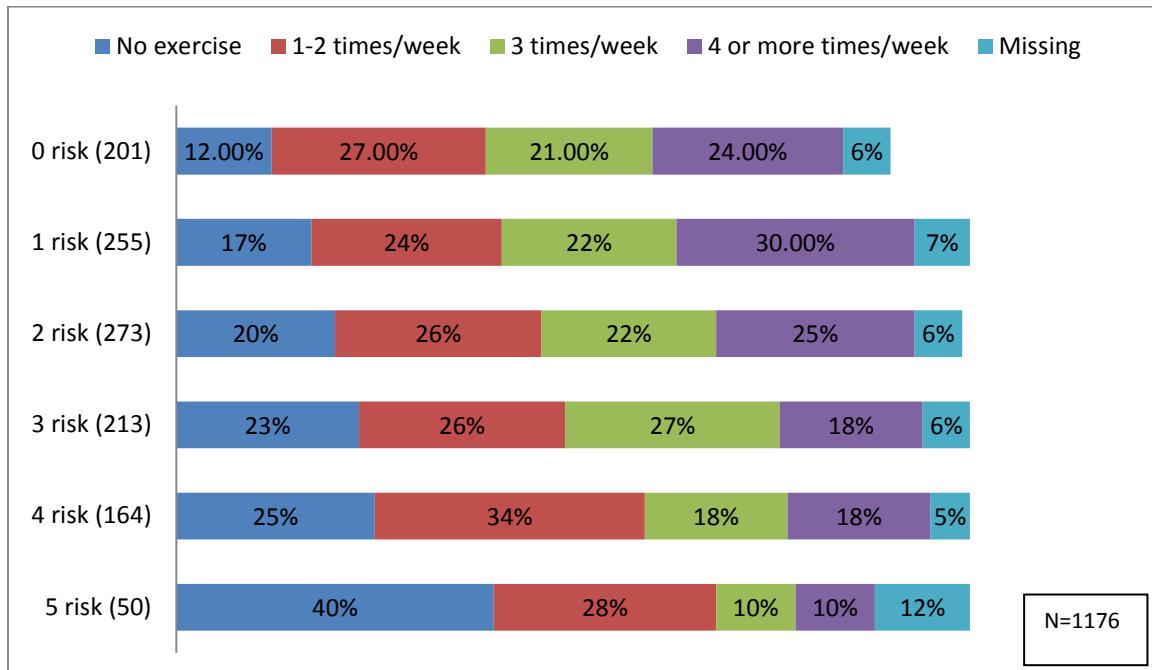


Table 13 presents data regarding hours of sleep. Among participants who had metabolic syndrome 3.28 percent slept nine or more hours and 19.20 percent reported sleeping eight hours. Also in participants with metabolic syndrome, 44.73 percent slept for seven hours and 24.36 percent slept for six hours or less. The remaining 8.43 percent did not answer regarding amount of sleep.

Figure 9 displays each risk group of metabolic syndrome (0 risk-5 risk) and the amount of self-reported sleep of individuals. The percentage listed indicates the percentage of participants in that risk group, not the overall percentage.

Table 13

Self-Reported Hours of Sleep

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)
9 hours or more	14 (3.28%)	13 (1.79%)
8 hours	82 (19.20%)	197 (27.02%)
7 hours	191 (44.73%)	307 (42.11%)
6 hours or less	104 (24.36%)	148 (20.30%)
Missing	36 (8.43%)	64 (8.78%)
N=1156		

Figure 9. Metabolic syndrome risks and self-reported hours of sleep.

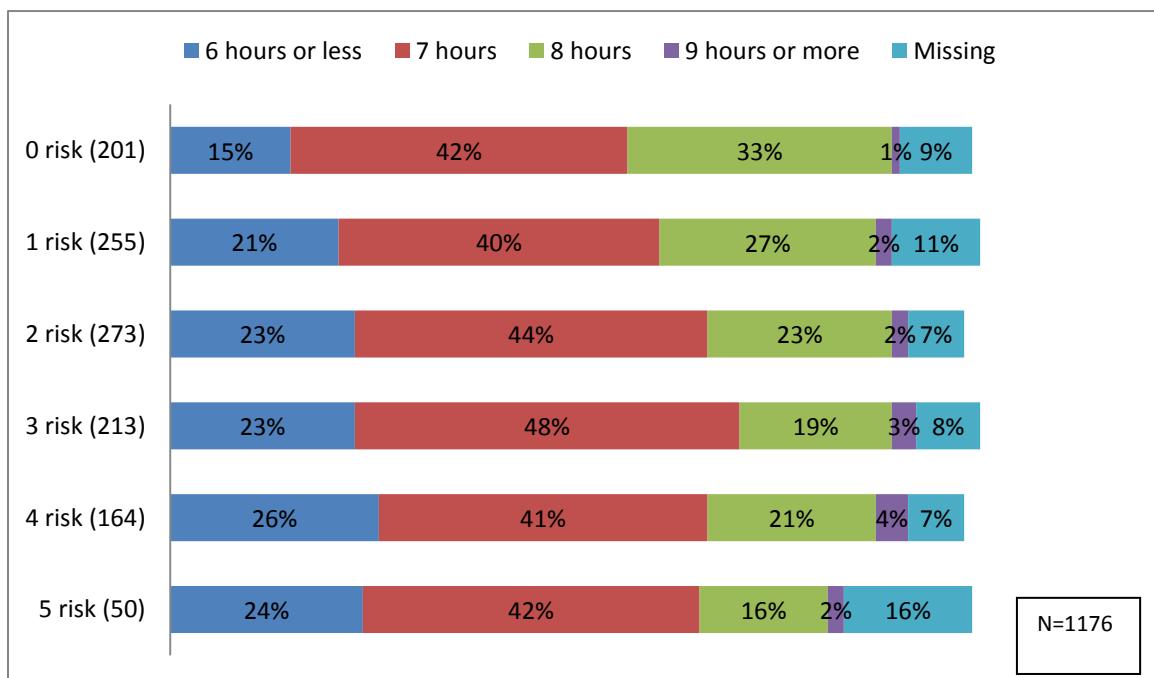


Table 14 presents data on smoking history. Among participants with metabolic syndrome, 45.67 percent had never smoked, 19.20 percent used to smoke, and 4.45 percent smoked at the time of screening. The remaining 30.68 percent did not answer regarding smoking history.

Table 14

Self-Reported Smoking History

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)
Never smoked	195 (45.67%)	368 (50.48%)
Used to smoke	82 (19.20%)	92 (12.62%)
Currently smoke	19 (4.45%)	23 (3.16%)
Missing	131 (30.68%)	246 (33.74%)

N=1156

Research Question 1

Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to smoking, physical activity and amount of sleep?

A MANOVA (Table 18) indicated that smoking ($F(5,746)=1.541$; $p=0.175$) was not significantly associated with an increased risk of metabolic syndrome but physical activity ($F(5,746)=8.110$; $p=0.000$) and sleep ($F(5,746)=2.184$; $p=0.054$) were significant.

For this analysis, smoking, physical activity and sleep were the dependent variables. In regard to smoking (Table 15), participants who had no metabolic risk factors, means were similar ($M=2.73$; $SD=.495$) to participants with five risk factors ($M=2.65$; $SD=0.544$). This indicates that there was not much difference in smokers and non-smokers. In regard to physical activity (Table 16), the mean days per week of exercise for participants with no metabolic risk factors ($M=1.77$; $SD=1.113$) was higher than participants with five risk factors ($M=0.74$; $SD=0.864$). This indicates that individuals with metabolic syndrome self-reported exercising for lower

amounts of time each week. The mean hours of self-reported sleep (Table 17) among participants who had no metabolic risk factors ($M=1.23$; $SD=0.722$) was higher than participants with five risk factors ($M=1.00$; $SD=0.778$). This indicates that participants that did not have metabolic syndrome reported higher numbers of sleep than those with more metabolic syndrome risks.

Table 15

Self-Reported Smoking Standard Deviation

	Mean	Standard deviation
No risk factors	2.73	0.495
1 risk factor	2.71	0.595
2 risk factors	2.70	0.541
3 risk factors	2.59	0.629
4 risk factors	2.59	0.616
5 risk factors	2.65	0.544

Table 16

Self-Reported Physical Activity Standard Deviation

	Mean	Standard deviation
No risk factors	1.77	1.113
1 risk factor	1.66	1.130
2 risk factors	1.56	1.096
3 risk factors	1.39	1.090
4 risk factors	1.18	1.055
5 risk factors	0.74	0.864

Table 17

Self-Reported Sleep Standard Deviation

	Mean	Standard deviation
No risk factors	1.23	0.722
1 risk factor	1.16	0.736
2 risk factors	1.11	0.751
3 risk factors	1.04	0.746
4 risk factors	0.96	0.785
5 risk factors	1.00	0.778

Table 18

MANOVA for Self-Reported Smoking, Physical Activity and Sleep

	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squ.	Power
Intercept	Smoking	3931.736	1	3931.736	11922.509	0.000	.947	1.000
	Phys. Act.	1059.408	1	1059.408	862.223	0.000	.545	1.000
	Sleep	650.984	1	650.984	1161.251	0.000	.609	1.000
Metabolic Syndrome	Smoking	2.540	5	.508	1.541	.175	.010	.542
	Phys. Act	48.150	5	9.630	8.110	.000	.052	1.000
	Sleep	6.120	5	1.224	2.184	.054	.014	.718
Error	Smoking	246.012	746	.330				
	Phys. Act.	885.785	746	1.187				
	Sleep	418.199	746	.561				

Table 19

Levene's Test of Equality of Error Variances for Physical Activity

	F	df1	df2	Sig.
Smoking	3.955	5	746	.002
Physical Act.	2.947	5	746	.012
Sleep	.833	5	746	.527

Research Question 2

Are there significant differences in self-reported overall physical health status in participants who have metabolic syndrome and participants who do not have metabolic syndrome?

The one way ANOVA (Table 21) indicated that self-reported overall physical health status was significantly associated with metabolic syndrome ($F(5,1070)=18.137$; $p=0.000$). The fewer metabolic syndrome risks, the better their self-reported overall physical health.

For this analysis, self-reported overall physical health status was the dependent variable. The mean of participants with no metabolic risk factors scored their health higher ($M=2.19$; $SD=0.586$) than participants with five risk factors ($M=1.61$; $SD=0.618$) (See Table 20).

Table 20

Self-reported Overall Physical Health Standard Deviation

	Mean	Standard deviation
No risk factors	2.19	0.586
1 risk factor	2.18	0.650
2 risk factors	1.97	0.574
3 risk factors	1.82	0.665
4 risk factors	1.75	0.706
5 risk factors	1.61	0.618

Table 21

ANOVA Self-Reported Overall Physical Health

	Type III Sum of Squares	df	Mean Squares	F	Sig.	Partial Eta Squared	Observed Power
Phys.Health	36.218	5	7.244	18.137	.000	.078	1.00
Error	427.332	1070	.399				
Total	4680.000	1076					

Table 22

Levene's Test of Equality of Error Variances for self-reported overall physical health

F	df1	df2	Sig.
6.845	5	1070	.000

Table 23

Least Significant Difference and Self-reported Overall Physical Health

# of metabolic risk factors	Compared to #of metabolic risk factors	Significance
0	1	0.927
0	2	0.000*
0	3	0.000*
0	4	0.000*
0	5	0.000*
1	2	0.000*
1	3	0.000*
1	4	0.000*
1	5	0.000*
2	3	0.013*
2	4	0.001*
2	5	0.001*
3	4	0.343
3	5	0.051*
4	5	0.191

*Statistical Significance

Research Question 3

Are demographic, psychosocial or physical variables predictors of metabolic syndrome?

For this analysis, metabolic syndrome was the dependent variable. Table 24 compares participants with metabolic syndrome and without metabolic syndrome in regard to the demographic, psychosocial or physical variables that were tested. The stepwise regression model examining metabolic syndrome included gender, race, education, personal history of high blood pressure, personal history of elevated cholesterol, personal history of cardiovascular problems, personal history of diabetes, family history of high blood pressure, family history of elevated cholesterol, family history of cardiovascular problems, family history of diabetes, occupational classification and household family income.

Table 24 *Stepwise Regression Variables for Metabolic Syndrome*

	Metabolic Syndrome (n=427)	No Metabolic Syndrome (n=729)	Total (N=1156)
Female	272 (34%)	531 (66%)	803
Male	155 (44%)	198(56%)	353
Race			
White	315 (37%)	539 (63%)	854
African American	93 (43%)	124 (57%)	217
Hispanic	6 (27%)	16 (73%)	22
Other	13 (21%)	50 (79%)	63
Education			
Some HS or less	3 (33%)	6 (66%)	9
HS graduate	19 (28%)	49 (72%)	68
Some college	31 (36%)	54 (64%)	85
College graduate	28 (25%)	86 (75%)	114
Post graduate	49 (26%)	141 (74%)	190
Household Income			
<\$35,000	34 (32%)	73 (68%)	107
\$35,000-\$49,999	15 (19%)	64 (81%)	79
\$50,000-\$74,999	30 (37%)	52 (63%)	82
\$75,000-\$99,000	15 (22%)	53 (78%)	68
≥\$100,000	29 (28%)	76 (72%)	105
Family History			
High blood pressure	298 (40%)	442 (60%)	740
Heart problems	238 (41%)	339 (59%)	577
Diabetes	224 (39%)	345 (61%)	569
High cholesterol	231 (39%)	362 (61%)	593
Occupational Classif.			
Faculty	64 (30%)	148 (70%)	212
Staff	330 (38%)	533 (62%)	863
Other	33 (41%)	48 (59%)	81
Self-Reported History			
Diabetes	22 (100%)	0 (0%)	22
Cardiovascular Disease	9 (36%)	16 (64%)	25
Elevated cholesterol	55 (53%)	48 (47%)	103

Using an alpha of .05, the variables of educational level, gender, family history of high blood pressure and race (Table 25) were included in the model while all the others were excluded. Educational level ($p=0.000$), gender ($p=0.000$), family history of high blood pressure ($p=0.000$) and race ($p=0.006$) were statistically significant. The model was statistically significant (Table 26) and explained 7.5% of the variance in metabolic syndrome among employees participating in the screenings.

Table 25

Metabolic Syndrome Model Summary

Model	R	R ²	Adj. R ²	SE	R ² change	F change	df1	df2	Sig.	Durbin-Watson
Educational Level	.175	.031	.30	1.401	.031	30.113	1	951	.000	
Educational Level and gender	.214	.046	.044	1.390	.031	15.203	1	950	.000	
Educational Level, gender and family history of high blood pressure	.259	.067	.064	1.375	.021	21.705	1	949	.000	
Educational level, gender, family history of high blood pressure and race	.273	.075	.071	1.371	.009	7.679	1	948	.006	1.277

Table 26

Stepwise Regression Model for Metabolic Syndrome

	B	SE	t value	p value
(Constant)	3.494	.502	6.962	.000
Educational level	.061	.011	5.706	.000
Gender	-.495	.101	-4.888	.000
Family History of high blood pressure	.460	.105	4.388	.000
Race	-2.64	.095	-2.771	.006

R²=.075 B=unstandardized beta weight; SE=standard error

Research Question 4

Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?

For this analysis, metabolic syndrome was the dependent variable. A stepwise regression model was used to examine metabolic syndrome in regard to waist circumference risk and body mass index. The model was statistically significant (Table 27) and explained 4.71% of the variance in metabolic syndrome in regard to waist risk and body mass index among employees participating in the WellBama screenings. Both waist circumference and BMI were statistically significant ($p=.000$). Waist circumference had an unstandardized Beta weight of 1.635 compared to BMI at .518. Therefore, in this sample, waist circumference was more predictive of metabolic syndrome than BMI. However, both predict metabolic syndrome.

Table 27

Stepwise Regression for Waist Risk and BMI

	B	SE	t value	p value
(Constant)	.793	.056	14.175	.000
Waist Risk	1.635	.080	20.417	.000
BMI	.518	.087	5.956	.000

R²=.0471 B=unstandardized beta weight; SE=standard error

Table 28

Model Summary for Waist Risk and BMI

Model	R	R²	Adj.R²	SE	R² change	F change	df1	df2	Sig.	Durbin- Watson
1	.675	.455	.455	1.059	.455	964.247	1	1154	.000	
2	.687	.471	.471	1.044	.016	35.471	1	1153	.000	1.845

1=Waist Risk, 2=Waist Risk and BMI

CHAPTER 5

DISCUSSION

The purpose of this study was to determine if there were significant differences between individuals with metabolic syndrome and individuals who did not meet the criteria for metabolic syndrome. Modifiable risk factors of tobacco use, physical activity and sleep were examined for their relationship with metabolic syndrome among employees at a southeastern university that participated in a wellness program. Self-reported overall health status was compared in participants who were classified as having metabolic syndrome and ones who did not meet the criteria. This study also identified common demographic, psychosocial and physical variables that predicted metabolic syndrome. Finally, waist circumference and BMI were compared to determine if one was superior in predicting metabolic syndrome.

This chapter presents 1) a summary of results, 2) conclusions based on the research objectives, 3) discussion, 4) implications and 5) recommendations for future research.

Summary of Results

Many studies associated with metabolic syndrome have focused on the diagnostic factors associated with the syndrome. An ongoing argument lingers in literature regarding which definition is ideal to use when identifying metabolic syndrome (Tenenbaum & Fisman, 2011). In this struggle to identify the best defining characteristics of the syndrome, a lack of attention has been given to comparing the characteristics of individuals with metabolic syndrome to individuals who do not have the clustering of risk factors. Understanding the criteria for

determining metabolic syndrome for each definition is important; however, a more detailed understanding of the individuals that develop metabolic syndrome is vital for prevention.

Rates of metabolic syndrome continue to increase in the United States. Presently, approximately 34 percent of the population in the United States has metabolic syndrome (Ervin, 2009), and some areas of the country have even greater incidences (Sinclair, Bogart, Buchwald, & Henderson, 2011). These rates are up from 26 percent in 2002 (Ford, Giles, Dietz, 2002). Focusing on preventing metabolic syndrome is advised to improve the overall health of the population.

For the focus to move to prevention, behaviors and characteristics of individuals with metabolic syndrome are important to explore when developing health promotion strategies that target decreasing metabolic syndrome risks. Metabolic syndrome is unique in that it is a clustering of risk factors. This clustering of individual risk factors can be more difficult to address and each addition of a risk factor increasingly affects health and well-being. A targeted, comprehensive approach is warranted in order to be proactive and not reactive to the individual's predisposition to metabolic syndrome.

There are multiple risk factors that are attributed to metabolic syndrome. Age, sex, and family history are all non-modifiable risk factors that have been shown to predispose individuals to metabolic syndrome. Smoking, lack of physical activity, sleeping habits, dietary habits and stress are all modifiable risks that also are prevalent throughout the literature. With these known risks, it is important to understand if some are more strongly associated with metabolic syndrome than others.

Of the 1156 participants in the study, 803 (70%) were female, 854 (73.9%) were Caucasian and a total of 884 (76.47%) were between the ages of 30-59. All participants who signed an informed consent to participate in the WellBama program, 2009-2011, are included in the study sample. During this same period of time, full-time employees of The University of Alabama were 56 percent female and 80 percent were Caucasian (Office of Institutional Research and Assessment, 2012). The participants in this study are representative of the university in regard to race; however, a limitation is the need for more male participation.

Of the 1156 study participants, 37 percent (427) had at least three of the five risks factors thus having metabolic syndrome. This is slightly higher than the national average. In 2009, the most recent documented rate of metabolic syndrome in United States was 34 percent (Ervin, 2009). Therefore, these findings indicate that this sample had a higher rate of metabolic syndrome than the national average. The higher prevalence of metabolic syndrome in this population may be attributed to geographic location. The southeastern region of the United States has higher rates of hypertension, diabetes and obesity which all contribute to the metabolic syndrome (Ervin, 2009).

The research for this study sought to answer the following questions:

Research Questions

- 1) Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to smoking, physical activity and amount of sleep?

- 2) Are there significant differences in self-reported overall physical health status in participants who have metabolic syndrome and participants who do not have metabolic syndrome?
- 3) Are demographic, psychosocial or physical variables predictors of metabolic syndrome?
- 4) Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?

Conclusion Based on Research Objectives

Research Question 1: Are there significant differences in participants with metabolic syndrome and participants who do not have metabolic syndrome in relation to smoking, physical activity and amount of sleep?

The multivariate analysis of variance (MANOVA) included the dependent variables of smoking, physical activity and sleep. Smoking was not found to be statistically significant ($p=.175$) in this population. Physical activity ($p=.000$) and sleep ($p=.054$) were statistically significant. Results showed increased physical activity decreases the chance of an individual having metabolic syndrome. Additionally, results indicate that the more sleep a person receives each day, the less likely they are to have metabolic syndrome.

Smoking has been reported to lower HDL cholesterol, increase LDL cholesterol and increase triglycerides, thereby increasing cardiovascular risk (Mjos, 1988). With the effect that smoking has on cholesterol levels, the assumption is that metabolic syndrome risks would be increased. However, this study indicated no significant relationship between smoking and metabolic syndrome. Previous research by Weitzman et al. (2005) and Kawada et al. (2010)

demonstrated a strong correlation between metabolic syndrome and smoking. In a study of a population of 4,000 Koreans, Lee et al. (2004) demonstrated that smokers who smoked 20 packs or more per year were two times more likely to develop metabolic syndrome than those who did not smoke.

Other researchers have found no association in smoking and the development of metabolic syndrome. Santos, Ebrahim, and Barros (2007) found smoking not to be associated with metabolic syndrome and showed that smoking did not appear to exert the risk of metabolic syndrome. They attributed their findings to an inverse relationship with obesity and smoking, particularly in females (Santos, Ebrahim & Barros, 2004).

There are a few possibilities why the results of this study are not consistent with findings from other studies. One may be that individuals did not correctly report smoking, fearing the results were going to be shared with their employer. Secondly, individuals that smoke tend to weigh less and would not be as likely to have increased waist circumference. Also, a large number, 377 employees, did not respond to the question regarding smoking history. This low response rate of smoking history could confound the results and generalizability of the findings. Another aspect to consider is that the studies mentioned above were conducted outside the United States. Results from previous research may not be translated to a southeastern population for this reason.

With consideration to physical activity, the findings from this study support the need for physical activity and are consistent with previous literature. Mozumdar & Liguori (2011a) found that a lack of physical activity increased the risk of developing metabolic syndrome. Santos, Ebrahim & Barros (2007) also showed an inverse relationship with physical activity and

metabolic syndrome. They demonstrated that physical activity not only decreases individual risks for metabolic syndrome but also the cluster of risks known as metabolic syndrome. Other researchers have reported that individuals who did not exercise were 1.7 times more likely to develop metabolic syndrome than those who exercised regularly (Lee et al., 2004). In determining this risk, the researchers assessed physical activity by classifying participants as exercising more than five times per week, one to five times per week, or not exercising (Lee et al., 2005). A hallmark study that researched NHANES data from 1999-2000 regarding the frequency and duration of leisure time physical activity showed that those that spent at least 150 minutes per/week in moderate to vigorous physical activity were twice as likely not to develop the metabolic syndrome (Ford, Kohl, Mokdad, & Ajani, 2005).

The method in which all of these studies addressed physical activity varied. Studies assessed the days and times per week that an individual participated in physical activity differently. This study asked participants to report the number of days each week that they engaged in physical activity for at least 20 minutes. Physical activity has previously been recorded in minutes per week (Ford, Kohl, Mokdad, & Ajani, 2005). Likewise, the amount of time spent in different forms of physical activity has been placed into a formula in an effort to categorize exercise levels by high intensity or low intensity (Laaksonen et al., 2002). Similar to this study, days per week have been used but the breakdown of self-reported days per week was not identical to what was used in this study (Lee et al., 2005). Regardless of the different methods in which researchers recorded the amount of physical activity engaged in each week, the results of the importance of physical activity and decreasing metabolic syndrome risks are consistent.

The findings from this study support the need for increased sleep. Lower amounts of sleep were associated with metabolic syndrome. Existing literature also associates lack of sleep and metabolic syndrome (Hall et al., 2008). Results from this study indicated no relationship with larger amounts of sleep.

Studies done to evaluate the relationship of sleep duration and the metabolic syndrome have shown that short duration sleepers increase their risk of metabolic syndrome when compared to individuals that sleep between seven and eight hours (Hall et al., 2008). The Hall et al. (2008) study was done in individuals aged 30-45 years and, like this study, utilized self-reported sleep duration. Similarly, another study in an Iranian population of 12,492 showed sleep duration less than 5 hours was positively associated with metabolic syndrome and sleep greater than nine hours was protective against metabolic syndrome. (Najafian, Toghianifar, Mohammadifard, & Nouri, 2011).

The findings from this study contradict findings from the Korean National Health and Nutrition Survey. In 4,222 participants, less than five hours of sleep or more than nine hours of sleep placed individuals at increased risk of developing metabolic syndrome (Choi et al., 2001). Other studies show that loss of sleep due to obstructive sleep apnea, difficulty falling asleep and snoring are all associated with a higher risk of metabolic syndrome (Troxel et al., 2010). Santos, Ebrahim, and Barros (2007) found similar results in a Portuguese population. The females in this study who slept nine hours or more were two times more likely to develop metabolic syndrome than those that slept seven hours (Santos, Ebrahim, & Barros, 2007).

Research Question 2: Are there significant differences in self-reported overall physical health status in those that have metabolic syndrome and those that do not have metabolic syndrome?

The one-way analysis of variance (ANOVA) included the dependent variable of self-reported overall physical health status. Self-reported overall physical health status was statistically significant ($p=.000$). The fewer metabolic risks that study participants had, the higher they rated their overall physical health.

Levene's test of Equality of Variances showed significance at $p<.000$. This was due to the wide range in means in those that had five risk factors (1.61) for metabolic syndrome and those that had one risk factor (2.19).

Few studies have examined the effects of metabolic syndrome on quality of life. Of these studies, only one known study was conducted in a United States population. The study that was done in the United States population used a national data set (NHANES).

Findings of this research study are consistent with the Amiri, Hosseinpah, Rambod, Montazeri, and Fereidoun (2009) study. They associated each additional metabolic syndrome risk factor with lower health related quality of life. Their study which was conducted in an Iranian population utilized the Short Form Health Survey (SF-36) to assess health related quality of life. However, unlike the present study, this research was done in women with metabolic syndrome (Amiri, Hosseinpah, Rambod, Montazeri, & Fereidoun , 2009).

Ford and Li (2008) utilized NHANES data from 2001-2002 to examine health related quality of life among adults with metabolic syndrome. Using questions in which individuals ranked their health as excellent, very good, good, fair or poor, the results of the study showed that the individuals with metabolic syndrome had fair or poor health which was statistically significant. In this study of 5,311 participants, the researchers concluded that people with

metabolic syndrome have reduced health related quality of life compared with those who do not have the syndrome (Ford & Li, 2008).

In a study done with the Korean NHANES data from 2005 findings health related quality of life was negatively associated with metabolic syndrome. They noted that women had lower quality of life scores than men (Park, Yoon, & Oh, 2010).

Research Question 3: Are demographic, psychosocial or physical variables predictors of metabolic syndrome?

Stepwise regression was done to examine what independent variables were predictors for the dependent variable of metabolic syndrome. The final regression model for predicting metabolic syndrome included educational level ($p=.000$), gender ($p=.000$), family history of high blood pressure ($p=.000$) and race ($p=.006$). This subset of variables accounted for 7.5 percent of the variance. In those that participated in this study, having a higher education level, being male, having a family history of high blood pressure and being Hispanic were associated with higher risk of metabolic syndrome. African Americans were closely behind Hispanics in metabolic syndrome risks in this study.

The findings for education level contradict previous research. In a previous study, a lower education level was consistent with higher metabolic syndrome risks (Lee et al., 2005). It is important to note that the study by Lee et al. was in a Korean population undergoing health check-ups conducted in a hospital and clinic setting which may account for some of the difference in findings. In another study done in the United States utilizing NHANES data from 1988-1994, education level for women was inversely related to metabolic syndrome but was not

statistically significant in males. Therefore, the higher the level of education in women, the lower the metabolic syndrome risks (Loucks et al., 2007). The differences in findings are not clear. Some studies suggest that research done on metabolic syndrome risks have not considered different regions of the country (Salsberry, Corwin, & Reagan, 2007). Perhaps, this is a finding that is characteristic to the southeastern United States. Findings from this study might also be attributed to the fact that it is a population on a university campus where people are usually more educated than residents in other settings. However, more research into this topic is needed.

For the most part, previous research has not been clear on what gender has the highest prevalence of metabolic syndrome. This study found that males had a higher rate of metabolic syndrome than females which is consistent with research done by Carnethon et al. (2004) and Cheung et al. (2008). Meigs et al. (2003) also found that men had higher risk than women in regard to metabolic syndrome but that women had a significantly higher waist circumference risk than men (Meigs et al., 2003). Salsberry, Corwin, & Reagan (2007) found women had the highest risk of developing metabolic syndrome in a study done using NHANES data from 1999-2002. These researchers demonstrated that up to the age of 65, women had higher metabolic syndrome risks, especially women who have the risk factor of abdominal obesity (Kuk & Ardern, 2010). Likewise, in another study, younger women were found to have the highest prevalence of metabolic syndrome (Mozumdar & Liguori, 2011). In contrast, Ford (2005) found equal rates of metabolic syndrome in women and men.

Family history of high blood pressure was shown to be an important predictor variable for metabolic syndrome and is consistent with previous research findings. Lee et al. (2005) noted that individuals with a family history of high blood pressure were 1.3 times more likely to

develop metabolic syndrome than those without a family history. In a prospective study, when considering a family history of cardiovascular disorders, individuals were more likely to suffer from the metabolic syndrome and had a higher mortality risk ratio when compared to individuals without this history (Lakka et al., 2002). Family history of cardiovascular disease has long been associated with an increased risk of high blood pressure, stroke and coronary disease (Barrett-Connor & Shaw, 1984). The results of this study are consistent with the literature regarding the significance of a family history and metabolic syndrome risks.

Race was also identified in this model as being a predictor for metabolic syndrome in this population. Hispanics that participated in the WellBama program were more likely to have metabolic syndrome followed by African Americans. This is consistent with previous research by Ford (2005). He found that Mexican Americans were more likely to suffer from metabolic syndrome than African Americans or Caucasians. Likewise, in similar national database studies, as well as longitudinal prevalence studies, Mexican Americans had the highest prevalence of metabolic syndrome when compared to Caucasians and African Americans (Meigs et al., 2003; Ford, Giles, & Dietz, 2002)

Research Question 4: Is waist circumference or BMI a better predictor of metabolic syndrome in this employee population?

Stepwise regression was done to examine whether the independent variables of waist circumference or BMI were better predictors for the dependent variable of metabolic syndrome. Both waist circumference ($p=.000$) and BMI ($p=.000$) were significant. However, waist risk best predicted metabolic syndrome with an unstandardized beta weight of 1.635 in comparison to an

unstandardized beta weight of .518 for BMI (constant beta weight was .793). Therefore, waist circumference was found to be the best predictor of metabolic syndrome in this population.

International standards for identifying overweight and obesity in adults using body mass index have been established by the World Health Organization (World Health Organization, 1997). However, increased risk of cardiovascular disease is directly linked to excess body fat in the abdominal region. Most studies agree that waist circumference is a better indicator; however, it is not a standard measurement in the majority of health care encounters in the United States (Smith & Haslam, 2007). In areas outside the United States, waist circumference is the preferred method of assessing overweight and obesity related health risks due to the ease in measurement. Body mass index requires the calculation of weight divided by height squared and then multiplied by a conversion factor, whereas waist circumference is one single measurement with no formula or calculation (Lean, Han, & Morrison, 1995).

This corresponds with previous research by Shen et al. (2006) that showed the superior method for measuring health risk was waist circumference followed by BMI. Ardern, Katzmarzyk, Janssen, and Ross in a 2003 study and Zhu et al. (2004) showed that waist circumference in addition to BMI is superior to BMI or waist circumference alone in determining cardiovascular risk. Similar findings were seen in children by Moreno et al. (2002). The researchers found that waist circumference was the best predictor of metabolic syndrome when compared to BMI and skinfold ratio (Moreno et al., 2002).

Discussion

This research has several implications for researchers and worksites with an interest in improving the overall health of individuals. Metabolic syndrome has been shown to increase

cardiovascular disease and diabetes (Lewis et al., 2008). Decreasing just one risk factor associated with the metabolic syndrome can increase life expectancy, decrease the risk of developing chronic medical conditions and improve the overall feeling of well-being (Klein, Klein, & Lee, 2002).

Of the 1,156 participants in this study, 37 percent had a systolic blood pressure of greater than or equal to 130 mmHg or were on a medication to control blood pressure. According to the Alabama Behavioral Risk Surveillance System, this is consistent with statewide averages of hypertension reported at 37 percent (CDC, 2010) but is higher than the 31 percent national average for hypertension (CDC, 2011). Of the 427 individuals in this study with metabolic syndrome, 68 percent had systolic blood pressure greater than 130mmHg or were on medication for high blood pressure. However, only 17 percent reported a history of being diagnosed with hypertension or taking hypertension meds. This indicates a disparity of 51 percent. Therefore, if these individuals reported correctly, over half of the population in this study with metabolic syndrome had a systolic blood pressure risk and were not currently being treated.

The findings of this study showed that a family history of high blood pressure was a very important risk for metabolic syndrome. Of the participants with metabolic syndrome, 40 percent had a family history of high blood pressure. The findings show that of the remaining participants that had a family history of high blood pressure, 41 percent of these had at least two risk factors for metabolic syndrome. This is a very high risk group. Not only do they have two of the five risk factors, they also have the significant variable of family history.

Another important finding of this research is the need for individuals to participate in physical activity to avoid metabolic syndrome. In this study, 26 percent of individuals with

metabolic syndrome did not report exercising at all and another 29 percent reported exercising only one to two times per week. If these participants would begin an exercise regimen, they may lower metabolic syndrome risks. Increasing physical activity and decreasing sedentary behaviors such as non-work computer time and television time can have a positive impact on decreasing metabolic risk factors (Ford, Kohl, Mokdad, & Ajani, 2005).

In the current study, sleep was found to be important in decreasing metabolic syndrome risks. Previous research by Santos et al. (2007) indicated a need for an average of seven to eight hours of sleep in order to decrease risks for metabolic syndrome. For this study, in participants with metabolic syndrome, 24 percent received six hours or less sleep. This is consistent with the 25 percent of Alabamians that report not receiving enough sleep (CDC, 2010). Sleep is a modifiable variable that is often overlooked and one that can often be targeted successfully (Strine & Chapman, 2005).

Self-reported overall physical health is another area of importance, as findings from this study indicate. Of the individuals in this study who were classified as having metabolic syndrome, 28 percent rated their health as fair or poor compared to 12 percent of individuals without metabolic syndrome. Nationally, 17 percent of the overall population rated their health as fair or poor and 23 percent of Alabamians listed their health as fair or poor (CDC, 2011). A lack of published research in the area of perceived health status as related to metabolic syndrome exists. The findings from this research are a starting point for attempting to understand the connection between metabolic syndrome and perceived overall health status. More research and attention are warranted as to how to improve overall health perception and determine if a low

perception of health deters these individuals from acting to improve their health or if the low perceived health is specifically related to metabolic syndrome risks.

Strengths of the Study

This is the first study of knowledge to compare the characteristics of individuals with and without metabolic syndrome in a southeastern population and in a university setting. Other strengths of the study are a large sample size and the method of data collection. Data were collected by trained personnel.

Limitations of the Study

This research is an important step in the investigation of metabolic syndrome and the most commonly seen characteristics in this employee population. Although many interesting results were identified that will contribute to the literature, especially in regard to a southeastern population, there are limitations to note.

Data were collected from wellness screenings by numerous individuals. Due to the fact that different individuals collected the data, slight variability in measurements such as blood pressure, waist circumference, height and weight are possible. All individuals participated in training through an informational video session regarding how to obtain measurements and had baseline knowledge of obtaining biometric data.

Individuals that volunteered to participate in the wellness screenings may differ from those that chose not to participate. Healthier individuals may be more likely to participate in wellness screenings than those that are unhealthy. Sogaard, Selmer, Bjertness, and Thelle (2004) found in the Oslo Health Study that self-selection, according to socio-demographic variables, had

little impact on prevalence estimates but that unhealthy persons participated less in the research than healthy individuals.

Self-reported data were utilized to obtain information regarding personal and family health history. The surveys were completed either online by the participant prior to coming to WellBama or at the screening on via paper and pencil format. Individuals may have reported information that was deemed socially acceptable to the researcher instead of their true medical situation, such as with smoking history (Cook & Campbell, 1979). Previous studies have been successful in relying on self-reported data and have shown it to be a reliable method to utilize (Bourgeois et al., 2007; Simpson et al., 2004). Schultz and Edington (2009) utilized self-reported data in secondary analysis when determining metabolic syndrome in an employee population. It is important to note that self-reported data collection methods are widely accepted in social science research (Colton & Covert, 2007).

Data for this study were cross-sectional. The nature of the design of this study does not provide a historical perspective on this population and does not allow inferences regarding causality on the associations found. This study was primarily a prevalence study and cause and effect cannot necessarily be determined. Conclusions were drawn from results of the population sample at one particular time. However, with this limitation in mind, cross-sectional study design has been frequently used throughout social science literature (Kuzma & Bohnenblust, 2001).

More information regarding sleep apnea or assistive sleep devices was needed. In future studies, more information will be gathered on aspects such as the use of assistive sleep devices

and hours of uninterrupted sleep. This limitation can confound the association found between shorter sleep duration and metabolic syndrome.

Blood work obtained for this study utilized different methods. Some blood was obtained from a venipuncture compared to individuals that participated in later years who had finger sticks for blood collection. In a recent statement regarding employee health screenings, the finger stick method was shown to be a reliable method for identifying individuals at risk and providing a basis for information regarding the next steps an individual needs to take regarding health. Finger stick results were available to the employee at the health screening. The finger stick method for cholesterol and glucose measurements was found to be an acceptable method for identifying health risk. Venipuncture is the preferred method if blood tests other than cholesterol or glucose levels are needed and if there is concern over the results of the finger stick results (Pennington, 2010).

The sample size included only those participants in the employee wellness program on a voluntary basis. The study sample may or may not be representative of all employees of the organization or the general working public. Individuals that did not participate may have higher risks of metabolic syndrome but this is not known. Also there may be healthier employees that did not participate in WellBama screenings that are not represented in this sample.

Finally, threats to internal and external validity are noteworthy. Internal validity threats are that participants could have answered WellBama profile questions in a manner that was not reflective of their true situation due to the fact that they were participating in research. This is known as the Hawthorne Effect. Another threat to the internal validity is the calibration of equipment used for blood testing. Due to possible differences in equipment at the WellBama

screenings, such as multiple blood analysis machines, slight variability is expected. Possible threats to the external validity of the study are population and environmental generalizability. The participants all worked in an institution of higher learning. With this university setting, there are various opportunities to participate in activities to promote health. There are multiple sites available for indoor and outdoor recreational activities, as well as access to healthy food alternatives that others may not have access (Slack & Draugalis, 2001).

Recommendations for Future Research

Future recommendations for research in the area of metabolic syndrome are vast. In this study, increased metabolic syndrome risk was strongly associated with Hispanic and African American males with a family history of high blood pressure and a higher level of education. This relationship can be further investigated and targeted interventions can be developed specifically for these populations. Further insight into sleep and the impact of metabolic syndrome are needed. Investigation into the dietary selections of participants who were identified with metabolic syndrome would also be an important aspect of developing metabolic syndrome prevention programs.

The future research of metabolic syndrome in this population should also include a longitudinal study of individuals as having metabolic syndrome in this study. Through the office of Health Promotion and Wellness, many initiatives have targeted decreasing many of the risk factors of metabolic syndrome. It would be interesting to see how these programs have had a positive impact on metabolic syndrome risks from 2009 to present.

Cost associated with metabolic syndrome is another area of research that is needed in this population. Decreasing healthcare associated costs is always an area that is attractive to

employers. Longitudinal study of these participants and healthcare costs should be a part of future research endeavors.

Future research is needed in the area of metabolic syndrome awareness. Determining if this population has heard of metabolic syndrome, if they understand the risk of metabolic syndrome and if they know how to decrease risk are all very important aspects of the continuation of knowledge regarding metabolic syndrome. When the knowledge of metabolic syndrome is increased, then research efforts can focus on whether knowledge of metabolic syndrome changes attitudes, behavior and lifestyle.

Finally, research is needed into the knowledge of metabolic syndrome and the screening and diagnostic practices of health care providers. Increasing knowledge regarding metabolic risk determination in everyday encounters is needed.

Final Conclusion

The findings reported in this study have added to the research regarding the importance of physical activity and sleep in decreasing the occurrence of metabolic syndrome. They have also given us insight into the overall feeling of health of those with metabolic syndrome. The research has also given us a predictive model for determining individuals at the greatest risk and solidified the importance of waist circumference measurements.

This research has created a wealth of knowledge in which to start working to improve the health of those with metabolic syndrome and those that are very close in converting to metabolic syndrome. Lifestyle modification and risk reduction are the charge and the trajectory of which to follow.

It is imperative that these research findings are translated into effective practices that will have a dramatic effect in decreasing metabolic syndrome. The knowledge must be used to improve health and wellbeing in an effort to move society toward a prevention model of health.

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Appendix A

IRB Approval

Office for Research
Institutional Review Board for the
Protection of Human Subjects

May 15, 2012



Melondie Carter, DSN, RN
Office of Health Promotion & Wellness
Capstone College of Nursing
The University of Alabama

Re: IRB # 09-OR-097-R3 "University of Alabama: Description of the Employee Health Status and Health Interests"

Dear Dr. Carter:

The University of Alabama Institutional Review Board has reviewed the revision to your previously approved expedited protocol. The board has approved the change in your protocol.

Please remember that your approval period expires one year from the date of your original approval, May 3, 2012, not the date of this revision approval.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants.

Good luck with your research.

Sincerely,

Carpantito T. Myles, MSM, FIM
Director & Research Compliance Officer
Office for Research Compliance
The University of Alabama



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**UNIVERSITY OF ALABAMA
INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS
REQUEST FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS**

I. Identifying information

Names:	Principal Investigator Melondie Carter, DSN	Second Investigator Rebecca Kelly, PhD, RD	Third Investigator Paige Johnson
Department:	Office of Health Promotion and Wellness	Office of Health Promotion and Wellness	Nursing
College:	Capstone College of Nursing	Office of Academic Affairs	Capstone College of Nursing
University:	University of Alabama	University of Alabama	University of Alabama
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Telephone:	205-348-0077	205-348-0077	205-348-2084
FAX:	348-6526	348-6526	348-5559
E-mail:	mcarter@ua.edu	rkelly@ua.edu	ptjohnso@ua.edu

Title of Research Project: University of Alabama: Description of the Employee Health Status and Health Interests

Date Submitted: April 12, 2012

Funding Source: Internal

Type of Proposal	<input type="checkbox"/> New	<input checked="" type="checkbox"/> Revision	<input type="checkbox"/> Renewal Please attach a renewal application	<input type="checkbox"/> Completed	<input type="checkbox"/> Exempt
Please attach a continuing review of studies form					
Please enter the original IRB # at the top of the page					

UA faculty or staff member signature: _____

II. NOTIFICATION OF IRB ACTION (to be completed by IRB):

Type of Review: Full board Expedited

IRB Action:

- Rejected Date: _____
- Tabled Pending Revisions Date: _____
- Approved Pending Revisions Date: _____

Approved—this proposal complies with University and federal regulations for the protection of human subjects.

Approval is effective until the following date: 5/1/13

- Items approved: Research protocol (dated _____)
- Informed consent (dated _____)
- Recruitment materials (dated _____)
- Other (dated _____)

Approval signature: _____

Date 5/15/2012

Appendix B

WellBama Score Sheet



CLUB SCORE SHEET

Height _____ Weight _____	Waist Circumference _____	Flexibility _____	Your Results	Bronze (0 pts)	Silver (5pts)	Gold (10 pts)	Crimson (15 pts)
Body Mass Index (BMI) ^ (OR) Body Fat Measurements				≥35	30-34.9	25-29.9	≤24.9
Male				≥26.1	21.1-26.0	16.1-21.0	≤16.0
Female				≥31.1	26.1-31.0	21.1-26.0	≤21.0
Systolic Blood Pressure + Diastolic Blood Pressure + <input type="checkbox"/> On medication <input type="checkbox"/> None				≥160*	140-159	120-139	<120
				≥100*	90-99	80-89	<80
LDL Cholesterol With 0-1 risk factors With 2+ risk factors With Diabetes, CHD, or >20% risk Risk factors: Non <input type="checkbox"/> OR Check Below <input type="checkbox"/> Diabetes <input type="checkbox"/> Smoking <input type="checkbox"/> Low HDL (<40mg/dl) <input type="checkbox"/> High blood pressure or on meds <input type="checkbox"/> Family history of early heart disease (mother or sister<65 or father or brother<55) <input type="checkbox"/> Age: men ≥45, women >55 <input type="checkbox"/> High HDL (≥60 mg/dl) minus 1 factor				≥200	180-199	161-179	≤160
Total Cholesterol _____				≥180	160-179	131-159	≤130
Total HDL Cholesterol _____ <input type="checkbox"/> On medication <input type="checkbox"/> None				≥140	120-139	101-119	≤100
Triglycerides				≥300	200-299	150-199	≤149
Glucose (blood sugar) OR HbA1c (%) _____ <input type="checkbox"/> On medication <input type="checkbox"/> None				≥140*	126-139	100-125	≤ 99
7.5				7.5	7.1-7.5	6.5-7.0	<6.5
Cardio Exercise days per week ^ Moderate intensity (Thirty minutes or more of aerobic activity)				0	1-2	3-4	5+
Tobacco Use (within 12 months) <input type="checkbox"/> Cigarettes <input type="checkbox"/> Dip/Chew <input type="checkbox"/> Pipe/cigar <input type="checkbox"/> former				Current user or quit <6 mos.	Quit for >6 mos. But <12 mos.		Never used or have quit for 12 mos.
TOTALS (^ indicates to point bonus if Crimson in both BMI & Exercise) (+ score lowest point value only)							
Range for Club Category				<45	45-79	80-114	115
Follow-up Times				3 months	6 months	6 months	1 year

<input type="checkbox"/>							
--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Male Female

CWID **Gender**

SWID

CWD Gender

Name _____

Department / **Box Number**

Phone Number

Date of Birth

E-mail

Date

Research: Yes No

Congratulations!

You are in WellBAMA Club

- Crimson
 - Gold
 - Silver
 - Bronze

2012 Annual Incentive \$25
paid at the end of the semester

Your next test will be
scheduled in

- 2012
2013

Earn up to \$200 in 2013

MY HEALTH COACH TODAY WAS

Office of Health Promotion & Wellness
The University of Alabama
321 Russell Hall | 348-0077
wellness@ua.edu

What does it all mean?

Definitions of the WellBAMA Screening Criteria

Waist Circumference is the distance around the umbilicus (bellybutton). Excess abdominal fat is a predictor of a number of negative health outcomes. Women with a waist measurement more than 35 inches or men with a waist measurement of more than 40 inches may have a higher disease risk.

Systolic Blood Pressure is a measure of the force in the arteries when the heart pumps and the pressure is the highest; 120 mmHg and below is considered normal. 140mmHg and above is considered high. Lowering blood pressure by dietary or pharmacologic means has been shown to decrease the risk of heart attacks, strokes and death. Excess weight, salt consumption, genetics and inactivity contribute to increased blood pressure. **Diastolic Blood Pressure** is a measure of the force in the arteries when the heart is between pumps and the pressure is the lowest. 80 mmHg and below is considered normal; 90 mmHg is considered high.

Body Mass Index (BMI) is a key measure for relating a person's body weight to their height (weight in kilograms/height in meters, squared). A person with a BMI of 25 is considered overweight and someone with a BMI of 30+ is considered obese.

Cholesterol is a waxy, fat-like substance that is found throughout the body. Total cholesterol levels should be kept under 200. Low-density lipoprotein (LDL) cholesterol is the "bad" cholesterol. Lowering LDL cholesterol by dietary or pharmacologic means has been shown to decrease the risk of heart attack, stroke and death. Eating too much animal, dairy, or partially hydrogenated fats can elevate LDL cholesterol. High density lipoprotein HDL cholesterol is the "good" cholesterol. A high level of HDL cholesterol in the blood (60+) is protective against heart disease, keeping arteries free of plaque build-up, while a low level increases the risk of disease. The level of HDL cholesterol is generally a factor of genetics. Smoking, obesity and inactivity can lower it while smoking cessation, increased physical activity, and modest alcohol intake can increase it.

Coronary Heart Disease (CHD) is the progressive reduction of blood supply to the heart muscle due to narrowing or blocking of a coronary artery. This progression can result in chest pain (angina) and eventually a heart attack. Coronary bypass or angioplasty is needed if medication and diet do not control the disease.

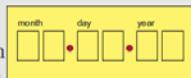
Sources: American Heart Association; National Heart Lung and Blood Institute; National Institutes of Health/National Institute of Diabetes & Digestive & Kidney Disease, National Cholesterol Education Program, Centers for Disease Control and American College of Sports Medicine.

If it is unreasonable because of a medical condition for you to achieve the standards for the reward under this program, or if it is medically inadvisable for you to attempt to achieve the standards for the reward under this program, please contact The University of Alabama Director of Health and Wellness during your session or contact our office at 205-348-0077 and we will work with your to develop another way to qualify for the reward. Club scores are subject to change.

WellBAMA Personal Pledge

(Select one or two)

- I _____ do hereby commit to making the following lifestyle related changes to begin and to continue for one year/forever. In doing so, I understand that I will enjoy the benefits of healthier living to include feeling and looking better.
- I commit to losing 5% of my weight over the next six months with a goal weight of _____ in one year.
- I commit increasing my exercise to 3-5 days per week.
- I commit to reducing my use of tobacco over the next _____ weeks/months with a quit day of _____.
- I commit to increase my consumption of fruits and vegetable to five per day.
- I commit to decreasing my consumption of sugar and fried foods to 1-2 times weekly.
- I commit to identifying better ways to reduce stress to include: _____.
- I commit to seeing my primary care physician/nurse practitioner for my preventive physical exam.
- I commit to being compliant with my medication and following my doctor's orders for taking care of myself.
- Other: _____
- I commit to my family and friends that this pledge is important
- I commit to myself that I can do this.



Signature _____

Date _____

Appendix C

WellBama Profile

THE UNIVERSITY OF ALABAMA

Office of Health Promotion and Wellness
 321 Russell Hall
 Tuscaloosa, Alabama 35487
 (205) 348-0077

Date:	_____
Name:	_____
Date of Birth:	_____
Age:	_____
Gender:	<input type="checkbox"/> Male <input type="checkbox"/> Female

Confidential WellBama Profile

1. Considering your age, how would you describe your overall physical health?
 Excellent Good Fair Poor
2. How many servings of food do you eat each day that is high in fiber, such as whole grain bread, high fiber cereal, fresh fruits or vegetables?
 5-6 servings per day 3-4 servings per day
 1-2 servings per day Rarely/Never
3. How many servings of foods do you eat each day that are high in cholesterol or fat such as fatty meat, cheese, fried foods or eggs?
 5-6 servings per day 3-4 servings per day
 1-2 servings per day Rarely/Never
4. Of the following types of milk, which do you usually drink?
 Whole milk 2% milk Soymilk
 1% milk Skim milk Don't drink milk
5. How many drinks of alcoholic beverages do you have in a typical week? (One drink equals one beer, glass of wine, shot of liquor or mixed drink.)
 1-2 drinks 3-4 drinks Don't drink alcohol
 5-6 drinks 7 or more drinks
6. How would you describe your cigarette smoking habits?
 Still smoke (Go to Question 7)
 Used to smoke (Go to Question 8)
 Never smoked (Go to Question 9)
7. How many cigarettes on average do you smoke per day?
 Less than 9 10-15
 16-19 20+
8. How many years has it been since you smoked cigarettes on a fairly regular basis?
 1 2 3 4 5 6 7 8 9 10 or more
9. Do you smoke or use (Check all that apply):
 Pipes?
 Cigars?
 Smokeless tobacco?
 None
10. In the average week, how many times do you engage in physical activity (exercise or work which is hard enough to make you breath heavily and make your heart beat faster) and is done for at least 20 minutes? Examples are brisk walking, running, or heavy labor such as lifting digging, chopping, etc.)
 Less than 1 time per week 3 times per week
 1 or 2 times per week 4 or more times per week

11. How many hours of sleep do you usually get in a 24-hour period?
 9 hours or more 8 hours 7 hours 6 hours or less
12. In general, how satisfied are you with your life (including personal and professional aspects)?
 Completely satisfied Partly satisfied
 Mostly satisfied Not satisfied
13. Would you agree that you are satisfied with your job?
 Strongly agree Agree
 Disagree Strongly disagree
14. In general, how strong are your social ties with your friends and/or family?
 Very strong Weaker than average
 About average Not sure
15. Have you suffered a personal loss or misfortune in the past year? (For example, a job loss, disability, divorce, separation, jail term, or the death of someone close to you)
 Yes, two or more serious losses
 Yes, one serious loss
 No
16. How often do you feel tense, anxious, or depressed?
 Often Rarely
 Sometimes Never
17. Over the past two weeks, how often have you had little interest or pleasure in doing things?
 Not at all Several days
 More than half the days Nearly every day
18. Over the past two weeks, how often have you felt down, depressed or hopeless?
 Not at all Several days
 More than half the days Nearly every day
19. During the past year, how much effect has stress had on your health?
 A lot Some Hardly any None
20. How often do you use drugs or medication which affect your mood or help you to relax?
 Every day Almost every day Sometimes Rarely/never
21. In the past 12 months, how many days of work have you missed due to personal illness?
 Zero days 1-2 days 3-5 days 6-10 days 11-15 days 16 or more
22. During the past 4 weeks, how much did your health problems affect your productivity while you were working?
 A lot Some Hardly any None
23. Do you visit a physician or nurse practitioner for a yearly physical?
 Yes No
24. When was your last yearly physical?
 Past 12 months Past 2 years
 Past 3 years More than 3 years ago

25. In the past 12 months, how many times have you:

	None	1-2 times	3-5 times	6 or more times
Visited a physician's or nurse practitioner's office or clinic				
Gone to the emergency room				
Stayed overnight in a hospital				

26. When is the last time you had these preventive services or health screenings?

	< 1 yr ago	1-2 yrs ago	2-3 yrs ago	3-4 yrs ago	5-6 yrs ago	7 or more yrs ago	Never	Don't know
Colon cancer screening								
Rectal exam								
Flu shot								
Tetanus shot								
Blood pressure								
Cholesterol								
-WOMEN ONLY-								
Pap Test								
Mammogram								
Breast exam by MD or nurse								
-MEN ONLY-								
Prostate exam								

27. a. **Women:** How often do you examine your breasts for lumps?

Monthly Once every few months Rarely or never

b. **Men:** How often do you examine your testes for lumps?

Monthly Once every few months Rarely or never

28. Race/Origin

White (Non-Hispanic origin) Black (Non-Hispanic origin) Hispanic
 Asian or Pacific Islander American Indian/Alaskan Native Other

29. Highest level of education you have achieved:

Some high school or less High school graduate Some college
 College graduate Post-graduate or professional degree

30. Expected household income this year:

Less than \$35,000 \$35,000-\$49,999 \$50,000-\$74,999
 \$75,000-\$99,000 \$100,000 or more

31. Do you have a family history (brother, sister, mother, father, grandparent) of:

- a. High blood pressure Yes No I'm not sure
- b. Heart problems Yes No I'm not sure
- c. Diabetes Yes No I'm not sure
- d. Breast cancer Yes No I'm not sure
- e. Cancer (other than breast) Yes No I'm not sure
- f. High cholesterol Yes No I'm not sure

32. Do you have:

	Never	In the past	Currently have	If currently have	
				Taking medication	Under medical care
Allergies					
Arthritis					
Asthma					
Back pain					
Cancer					

Chronic bronchitis/emphysema					
Chronic pain					
Depression					
Diabetes					
Heart problems					
Heartburn or acid reflux					
High blood pressure					
High cholesterol					
Migraine headaches					
Osteoporosis					
Stroke					

33. In the next 6 months, are you planning to make any changes to keep yourself healthy or improve your health?

	Yes	No	Don't Know	Not needed
Increase physical activity				
Lose weight				
Reduce alcohol use				
Quit or cut down smoking				
Reduce fat/cholesterol intake				
Reduce salt intake				
Lower blood pressure				
Lower cholesterol level				
Cope with stress better				
Perform monthly self breast (female) or testes (male) exam				

34. How likely would you be to participate in the following at work in the next year:

	Extremely Likely	Somewhat likely	Somewhat unlikely	Extremely unlikely
Body fat testing				
Cancer prevention				
Heart disease prevention				
Stroke prevention				
Cholesterol reduction				
Effects of depression on work and family				
Walk-fit programs				
Healthy cooking (snacks/meals)				
Healthy eating (do's and don'ts)				
Weight management programs (diet and exercise)				
Smoking cessation programs				
Stress reduction programs				

