IDENTIFYING BARRIERS TO WEIGHT MANAGEMENT IN NATIVE HAWAIIAN WOMEN

by

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This dissertation is dedicated to my boys: Chris, Diesel and Driver. All I do in life is for you. Chris, thank you for never letting me give up especially when I really wanted to. Diesel and Driver, know that you are the motivating force that keeps me striving to be the best mom and best person I can be. I love you more than all the fishes in the sea and all the stars in the sky. I doubt you will ever read this dissertation, but I hope you at least read this page one day.

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ABSTRACT

Overweight and obesity has become one of the leading public health concerns of the 21st century, especially among high risk minority populations. The cause of overweight and obesity is multifactorial, encompassing genetics, diet, and physical inactivity. However, it has become generally accepted that the combined increase in caloric intake and subsequent decrease in physical activity observed in Americans is the underlying factor for the increase being observed in all segments of the population. The purpose of this study was to conduct an exploratory analysis to identify barriers to weight maintenance, specifically those related to physical activity and healthy eating, among Native Hawaiian women. Additionally, the extent to which personal behaviors, perceived barriers, and demographic characteristics affect weight management was also examined.

To fulfill the study purpose Native Hawaiian women were recruited via social media and email to complete a 4-part web-based survey. The survey assessed demographic characteristics, physical activity, dietary behaviors, and perceived barriers to healthy eating and physical activity. To identify barriers to weight management a Chi-square automatic interaction detector (CHAID) decision tree analysis was performed.

Based on the results of the CHAID decision tree analysis the strongest barrier to weight management in Native Hawaiian women is the extent to which participants feel they lack motivation to eat a healthy diet. Another dietary variable that was identified as a strong barrier to weight management among Native Hawaiian women was the self-reported consumption of high fat processed meats. Three variables related to physical activity were identified as barriers to weight management in our sample participants.

These included number of days participants walked for at least 10 minutes in the last 7 days, and the perceived lack of time due to family and job commitments.

The findings of this study that sought to identify barriers to healthy eating and physical activity has important implications for the development of well-tailored intervention and behavior change programs. This information is especially vital for practitioners looking to effect real change in the weight status of Native Hawaiians.

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CHAPTER I

INTRODUCTION

More than half of the U.S adult population is overweight and over a third are obese (Flegal, Carroll, Ogden, & Curtin, 2010). Incidence and prevalence rates for overweight and obesity continue to rise in both men and women, all ages, and among all racial and ethnic groups (Flegal et al., 2010). Obesity prevalence is slightly higher among women than in men and racial differences persist. Minority groups exhibit a ten percent higher combined prevalence of obesity than non-Hispanic whites (Wang & Beydoun, 2007). While Native Hawaiians are a relatively small group (< 1% of U.S. population) they exhibit a disproportionately high prevalence of obesity and obesity-related diseases (Davis et al., 2004; McNeely & Boyko, 2004). The most recent data indicated that 75.7% of all Native Hawaiians residing in the state of Hawaii are overweight and or obese (Hawaii Department of Health, 2014).

Overweight and obesity have been linked to many diseases and conditions and is a significant predictor of cardiovascular disease, especially in women (Hubert, Feinleib, McNamara, & Castelli, 1983; Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999). Native Hawaiians exhibit disproportionately high morbidity rates of many lifestyle-related diseases and conditions generally associated with being overweight and obese, particularly diabetes cardiovascular disease, and cancer (Bassett et al, 1969; Grandinetti et al., 1998; Hughes, Tsark, & Mokuau, 1996). Johnson, Oyama, LeMarchand, and Wilkens (2004) determined that Native Hawaiians in the state of Hawaii exhibit the

highest mortality rates from heart disease, diabetes, and cancer than any other racial group observed (Johnson, Oyama, LeMarchand & Wilkens, 2004).

The cause of obesity is multifactorial, encompassing genetics, diet, and physical inactivity. However, it has become generally accepted that the combined increase in caloric intake and subsequent decrease in physical activity observed in Americans is the underlying factor for the increase being observed in all segments of the population. While research on the dietary patterns of Native Hawaiians is sparse, the available body of literature suggests Native Hawaiians typically consume a hypercaloric diet (high in cholesterol, fat and refined grains) and are not meeting recommendations for fruit and vegetable consumption (Kolonel, Hankin, Nomura, & Chu, 1981; Moy, Sallis, & Thompson, 2010; Park, et al. 2005). With year-round warm weather and access to abundant outdoor recreational activities it would be expected that Native Hawaiians residing in the State of Hawaii would have higher levels of physical activity than the national norm. In a large longitudinal study conducted in Hawaii 52.8% of Hawaiians were meeting physical activity guidelines (Zou, Zhang, & Maddock, 2012). However, data presented did not specify gender differences in physical activity data. Therefore the activity levels of Native Hawaiian women specifically were not presented.

Research on barriers and facilitators to weight management on Native Hawaiians is extremely limited, again highlighting the need for further research in this area. Most studies on barriers to weight management in this population have been conducted among college/university students (Boyd & Brown, 2007). Identifying barriers to weight management in Native Hawaiian women of all ages is crucial. By identifying barriers for

women and finding ways to overcome these barriers, benefits will have a trickle-down effect and have the potential to affect the entire family.

Purpose Statement

The purpose of this study was to conduct an exploratory analysis to identify barriers to weight maintenance, specifically those related to physical activity and healthy eating, among Native Hawaiian women. Additionally, the extent to which personal behaviors, perceived barriers, and demographic characteristics affect weight management was also examined.

Research Questions

1. What are the perceived barriers to physical activity among Native Hawaiian women?
2. What are the perceived barriers to healthy eating among Native Hawaiian women?
3. Which barriers, those associated with physical activity or those associated with healthy eating, are a stronger hindrance to weight management among Native Hawaiian women?
4. How do variables such as demographic characteristics, dietary intake, and level of physical activity effect weight management among Native Hawaiian women?

Definition of Terms

1. Overweight: Body Mass Index (BMI) ≥25 but <30 (CDC, 2012).

2. Obese: BMI ≥ 30 (CDC, 2012).
3. Native Hawaiian: any individual who is a descendant of the aboriginal people who, prior to 1778, occupied and exercised sovereignty in the area that now comprises the State of Hawaii (Pub. L. 89–10, 2002).
4. Physical activity: any body movement produced by skeletal muscles that result in a substantial increase over the resting energy expenditure (Caspersen, Powell, & Christenssen, 1985).

Assumptions

1. It is assumed that all subjects will answer questionnaires honestly.
2. It is assumed that all information on the demographic sheet will be reported as accurately as possible.

Limitations

1. Due to the convenience sampling of participants rather than random sampling the generalizability of the results may be limited.

Significance of the Study

Obesity is one of the leading public health concerns of the 21st century, especially among racial/ethnic minority populations. The main contributors to obesity are lack of physical activity and poor dietary behaviors. Identifying the most significant barriers to weight management among Native Hawaiian women will allow for better tailored and

more appropriate intervention programs to be established to decrease and/or prevent the obesity epidemic from continually increasing in this population.

CHAPTER II

REVIEW OF LITERATURE

This chapter will review general information on the obesity epidemic in the U.S. and it's specific impact on the Native Hawaiian population including a review of the literature related to the prevalence of being overweight and/or obese in the United States, morbidity and mortality rates associated with obesity, and the relationship diet and physical activity has on prevalence of overweight and/or obesity. Current information on identified barriers and facilitators to weight management including healthy eating and exercise will be examined. To end the chapter, literature specifically related to any barriers to weight management identified among Native Hawaiian's will be presented.

Obesity in the U.S.

Obesity in the U.S. has become one of the leading public health concerns of the 21st century. As stated by former Surgeon General David Satcher, "Left unabated obesity will overtake smoking as the number one preventable cause of death in this country (Winters & Spurlock, 2004). Incidence and prevalence rates continue to rise in both men and women, all ages, and among all racial and ethnic groups (Flegal, Carroll, Ogden, & Curtin, 2010). This increase in virtually all demographics suggest that elevated weight levels are not due to genetics, but instead are due to lifestyle related choices. Data from the most recent National Health and Nutrition Examination Survey (NHANES) indicate that more than half of the U.S. adult population is overweight and the current prevalence

of obesity is 33.8% (Flegal et al., 2010). Obesity prevalence is slightly higher among women than in men and racial differences persist.

Although obesity is rising in all races, racial and ethnic minority groups have been disproportionately affected. Minority groups exhibit a ten percent higher combined prevalence of obesity than non-Hispanic whites (Wang & Beydoun, 2007). African-American and Mexican-American women for instance, exhibit a higher prevalence of overweight and/or obesity, and Mexican-American men have a greater prevalence of overweight and/or obesity than their non-Hispanic white and Black counterparts (U.S. Department of Health and Human Services [USDHHS], 2001). NHANES data indicate that the lowest prevalence of obesity are observed in Non-Hispanic white adults with non-Hispanic Black adults having the highest prevalence (Flegal et al., 2010). However, it is important to point out that the only racial/ethnic minority groups represented in NHANES are non-Hispanic Blacks and Mexican-Americans. The racial/ethnic variance in prevalence of obesity is stronger among women than men (Wang & Beydoun, 2007). Additionally among women, higher obesity rates are associated with lower levels of education and income (Chang & Lauderdale, 2005; Schoenborn, Adams, & Barnes, 2002; Wardle, Waller, & Jarvis, 2002). As, previously stated, NHANES data does not adequately represent racial minority groups beyond non-Hispanic Blacks and Mexican-Americans. Therefore, prevalence of overweight and obesity for other racial and ethnic groups are estimated from smaller less representative samples (Davis et al., 2004).

Traditionally, low prevalence rates of overweight and obesity has been observed in Asian/Pacific Islander's (Davis et al., 2004). However, this group is extremely heterogeneous and when broken up into individual Asian and Pacific Islander sub-groups

huge variances in obesity exists. Asian-Americans comprise 4.8% of the country's population and consist of Chinese, Filipino, Asian-Indians, Vietnamese, Korean, Japanese, and other Asian Ancestry (Hoeffel, Rastogi, Kim, & Shahid, 2012). When analyzed separately Asian-Americans have the lowest prevalence of obesity and lowest mean BMI for racial/ethnic minority (McNeely & Boyko, 2004). Majority of Pacific Islander Americans are Native Hawaiian, Guamanian/Chamorro, and Samoan (Hixson, Hepler, & Kim, 2012). Results of the 2010 U.S. Census indicate that Native Hawaiian and Pacific Islanders make up less than 1% of the total U.S. population (Hixson et al., 2012). While this is a relatively small group it exhibits a disproportionately high prevalence of obesity and obesity-related diseases (Davis et al., 2004; McNeely & Boyko, 2004). According to the most recent data 75.7% of all Native Hawaiians residing in the state of Hawaii are overweight and/or obese (Hawaii Department of Health, 2014). This number is staggering and represents a large increase since 2001 (Hawaii Department of Health, 2001). In 1991, Aluli went as far as suggesting that a subpopulation of Native Hawaiians living in a rural community in Hawaii may have the highest rates of obesity in the entire nation.

Genetic Influence on Obesity in Hawaiians

Past studies conducted on this under-researched population have found an increased percentage of Hawaiian ancestry to be significantly associated with increases in BMI, subcutaneous fat distribution, and waist-to-hip ratio (Brown, et al., 1993; Grandinetti, et al., 1999, 2002). The fact that this relationship was still observed after controlling for factors such as age, leisure time physical activity, total dietary energy intake, and in one study socioeconomic variables suggests an underlying genetic

predisposition for obesity in this population (Brown et al., 1993; Grandinetti et al., 1999). A genetic theory that Polynesians have adapted an efficient metabolism producing rapid adipose tissue growth to survive ancient sea voyages has been suggested by McGravey (1991). He theorized that in order to survive long sea voyages without risking starvation, Polynesians had to evolve and adapt a thrift-genotype mechanism featuring efficient metabolism and adipose reserves. In this scenario, those individuals who were able to adapt better would be more likely to survive and pass on their genes to future descendants. Exposure to modernization has decreased the need for these adaptations and may have an influence on the increased rates of obesity exhibited by Polynesians living in the developed world (McGravey, 1991). It should be remembered that this hypothesis is, as McGravey stated, "... an evolutionary scenario... it cannot be tested (McGravery, 1991, 1592S)." It should also be noted that this study primarily involved Samoans and was generalized to other Polynesian races. Polynesia is a distinct area of the Pacific, also called the Polynesian Triangle. The eight main Polynesian cultures come from Aotearoa (New Zealand), Hawaii, Tahiti, Rapa Nui (Easter Island), Fiji, Samoa, Tonga, and the Marquesas. Anthropologists believe that all modern Polynesian cultures descended from the same original culture that migrated and settled throughout the area (Bishop Museum, 1995). While underlying genetic influences to efficiently store fat and therefore increase body size may exist, genetics cannot be changed. Therefore, lifestyle modification focused on the main contributors to obesity; diet and exercise, need to be made to overcome this possible predisposition.

Defining Obesity

Obesity is defined as an excess of body fat mass (Guillaume, 1999). Measurement of body composition, which involves the comparison of fat and fat-free tissue, is used to determine if an individual is overweight and/or obese. There is no precise percentage of body fat associated with optimal health. However, values higher than 22% for males and 32% for females are considered unhealthy (American College of Sports Medicine [ACSM], 2009). Most population-based studies use body mass index, a ratio of a person's height compared to their weight, to categorize individuals as either normal weight, overweight, or obese. The Centers for Disease Control (CDC) defines overweight in adults as a BMI of 25 kg/m² to 29.9 kg/m² and obesity as a BMI of 30 kg/m² or greater (CDC, 2012).

Morbidity and Mortality Associated with Obesity

Overweight and obesity have been linked to many diseases and conditions including hypertension, Type II diabetes, osteoarthritis, hypercholesterimia, and gall bladder disease (Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999). Obesity is a significant predictor of cardiovascular disease, especially in women (Hubert, Feinleib, McNamara, & Castelli, 1983). The American Heart Association has classified obesity as a major modifiable risk factor for coronary heart disease (Eckel & Krauss, 1998). Obese men and women are at an increased risk for total cardiovascular disease, angina, coronary heart disease, congestive heart failure and coronary death (Hubert et al., 1983). Additionally, women who are obese also have an increased risk of myocardial infarction, atherothrombotic stroke, and cardiovascular death (Hubert et al., 1983). A link between

overweight and obesity and mortality from cancer has also been determined. Overweight and obesity is significantly associated with increased mortality rates due to esophageal, colorectal, liver, gallbladder, pancreatic, and kidney cancer for both men and women (Calle & Kaaks, 2004). In men there was also an increase in mortality rates from stomach and prostate cancer and in women there were greater deaths from cancers of the breast, uterus, cervix, and ovary associated with overweight and obesity (Calle & Kaaks, 2004). In 1999 it was estimated that there were 325,000 obesity-attributable deaths in the United States (Allison, Fontaine, Manson, Stevens, & VanItallie, 1999). A second study published in 2005 reduced this estimate to 111,909 excess deaths associated with obesity (Flegal, Graubard, Williamson, & Gail, 2005). While these numbers vary, they both illustrate the burden obesity has placed on the U.S. population. The problem is not just that obesity is related to an increased incidence of mortality, but also that it is related to premature mortality. A majority (84,145) of the 111,909 excess deaths associated with obesity occurred in individuals below the age of 70 (Flegal et al., 2005). Obesity significantly effects years of life lost and therefore lessens life expectancy, especially when obesity presents at a younger age (Fontaine, Redden, Wang, Westfall, & Allison, 2003). Using data from the Framingham Heart Study, Peeters et al. (2003) determined a decrease in life expectancy due to obesity of 5.8 years and 7.1 years for 40 year-old men and women, respectively. These numbers increased when individuals were not just obese but smokers as well (Peeters et al., 2003).

Native Hawaiians exhibit disproportionately high morbidity rates of many lifestyle related diseases and conditions generally associated with being overweight and obesity, particularly diabetes cardiovascular disease, and cancer (Bassett et al, 1969,

Grandinetti et al., 1998; Hughes, Tsark, & Mokuau, 1996). According to Grandinetti et al. (1998), the prevalence of Type II diabetes mellitus is higher among Hawaiians than whites. The prevalence of diabetes among Native Hawaiians was also found to be four times higher compared to the national prevalence rate determined by the second National Health and Nutrition Examination Survey population (Grandinetti et al., 1998). Due to these disproportionately high rates of diabetes secondary conditions such as diabetic retinopathy is also significantly higher among Native Hawaiian and Pacific Islanders as compared to non-Hispanic whites (McNeely & Boyko, 2005). Johnson, et al. determined that Native Hawaiians in the state of Hawaii exhibit the highest mortality rates from heart disease, diabetes, and cancer than any other racial group observed (Johnson, Oyama, LeMarchand, & Wilkens, 2004). These data highlight the need for primary prevention of obesity and its related comorbidities in this population.

Dietary Patterns and Obesity in the U.S.

The cause of obesity is multifactorial, encompassing genetics, diet, and physical inactivity. However, it has become generally accepted that the combined increase in caloric intake and subsequent decrease in physical activity observed in Americans is the underlying factor for the increase being observed in all segments of the population. Data show that Americans are consuming diets high in sugar and fat with few micronutrients (Block, 2004). The top ten energy contributors in the U.S. diet were foods such as soft drinks, sweets (such as donuts and cakes), and high fat foods like pizza, cheeseburgers and french-fries (Block, 2004). Alarmingly, 25% of all of the energy consumed by the Americans came from sweets, soft drinks, and alcohol (Block, 2004). Consumption of

energy-dense, nutrient-poor foods is often done at the expense of healthier nutritious options. Analysis of NHANES II found that individuals with a diet high in energy-dense and nutrient-poor food had lower levels of vitamins A, E, C, B12, and folate (Kant, 2000). Diets high in energy dense foods were independently and significantly associated with higher BMI in women, higher waist circumferences in both men and women. These diets are also independently associated with higher fasting glucose and metabolic syndrome (Mendoza, Drewnowski, & Christakis, 2007). Americans are eating double the recommended amount of refined grains and less than a third of the recommended amount of whole grains daily (Wells & Buzby, 2008).

A large proportion of Americans are not meeting daily recommendations for fruit and vegetable consumption (Casagrande, Wang, Anderson, & Gary, 2007). Only 28% and 32% of adults were meeting guidelines for fruit and vegetable consumption, respectively (Casagrande et al., 2007). About half of all adults reported consuming no whole fruits or fruit juice and 25% report consuming no daily vegetables (Casagrande et al., 2007). The prevalence of adherence to recommended guidelines for fruit and vegetable consumption is consistently lower in the southern United States and lowest in rural areas (Beydoun & Wang, 2008). The major cancer research governing bodies have determined that consumption of 5-6 servings of fruits and vegetable daily would lower global cancer rates by 20% (Glade, 1999). This conclusion highlights the need for programs and initiatives that promote adherence of dietary guidelines among Americans.

Additionally, a number of studies are showing a growing trend in the number of commercially-processed meals Americans consume away from home (Guthrie, Lin, & Frazao, 2002; Kant & Graubard, 2004; Nielsen, Siega-Riz, & Popkin, 2002). Foods

prepared at home are much more healthful than away-from-home foods (Lin & Frazoa, 1999). Meals and snacks that are not prepared in the home tend to be higher in calories, fat, saturated fat, and lower in fiber, calcium, and iron (Guthrie et al., 2002). Consumption of meals from fast-food chains is increasingly mentioned as one of the main culprits. Most fast food restaurant menus have an extremely high energy density that is 65% higher than the average diet (Prentice & Jebb, 2003). In a 15 year prospective study Pereira and colleagues found fast food consumption to be positively related to weight gain and insulin resistance, suggesting that fast food increases the risk for obesity and Type II diabetes (Pereira et al., 2005). Individuals who consume fast food are heavier than those who do not--probably due to the high caloric nature of the food options available at such eateries (Binkley, Eales, & Jekanowski, 2000). These dietary intake patterns are alarming and a probable contribution to the growing incidence of overweight and obesity in the U.S. Block (2004) makes a poignant recommendation, "…it is critical that weight reduction campaigns not emphasize eating less, but rather eating differently" (p. 442).

Dietary Fat and Obesity

The effect of dietary fat on overweight and obesity has been strongly debated in the literature (Bray, 1998; Katan, 1997; Willett, 1998). Two meta-analyses found that diets low in fat did in fact lead to weight loss in overweight subjects, but more importantly these diets helped to prevent weight gain in normal weight subjects (Astrup, Grunwald, Melanson, Saris, & Hill, 2000; Astrup, Ryan, Grunwald, Storgaard, Saris, Melanson, & Hill, 2000). A review of a number of large population based studies in the U.S. found what they called an "interesting paradox" (Heini & Weinsier, 1997).

According to Astrup (2001) there are 3 main reasons why diets high in fat contribute to overweight and obesity: foods high in fat are less satiating than foods high in carbohydrates, therefore eating a diet high in fat leads to “passive overconsumption” a positive energy balance and subsequent weight gain; fat is absorbed easier by the intestine therefore fecal energy loss is lower; lastly foods high in carbohydrates have a greater thermogenic effect that foods high in fat. Between the studies periods of 1976-1980 and 1988-1991 obesity rates significantly increase, however average fat intake decreased and the percentage of the population consuming low-calorie products significantly increased. According to the literature this paradox is due to the concomitant decrease in lifestyle related physical activity which is greater than the small decrease occurring in consumption of dietary fat.

Dietary Patterns in Native Hawaiians

Few studies analyzing the dietary patterns of Native Hawaiians have been conducted. Those that have are relatively small in sample size. However, a general view of the food intake of this population can be determined from the available body of literature. In a multi-ethnic cohort study looking at dietary patterns of Caucasians, African-Americans, Japanese-Americans, Latinos, and Native Hawaiians, Native Hawaiians consumed a higher mean intake of energy than all other ethnicities (Park et al., 2005). When compared to four other racial/ethnic groups in Hawaii, Native Hawaiians had the highest mean daily cholesterol intake and second highest intake of fat (Kolonel, Hankin, Nomura, & Chu, 1981). Compared to Japanese men residing in Hawaii, who interestingly enough have significantly lower rates of cardiovascular disease, Native

Hawaiian men consume significantly more calories from fat, lower proportion of carbohydrates, more alcohol, less fiber, and overall more daily calories (Bassett et al., 1969). Native Hawaiian women residing in Hawaii report eating higher amounts of processed meat, red meat, fish, poultry, eggs, fats and oils, and condiments than other racial groups (Maskarinec, Novotny, & Tasaki, 2000). This pattern of intake was related to a positive relationship to BMI after adjusting for daily energy intake (Maskarinec et al., 2000). In a study sample of 100 Native Hawaiian participants only 1% of the study population met recommendations for fruit and vegetable consumption (Moy, Sallis, & Thompson, 2010). This in a state that boasts a year-round climate ideal for producing a bounty of fresh locally-grown produce. All of these findings are supported by Parks et al., who also found that Native Hawaiians factor toward a more "Western" diet high in fat, meat, and refined grains (2005).

Diet and Health

Beyond the contribution it has on obesity, diet significantly impacts an individual's overall health (National Research Council, 1989). After in depth analysis of all available epidemiological, clinical, and laboratory evidence, the government formed Council on Diet and Health concluded that diet influences the risk of several major chronic diseases including: atherosclerotic cardiovascular disease; hypertension; many forms of cancer including esophageal, stomach, large bowel, breast, lung, and prostate cancer; chronic liver disease; and Type II diabetes (National Research Council, 1989).

A number of governmental and non-governmental agencies have developed dietary guidelines to improve the health of Americans. The American Heart Association

(AHA) recommends that individuals consume a variety of fruits, vegetables, and grains, especially whole grains, fat-free and low-fat dairy products, and lean proteins such as fish, legumes, and poultry (Krauss et al., 2000). The U.S. Department of Agriculture (USDA) and the USDHHS publishes the *Dietary Guidelines for Americans* report every five years. The most recent report released in 2010 has two main overarching goals (USDA & USDHHS, 2010). The first is to maintain healthy energy balance over time to achieve and sustain a healthy weight. Specifically individuals should consume only enough calories from foods and drinks to meet their energy needs and they should be physically active. The second goal is to focus on consuming nutrient dense foods and beverages. The foods this report recommends are virtually identical to that of the AHA: vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood, lean meats and poultry, eggs, beans and peas, and nuts and seeds.

There is no singular criteria for healthy eating. One can assume that following dietary guidelines such as those developed by the AHA, USDA & USDHHS would be considered eating healthy. Because no standard definition for healthy eating exists, individual conceptualization of healthy eating can vary (Falk, Sobal, Bisogni, Connors, & Devine, 2001; Povey, Conner, Sparks, James, & Shepherd, 1998). Falk and colleagues identified seven predominant themes in the perceived definition of healthy eating (2001). According to their research people view eating healthy as: eating low-fat foods; eating natural/unprocessed foods; balanced eating; eating to prevent disease; maintaining nutrient balance; eating to manage a disease; and eating to control weight (Falk et al., 2001). Povey and colleagues (1998) found that participants view healthy eating as: eating foods containing fiber and vitamins, eating natural foods, eating fresh foods, consuming a

variety of foods, avoiding fried foods, eating a balanced diet, and being careful about food. British adults define healthy eating as a varied diet including all of the major food groups but with lots of fruits and vegetables (Lake et al., 2007). While these views and definitions vary there also exist some overlap and commonalities. Having a clearer understanding of what healthy eating means to Native Hawaiian women can help in the development of programs and initiatives targeted to this population.

Barriers to Healthy Eating

Socioeconomic Status

Socioeconomic status (SES) has a significant impact on health. In a systematic review of literature on SES and its effects on obesity it was concluded that in developed societies, such as the U.S., higher SES is associated with lower prevalence of obesity in women (Sobal & Stunkard, 1989). However there is large variability in research with regards to conceptualizing and measuring socioeconomic status. A wide variety of constructs have been used to measure SES. Most frequently measures of income, education level, or a combination of the two are used (Sobal & Stunkard, 1989). When controlling for age, sex, region, race/ethnicity, and urbanization, Beydoun and Wang (2008) found a significant and positive relationship between SES and adherence to dietary guidelines and diet quality. Additionally, they found a strong positive association between SES and nutritional knowledge and beliefs indicating that individuals with a higher SES who have also been educated on proper nutritional practices are most likely to follow and adhere to nutritional guidelines than those with a high SES who have less nutritional knowledge and beliefs (Beydoun & Wang, 2008). Women in low-income

groups report higher total energy intake and higher percentage of energy from fat (Jeffery & French, 1996). Individuals who live in higher SES neighborhoods consume more fruits and vegetables. Specifically, Dubowitz and colleagues concluded that for every one standard deviation increase in the neighborhood SES resulted in an additional 0.13 servings of fruit and an additional 0.11 servings of vegetables per day (Dubowitz et al., 2008). Research has also shown that individuals with higher SES engage in caloric restriction and dieting more frequently than those from lower SES (Jeffery, Adlis, & Forster, 1991; Jeffery & French, 1996).

Access to Food Sources

It has been suggested that access to different food sources and food purchasing options can have a significant impact on diet quality and thus body composition. Individuals living in close proximity to large corporate-owned chain supermarkets have a lower prevalence of overweight, obesity, and hypertension (Morland, Diez Roux, & Wing, 2006). A number of studies have also found that individuals who shop at large chain supermarkets versus other food stores, such as gas station convenience stores, consumed significantly more fruits and vegetables (Rose & Richards, 2004; Zenk et al., 2005). In a study accessing the dietary quality of pregnant women, those who lived greater than four miles away from a supermarket were twice as likely to fall in the lowest quality diet category as compared to those who lived within two miles of a full service supermarket (Laraia, Siega-Riz, Kaufman, & Jones, 2004). Living within a mile of your primary food store has a positive effect on fruit and vegetable consumption (Rose & Richards, 2004).

SES can have an effect on access to food sources as well. In a multi-site population based sample of Americans, Morland and colleagues (2002) found that there are three times as many supermarkets in wealthier neighborhoods. Wealthier neighborhoods also have fewer small grocery stores, convenience stores, and specialty food stores that sell predominantly high fat, high sugar, processed snack food options. When assessing racial composition in these neighborhoods, Morland and colleagues found that supermarkets are four times more common in predominantly white neighborhoods than in predominantly Black neighborhoods (Morland, Wing, Diez Roux, & Poole, 2002). Grocery stores in predominantly Black neighborhoods are also less likely to sell healthy foods or healthier food options such as fat free milk versus whole milk (Sloane et al., 2003). In a qualitative study African-American participants identified inaccessibility to grocery stores as a barrier to eating and purchasing fruits and vegetables (Yeh et al., 2008). Additionally it has been suggested that fast food outlets, which as discussed earlier are associated with excessive weight gain and type II diabetes, are more common in poorer neighborhoods (Reidpath, Burns, Garrard, Mahoney, & Townsend, 2002). After conducting an in-depth literature review on access to food sources, Larson and colleagues concluded that residents of low-income, minority, and rural neighborhoods are most often affected by poor access to supermarkets and healthful foods (Larson, Story, & Nelson, 2009).

Food Cost

Advances in food manufacturing technology have made energy dense foods that are high in processed sugars and fat available to consumers at a very low price (Drewnowski & Specter, 2004). When comparing foods on a per-calorie basis, energy

dense foods that have lower nutritional quality often cost less than energy diluted healthier food options (Drewnowski, 2004). Foods that are encouraged and included in government recommendations such as lean meats, fish, fruits and vegetables cost more per calorie and can sometimes be difficult to obtain for low SES individuals (Drewnowski & Darmon, 2005). An analysis of household spending found that wealthier households bought leaner meats, more fruits, and more vegetables (Kauffman, MacDonald, Lutz, & Smallwood, 1997). This pattern suggests that an individual's food purchasing may be affected by their ability to afford healthier foods. A survey of women in Australian indicated that one of the main self-reported barriers to healthy eating was the perception that healthier foods cost more and are more difficult to prepare (Andajani-Sutjahjo, Ball, Warren, Inglis, & Crawford, 2004). The most commonly reported barrier to fruit and vegetable consumption in a qualitative analysis among a multi-ethnic study population was the high cost of fruits and vegetables (Yeh et al., 2008). African-Americans in the sample reported limited access to full-service grocers which led to infrequent visits. Because visits were so spread out the fruits and vegetables were either consumed quickly and not replenished for days or they spoiled before being consumed which led to frustration (Yeh et al., 2008). While no research exists it can be assumed that this would be a significant barrier to healthy eating for Native Hawaiians since food prices are significantly higher in Hawaii than in the continental U.S. For instance, current prices for a gallon of milk in Hawaii can be as high as $8.99 per gallon (Hillyer, 2014).

Lack of Time

In a number of studies conducted in the European Union the most widely reported perceived barrier to eating healthy was lack of time (Kearney & McElhone, 1999;

Lappalainen, Saba, Holm, Mykkanen, & Gibney, 1997). Respondents reported that irregular work hours and busy lifestyles were preventing them from adopting healthier eating patterns (Kearney & McElhone, 1999). A survey of women in Australia found time constraints to be one of the top three barriers to healthy eating and physical activity (Andajani-Sutjahjo et al., 2004). Results of another study in a similar population of Australian women found the most commonly reported cause of time pressure was long hours at work or study (Welch, McNaughton, Hunter, Hume, & Crawford, 2009). Other reported causes of time pressure were inflexible and unpredictable hours at work, working unusual hours, and commitments to children, other family members and friends (Welch et al., 2009). Less research on the effect of time constraints on diet and diet selection have been conducted in the United States. A study of low income families in Minnesota found that half of all respondents felt time was a barrier to healthy eating (Eikenberry & Smith, 2004). Lack of energy and preparation time were commonly mentioned barriers in a qualitative study of multiethnic populations in Connecticut and North Carolina (Yeh et al., 2008). When accessing barriers to physical activity in U.S. adults, Brownson and colleagues found that women more frequently reported personal barriers such as lack of time and energy than men (Brownson, Baker, Housemann, Brennan, & Bacak, 2001). However, large population studies, like those conducted in Europe and Australia, specifically accessing barriers to healthy eating are lacking in the U.S.

Facilitators for Healthy Eating

Knowledge

Many studies have found an association between diet/nutritional knowledge and healthy eating. Increased knowledge of nutrition and diet-health awareness is positively associated with increased scores on the Healthy Eating Index, a questionnaire developed by the U.S. Department of Agriculture that measure how well someone's diet conforms to governmental dietary guidelines (Variyam & Blaylock, 1998). Among British nationals, those who scored in the highest quartile on nutritional knowledge were 25 times more likely to meet British guidelines for fruit, vegetable, and fat intake than those in the lowest quartile (Wardle, Parmenter, & Waller, 2000). When interviewed respondents state that the key perceived enabler to fruit and vegetable consumption and healthy diet is knowledge about the health benefits of fruits and vegetables (Yeh et al., 2008). As previously stated, SES is associated with healthier eating. However, findings from Beydoun and Wang (2008) suggest that health and nutrition education is important since education level alone did not lead to healthier eating among the participants in their study. Instead, the positive association of SES with diet quality varied by the nutrition knowledge and beliefs of their participants (Beydoun & Wang, 2008). Variyam and Blaylock (1998) found racial differences in nutritional knowledge. When controlling for all other variables, Blacks and other ethnic and racial minority groups have lower nutritional knowledge than whites (Variyam & Blaylock, 1998). In studies it has been observed that African-American women have lower levels of nutritional knowledge than whites and Hispanics (Klohe-Lehman et al., 2006).

Women often do majority of the shopping and have a strong influence on the diets of other family members in the household. Their level of nutritional knowledge can often influence that of their children as well (Gibson, Wardle, & Watts, 1998). Maternal nutritional knowledge has a strong positive impact on the diets of the children in the household (Variyam, Blaylock, Lin, Ralston, & Smallwood, 1999). This relationship tends to be stronger among younger children and tappers off as children age (Variyam et al., 1999). A strong positive correlation has been found between mother's nutritional knowledge and the fruit and vegetable consumption of her children (Gibson et al., 1998). Additionally, maternal intake of fruits and vegetables is a strong predictor of child fruit and vegetable intake (Cooke et al., 2004).

Access to Food Sources

While it has been earlier identified as a barrier, food access and availability can also be a facilitator to healthy eating. A number of variables within the home have been associated with healthy dietary behaviors. When fruits, 100% fruit juice, and vegetables are kept in the home adolescents are more likely to eat them even when they don't prefer to consume these types of foods (Cullen et al., 2003). While access to healthier options such as fruits, 100% fruit juice, and vegetables can increase consumption this remains true with less healthy option such as soft drinks. The availability of soft drink in the home and soft drink vending machines at school has a strong association with soft drink consumption in adolescents (Grimm, Harnack, & Story, 2004).

Social Influences

Our social environments and social groups can have an effect on our attitudes and knowledge about food and our food choices. An individual's family has been identified

as an important influential factor for how they view and define healthy eating especially if there exists a diet related chronic diseases in their family medical history (Falk et al., 2001). Being aware that a condition, such as high blood pressure for example, is common among multiple family members can influence someone's dietary decision making. Additionally, as previously mentioned the home environment we grew up in and currently live in has an impact on our dietary behaviors (Cooke et al., 2004; Cullen et al., 2003; Gibson et al., 1998).

Other social groups that have an impact on healthy eating and our views on healthy eating are friends, the organizational culture at our workplace, and the ethnic-racial group we most identify with. Individuals who participate in weight-loss interventions with friends and family have higher retention rates and tend to be more successful at losing and maintaining weight-loss post intervention than those who participate on their own (Wing & Jeffery, 1999). Dietary behavior change can be hard to attain. Research shows that social support from co-workers can have a significant effect on someone's readiness to change their diet and increase their fruit and vegetable consumption (Sorensen, Stoddard, & Macario, 1998).

Faith Communities

In recent years a growing body of research has focused on religious involvement and its impact on health and wellness. High religious involvement is associated with better overall physical health as measured by various health indicators (Chatters, 2000). Religious adolescents are less likely to participate in behaviors that have the potential to be detrimental to their health and are more likely to engage in behaviors that have a positive effect on their health (Wallace & Forman, 1998). Adolescents who report that

religion is very important to them are more likely to eat nutritiously, exercise regularly, and get adequate amounts of rest compared to their less religious peers (Wallace & Forman, 1998). In a study conducted to ascertain barriers and facilitators to fruit and vegetable consumption, African-American participants described their churches as a good setting for educating and motivating healthy eating (Yeh et al., 2008). However, these faith communities can also be a barrier. Many African-American churches have "Sunday feedings" which are potluck style fellowship gatherings after church service. Generally these feedings consist of high fat, high calorie, traditional "soul-food". In an effort to improve the health of their parishioners many Black churches offer health services and programs (Thomas, Quinn, Billingsley, & Caldwell, 1994). Because African-Americans report being receptive to health information delivered via their faith community churches serve as a great real life setting for the implementation of health interventions. As such a number of studies have been successful in implementing churched based nutritional interventions (Campbell et al., 1999; Resnicow et al., 2001, 2002, 2004; Winett, Anderson, Wojcik, Winett, & Bowden, 2007).

Physical Activity Patterns in the U.S.

The World Health Organization (WHO) recommends that adults get at least 150 minutes of moderate-intensity aerobic physical activity or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate and vigorous intensity activity in bouts lasting at least 10 minutes at a time. In addition to aerobic activity, muscular strengthening activities involving all major muscle groups should be conducted at least 2 or more days per week

(WHO, 2010). These guidelines are in line with the most recent Physical Activity Guidelines for Americans (USDHHS, 2008). Data collected via the National Health Interview survey in 2008 indicates that 43.5% of Americans meet recommendations for aerobic activity, 21.9% meet guidelines for muscular-strengthening activity, and 18.2% of American meet guidelines for both recommendations (Carlson, Fulton, Schoenborn, & Loustalot, 2010). According to the 2005-2006 NHANES the amount of physical activity U.S. adults met varied greatly based on the method of data collection. When collected via self-report survey data 62% were meeting the Physical Activity Guidelines for Americans, whereas only 9.6% were meeting these guidelines based on accelerometer measurements (Tucker, 2011). Trojano et al. (2008) also found that levels of physical activity were substantially lower for accelerometer measured activity than for self-reported measurements. With this being said most large scale population based studies in the U.S. that access physical activity do so via self-report. Individuals were more likely to meet 2008 Physical Activity Guidelines for Americans if they were male, younger, white, had higher levels of education, and had a lower BMI (Carlson, Fulton, Schoenborn, & Loustalot, 2010).

Physical Activity Patterns in Native Hawaiians

With year-round warm weather and access to abundant outdoor recreational activities it would be expected that Native Hawaiians residing in the State of Hawaii would have higher levels of physical activity than the national norm. In a large longitudinal study conducted in Hawaii, 49.1% of adults in Hawaii were meeting physical activity guidelines (Zou, Zhang, & Maddock, 2012). When looking specifically at Native Hawaiians, this number increased to 52.8% (Zou et al., 2012). Native Hawaiians,

according to this data set, were one of the most active ethnic groups in the State. For residents of the state of Hawaii predictors for meeting physical activity recommendations include being male, younger, Native Hawaiian, having a job that involves walking or heavy labor, not being obese, being in excellent health, having high self-efficacy, spending less time sitting, and walking a dog frequently (Zou et al., 2012).

Physical Activity and Health

Regular aerobic physical activity can increase cardiovascular function in turn preventing cardiovascular disease (Fletcher et al, 1996). A large body of evidence has shown that physical inactivity is a risk factor for coronary artery disease and there exists a direct link between inactivity and cardiovascular related mortality (Fletcher et al, 1996). When looking at exercise as medicine a meta-analysis looking at the protective effect of physical activity on cardiovascular and all-cause mortality found that physical activity was associated with a risk reduction of 35% and 33% for cardiovascular mortality and all-cause mortality, respectively (Nocon et al, 2008). Individuals who engage in no leisure time physical activity have twice the odds of developing metabolic syndrome, which is marked by high levels of abdominal obesity, hypertriglyceridemia, low high-density lipoprotein cholesterol, high blood pressure, and hyperglycemia (Ford, Kohl, Mokdad, & Ajani, 2005). Metabolic syndrome is associated with high morbidity, specifically from diabetes and cardiovascular disease, and mortality (Ford et al., 2005). Current estimates indicate that one in four Americans participate in no leisure-time physical activity (Moore, Harris, Carlson, Kruger, & Fulton, 2013).

Barriers to Physical Activity

Barriers to physical activity may be either personal or environmental. Environmental barriers to physical activity may include things like weather conditions, lack of facilities or sidewalks, pollution, or safety. While personal barriers include lack of time, family and work commitments, lack of motivation, social support, disability or injury, etc. Individuals may face a number of perceived personal or environmental barriers to participation in physical activity. To design well planned and effective interventions to increase physical activity and health a clear understanding of what these perceived barriers are in a given population are crucial.

The highest reported perceived barriers to participation in physical activity are lack of time and lack of motivation (Brownson, Baker, Housemann, Brennan, & Bacak, 2001; Chin, White, Harland, Drinkwater, & Raybould, 1999). Few studies have looked at weather as a perceived barrier. Of those that have none have found a strong association for this variable (Humpel, Owen, & Leslie, 2002). In a multi-ethnic sample of older U.S. women the most frequently reported perceived barriers to physical activity were caregiving duties and lack of energy, both of which are personal barriers (King et al., 2000). Lack of time and feeling too tired for physical activity were both highly reported in most of the ethnic groups accessed in this study as well (King et al., 2000). Eyler et al. (2002) found in a large sample of ethnically diverse women that family priorities were the main barrier to physical activity in all of the groups represented. Individuals that report receiving social support to exercise are more likely to meet recommendations for physical activity (Parks, Houseman, & Brownson, 2003).

Perceived barriers vary when looking at socioeconomic standing. When assessing those with higher income lack of time and motivation remains the dominant perceived barriers for this group. While those with lower income report illness or disability, lack of money, and lack of transport as strong barriers to physical activity (Chin, White, Harland, Drinkwater, & Raybould, 1999). Income level in and of itself may be a barrier to physical activity. In studies, lower income participants were less likely to meet physical activity recommendations than higher income participants (Parks et al., 2003; Whitt-Glover, Taylor, Heath, & Macera, 2007).

Barriers and Facilitators to Weight Management in Native Hawaiians

Research on barriers and facilitators to weight management on this specific and under-researched population is limited, again highlighting the need for further research in this area. Most studies on barriers to weight management on Native Hawaiians have been conducted among college/university students. This is most likely to do accessibility of a study sample. Most scientific studies are conducted by academics working at a college or university and the most accessible sample for these individuals would be the students at these institutions. While these studies have limited generalizability due to the fact that they are predominantly focused on college age participants (ages 18-25) it still gives us some information specific to the Native Hawaiian population. Boyd and Brown (2007) conducted one of the few studies that assessed the topics of barriers and facilitators to weight management. According to their focus group findings the biggest barrier to physical activity levels was lack of time, such as lack of time to travel from school, to work, and to a place (beach, mountain, field, or facility) where they could engage in

activity. A repeated theme mentioned by numerous participants was the inability to find time for physical activity when juggling the demands of school, work, and home life. This is interesting since Hawaii boast a year-round warm climate and ample access to outdoor recreational areas ideal for participation in physical activity, which ironically was identified as a facilitator to physical activity. Social support for healthy eating and physical activity was also identified as a facilitator among this group as well (Boyd & Brown, 2007). Zou, Zhang, and Maddock (2012) found that education level and household income were not significantly associated with meeting physical activity recommendations.

CHAPTER III

METHODS

Participants

Volunteers were recruited using e-mail solicitation through non-profit organizations, professional organizations, alumni groups, Facebook and other social media. Approval to conduct this study was obtained from the Internal Review Board at Middle Tennessee State University (Appendix A).

Inclusion criteria for the study were:

a. Participants must be female.

b. Between the ages of 18 and 65.

c. Have some self-reported blood quantum of Native Hawaiian.

Measures

All data was collected electronically via the use of the online survey tool Survey Monkey. A link to the survey was dispersed to prospective participants via social media outlets such as Facebook, and via email, as previously mentioned. The online survey included the collection of multiple data types such as demographic information, questions to access level of physical activity, a quick dietary analysis, and most importantly an inventory to access barriers to weight management.

Demographic Information

Demographic questions were asked to gather background information on all participants. Information that was ascertained included level of education, household income, marital status and familial composition (whether the participant is living with and raising children). Additionally, personal information such as age and self-reported percentage of Native Hawaiian ancestry was collected as well. This part of the online survey also asked participants to self-report their height and weight. This information was used to calculate Body Mass Index (BMI) for each participant. Using this data women will be categorized as overweight (BMI $\geq$ 25) or not overweight (BMI $\leq$ 25).

Physical Activity

Current physical activity level was assessed using the International Physical Activity Questionnaire short version (IPAQ-short, Appendix B). The IPAQs has been used extensively to estimate the prevalence of activity and sedentary behaviors in over 70 countries (Baunman et al., 2009; Guthold, Ono, Strong, Chatterji, & Morabia, 2008). Validity and reliability of the IPAQs has been established for a diverse range of populations (Craig et al., 2003).

Dietary Intake

The Rapid Eating Assessment for Participants Shortened Version (REAP-short) was used to assess participants' dietary behaviors. This sixteen-item survey that quickly analyzes the relative intake of fat, cholesterol, fiber, sugar, and selected food groups (Gans et al., 2003, Appendix C). While originally designed to be used for pre-diabetes

patients in low-literacy populations this tool addresses many of the dietary concerns of interest for this current study including: fat intake, meals consumed away from home, fruit and vegetable intake, as well as a final question to access willingness or intention to change eating habits. A number of validation studies have been conducted on this instrument and it has been found to be useful at estimating fruits, vegetables, and milk servings, as well as fat, cholesterol, fiber and sugar intake (Segal-Isaacson, Wylie-Rosett, & Gans, 2004). The REAP-s has demonstrated a high test re-test reliability ($r = 0.86$, $p < .0001$) (Gans et al., 2006).

Barriers to Weight Management

Perception of barriers to weight management was determined using a survey developed by Andajani-Sutjahjo, Ball, Warren, Inglis, & Crawford (2004). This 22-item questionnaire assesses 2 sets of barriers, those related to physical activity and those related to healthy eating. Item response options include: Not a barrier, A somewhat important barrier, A very important barrier, and Not applicable (Appendix D).

Data Analysis

All statistical analyses were conducted using IBM SPSS v21. Descriptive analysis was done to determine demographic data on the sample population. This study utilized Chi-squared automatic interaction detector (CHAID) a data mining algorithm to analyze barriers to weight management. This method splits study samples into homogenous groups based on the strength of designated predictor variables. This decision tree analysis is useful when the intended outcome is exploratory rather than confirmatory, involves

multiple independent variables and their interactions with a single dependent variable, and when there is a lack of evidence on the extent to which these independent variables predict the dependent variable (Boslaugh, Kreuter, Nicholson, & Naleid, 2005). Additionally, classification tree analyses allow variables of different levels (nominal, ordinal, scale) to be combined in the same analysis without having to recode variables. For these reasons the CHAID decision tree analysis was deemed more suitable than classical statistical methods such as logistic regression.

CHAPTER IV

RESULTS

Participants

A total of 272 individuals voluntarily participated in the survey. Of the initial 272 participants 17 individuals were immediately excluded due to being male or not having any Native Hawaiian ancestry, making the participant total 255. Two hundred and twenty-nine women completed all parts of the web-based survey.

Descriptive Characteristics

Table 1 summarizes the demographic and descriptive characteristics of the women who volunteered for the study. The average age of participants was 41.3 years old, and a large proportion were less than half Native Hawaiian (77%, *N* = 196). A third of the participants possessed a Bachelor's degree from a four-year institution, and a little over one third (32%) of the women who participated in the survey had a household income of greater than $100,000 per year. Majority of the participants (60%) were married or in a domestic partnership or civil union and were the primary caregiver for a minor(s) under the age of 18.

Anthropometric Data

Self-reported height and weight was used to calculate participants BMI. Table 2 depicts the frequency of BMI levels. The mean BMI for the entire study sample was 29.1 (*SD* = 6.9). A large proportion of the sample population had BMI levels that classify

Table 1
Descriptive Characteristics of Survey Participants

	Included cases for analysis (*N* = 255)
Variable	*N (*%) or *mean* ± *SD*
Age (Y)	41.3 ± 11.4
18 – 35	97 (38)
36 – 55	122 (48)
56 or older	36 (14)
Percentage of NH	
25% or less	109 (42.7)
≥25% but <50%	87 (34.1)
≥50%	59 (23.1)
Education Level	
< High School	2 (1)
High School or GED	21 (8)
Some College	56 (22)
Vocational or Technical School	14 (5)
Associates	20 (8)
Bachelors	76 (30)
Graduate	66 (26)
Household Income (*N* = 253*)*	
<$50,000	74 (29)
≥$50,000 but <$100,000	98 (39)
≥$100,000 or more	81 (32)
Relationship Status	
Married, Domestic Partnership or Civil Union	153 (60)
Widowed, Divorced, or Separated	36 (14.5)
Single, but cohabitating	37 (14.5)
Single, never married	29 (11)
Primary Caregiver of Child(ren) <18	
Yes	151 (60)
No	102 (40)

Table 2

Anthropometric Data

	Included cases for analysis (N = 255)
	N (%) or *mean* ± *SD*
Body Mass Index	29.1 ± 6.9
Underweight (<18.5)	1 (0.4)
Normal (18.5 – 24.99)	84 (32.9)
Overweight (25 – 29.99)	63 (24.7)
Obese (30 – 34.99)	63 (24.7)
Obese Class II (35 – 39.99)	27 (10.6)
Morbidly Obese (40 – 80)	17 (6.7)

them as either overweight and/or obese (66.7%, *N* = 170). Additionally, 6.7% (*N* = 17) possessed a BMI of greater than 40 placing them in the morbidly obese category. A BMI of greater than 40 indicates they likely have acquired some obesity-related disease or disorder.

Physical Activity Data

The IPAQ-short was used to determine participant's level of physical activity. This data is presented in Table 3. A total of 23 women failed to answer questions on physical activity. Participants reported both the number of days and the average amount of time per week spent participating in moderate and vigorous physical activity and walking. This data was used and compared to the recommended levels based on the *Physical Activity Guidelines for Americans* (USDDHS, 2008). These guidelines recommend at least 150 minutes per week of moderate and/or 75 minutes per week of vigorous physical activity. A small percentage of women (11%, *N* = 21) met recommendations for both moderate and vigorous physical activity, and slightly more than half (56%, *N* = 130) met neither of the recommendations.

Dietary Intake

Dietary behaviors, as measured by the REAP-short are listed in Table 4. Of the 255 Native Hawaiian women who accessed the web-based survey 15 chose to omit answers to this section. This 16-item tool collects the frequency (usually/often, sometimes, with regards to many major food groups. The behavior in which volunteers

Table 3

Physical Activity Guidelines for Americans

	Included cases for analysis (N = 232)
Physical Activity Level	*N* (%)
Moderate	
Yes	47 (20)
No	132 (80)
Vigorous	
Yes	76 (33)
No	156 (67)
Both	21 (11)
None	130 (56)

Table 4
Participants Results for Rapid Eating Assessment for Participants Shortened Version

	Included cases for analysis (*N* = 240)		
Dietary Item How often do you …	Usually/Often *N* (%)	Sometimes *N* (%)	Rarely/Never *N* (%)
skip breakfast?	86 (36)	82 (34)	72 (30)
eat > 4 meals from a sit-down restaurant?	53 (22)	78 (33)	109 (45)
eat < 2 servings of whole grains product or high fiber starches a day?	53 (22)	101 (42)	86 (36)
eat < 2 servings of fruit a day?	56 (23)	101 (42)	83 (35)
eat < 2 servings of vegetables a day?	48 (20)	95 (40)	97 (40)
eat or drink < 2 servings of milk, yogurt, or cheese a day?	79 (33)	95 (40)	66 (27)
eat > 8 ounces of meat, chicken, turkey or fish per day?	81 (34)	103 (43)	56 (23)
use regular processed meats instead of low fat processed meats?	37 (15)	105 (44)	98 (41)
eat fried foods?	44 (18)	137 (57)	59 (25)
eat regular potato chips or salty snacks instead of low fat chips or salty snacks?	50 (21)	120 (50)	70 (29)
add butter, margarine or oil to bread potatoes, rice, or vegetables?	75 (31)	88 (37)	77 (32)
eat sweets > 2 times per day?	52 (22)	109 (45)	79 (33)
drink 16 ounces or more of non-diet sugar sweetened beverages?	32 (14)	44 (18)	164 (68)

Item	Yes *N (%)*	No *N (%)*
You or a member of your family usually shops and cooks rather than eating out?	193 (80)	47 (20)
Usually feel well enough to shop or cook?	222 (93)	18 (8)

report participating in the most was skipping breakfast (*N* = 86, 36%) and the least was drinking non-diet sugar sweetened beverages (*N* = 164, 68%). The final item of the REAP- short asked respondents to rate their willingness to change their eating habits in order to be healthier, with 1 being very willing and 5 being not at all willing. Majority of the participants (*N* = 145, 61%) rated themselves as very willing to make a change, while none of the participants reported being not at all willing to make a change.

Barriers to Weight Management Survey

A 22-item Likert-scale survey was used to collect participant's perceptions of the extent to which various items were a barrier to personal weight management. Results to this survey can be found on Table 5. Attrition was highest for this section of the web-based survey with 30 participants failing to participate. "Not having motivation to do physical activity, exercise or sport" had the highest response rate as a "very important barrier" (*N* = 107, 48%). Additionally, "Not having time to be physically active because of my job" (*N* = 85, 38%), "not having time to be physically active because of family commitments" (*N* = 74, 33%), and "not being able to buy healthy foods that are inexpensive" (*N* = 76, 33%) had the next highest ratings as being "very important barriers". The highest proportion of participants (*N* = 156, 70%) felt that "not having enough information about how to increase my physical activity" was not a barrier to their personal weight management.

Table 5
Participants Results for Barriers to Weight Management Survey

Item	Important Barrier *N* (%)	A Somewhat Important Barrier *N* (%)	Not a Barrier *N* (%)	N/A *N*(%)
Not having enough information about how to increase my physical activity?	20 (9)	30 (13)	156 (70)	19 (8)
Not having enough information about a healthy diet?	28 (12)	34 (15)	148 (66)	15 (6)
Not having the motivation to do physical activity, exercise or sport?	107 (48)	66 (29)	44 (20)	8 (3)
Not having the motivation to eat a healthy diet?	69 (31)	85 (38)	64 (28)	7 (3)
Not enjoying physical activity, exercise or sport?	45 (20)	64 (29)	102 (45)	14 (6)
Not enjoying eating healthy foods?	29 (13)	70 (31)	114 (51)	12 (5)
Not having the skills to do physical activity, exercise or sport?	17 (8)	52 (23)	140 (62)	16 (7)
Not having the skills to plan, shop for, prepare or cook healthy foods?	49 (22)	56 (25)	109 (48)	11 (5)
Not having my partner's support to be physically active?	39 (17)	40 (18)	122 (54)	24 (11)
Not having my partner's support to eat a healthy diet?	41 (18)	47 (21)	111 (49)	26 (12)
Not having my children's support to be physically active?	13 (6)	25 (11)	137 (61)	50 (22)
Not having my children's support to eat a healthy diet?	19 (8)	38 (17)	117 (52)	51 (23)
Not having my friends' support to be physically active?	9 (4)	36 (16)	150 (67)	30 (13)
Not having my friends' support to eat a healthy diet?	7 (3)	44 (20)	147 (65)	27 (12)
Not having access to places to do physical activity, exercise or sport?	28 (12)	47 (21)	131 (58)	19 (9)
Not having access to healthy foods?	31 (14)	46 (20)	135 (60)	13 (6)

Table 5.

Item	Important Barrier *N* (%)	A Somewhat Important Barrier *N* (%)	Not a Barrier *N* (%)	N/A *N* (%)
Not having access to places to do physical activity, exercise or sport?	28 (12)	47 (21)	131 (58)	19 (9)
Not having access to healthy foods?	31 (14)	46 (20)	135 (60)	13 (6)
Not being able to find physical activity facilities that are inexpensive?	60 (27)	49 (22)	103 (45)	13 (6)
Not being able to buy healthy foods that are inexpensive?	76 (33)	69 (31)	67 (30)	13 (6)
Not having time to be physically active because of my job?	85 (38)	60 (27)	59 (26)	21 (9)
Not having time to prepare or eat healthy foods because of my job?	63 (28)	62 (27)	76 (34)	24 (11)
Not having time to be physically active because of family commitments?	74 (33)	62 (28)	75 (33)	14 (6)
Not having time to prepare or eat healthy foods because of family commitments?	59 (26)	77 (34)	74 (33)	15 (7)

CHAID Decision Tree Analysis

In attempting to find the most accurate tree classifier, the CHAID constructed tree was allowed to auto grow as many branches as necessary with a minimum number of 30 cases in the parent node (root/target variable) and 15 cases in each child node (descendent node). The alpha criterion was set at 0.05 and the Bonferroni adjustment measure was chosen. Lastly, the Pearson chi-square method was selected to find the best splits.

The CHAID decision tree can be found in Figure 1. The results of the analysis indicated that “lack of motivation to eat a healthy diet” is the most important perceived barrier for weight management as represented by BMI. This first-level split produced the three initial branches, or groups, of the classification tree: those that felt it was not a

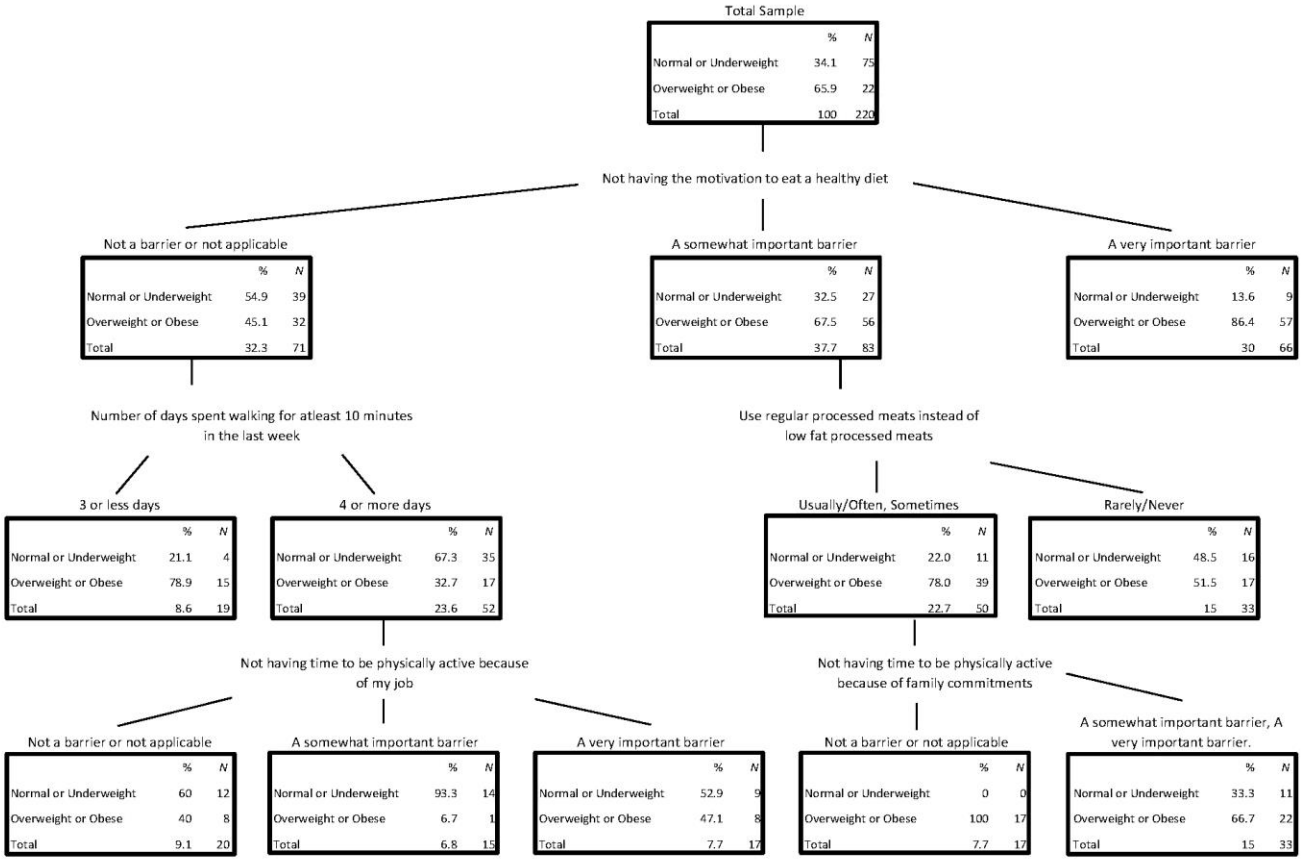

Figure 1. CHAID Decision Tree Analysis

barrier or not applicable, a somewhat important barrier, and a very important barrier. The group of respondents who self-identified that lacking motivation to eat a healthy diet was a very important barrier had the highest proportion of overweight and obesity at 87%, 67.8% of those who felt it is a somewhat important barrier were overweight or obese, and 45% of those who felt it was not a barrier or not applicable were overweight or obese.

The branch for individuals who felt "lack of motivation to eat a healthy diet" was a very important barrier led to a terminal node. For participants who felt that lack of motivation to eat a healthy diet was a "somewhat important barrier" an additional split was caused based on their response to the question "Do you eat regular processed meats instead of low fat processed meats". This split resulted in two branches: 78% of those who responses were "Usually/Often" or "Sometimes" were overweight or obese, and 51.5% of those who responded "Rarely/Never" were overweight or obese. For the group who responded "Usually/Often" or "Sometimes" to the question on consumption of processed meats a final split occurred based on their response to the perceived barrier "not having time to be physically active due to family commitments". In this split all of the respondents who identified that this was not a barrier or not applicable were overweight or obese, and 66.7% of those who felt it was either a very important or somewhat important barrier were overweight or obese.

For the third group in the initial split (those who felt "not having time motivation to eat a healthy diet" was not a barrier or not applicable) the most important factor was the number of days they spent walking in the last 7 days. Walking 3 or fewer days led to a terminal node in which 78.9% of respondents were overweight or obese, while only 32.7% of those who indicate they walk 4 or more days were overweight or obese. The

final split in this branch was caused by the perceived barrier “not having time to be physically active because of my job”. The terminal nodes for this split were: 47.1% of those that felt this was a very important barrier were overweight or obese, 6.7% of those who felt it was a somewhat important barrier were overweight or obese, and 40% of those who felt it was not a barrier or not applicable were overweight or obese. The overall classification accuracy is 74.1% with a risk estimate of .259. Additionally this model had a classification accuracy of 88.3% for those in the overweight and obese category. These results demonstrate that the constructed decision tree model performs well for predicting BMI, especially overweight and obesity, in Native Hawaiian women.

CHAPTER V

DISCUSSION

The purpose of this study was to conduct an exploratory analysis to identify barriers to weight maintenance, specifically those related to physical activity and healthy eating, among Native Hawaiian women. Additionally, the extent to which personal behaviors, perceived barriers, and demographic characteristics effect weight management was also examined. In an effort to fulfill the study purpose a decision tree analysis was used to identify barriers to weight maintenance. The resulting decision tree, as well as descriptive statistics of demographic and other variables, was used to answer the initial research questions.

Our CHAID decision tree analyses produced a moderately high predictive model that provides insight into the variables that influence weight maintenance among Native Hawaiian women. Based on the results of this analysis the strongest barrier to weight management in Native Hawaiian women is the extent to which participants feel they lack motivation to eat a healthy diet. These findings are consistent with other studies that previously identified motivation to be a strong barrier to healthy eating and weight management (Andajani-Sutjahjo et al., 2004; Greener, Douglas, & van Teijlingen, 2010; LaCaille, Dauner, Krambeer, & Pederse, 2011; Newsom, Kaplan, Huguet, & McFarland, 2004). These findings on motivation, as well as the low proportion of individuals who identify “knowledge” as a barrier to weight management, highlight the need for a shift in the focus of weight management interventions among this population. Research on the extent to which knowledge effects weight management is mixed. While research

indicates that a higher degree of diet/nutritional knowledge does lead to adherence to a more healthful diet (Variyam & Blaylock, 1998; Wardle, Parmenter, & Waller, 2000) when asked to identify what they feel most strongly prevents them from eating healthy respondents seldom choose knowledge as a barrier (Andajani-Sutjahjo et al., 2004, Kearney & McElhone, 1999; Lappalainen, Saba, Holm, Mykkanen, & Gibney, 1997). This indicates that the problem is not that Native Hawaiian women don't know what they should eat, but instead may just lack the motivation to consume foods they know are more nutritious. Results of this current study demonstrate that more focus needs to be placed on finding ways to both intrinsically and extrinsically motivate individuals to make healthier food choices.

Another dietary variable that was identified as a strong barrier to weight management among Native Hawaiian women was the self-reported consumption of high fat processed meats. These findings are not surprising. Especially when one is aware of the long standing love affair Hawaii has with SPAM. SPAM, a processed canned ham product produced by Hormel, which is high in fat and sodium, became popular in Hawaii during World War II. Today Hormel sells 7 million cans of SPAM a year in Hawaii (Kohatsu, 2012). This is the largest per capita consumption of SPAM in the U.S., which equates to almost 6 cans of SPAM per person per year (Song, 2004). SPAM is so entrenched in Hawaii's food culture that both McDonald's and Burger King feature SPAM platters on their breakfast menus. While the love for SPAM crosses all racial and socio-economic divides in Hawaii, consumption of processed meats has been found to be especially high among Native Hawaiian women. In a multiethnic study of adults residing in Hawaii Native Hawaiian women reported eating more processed meats than all other

racial ethnic groups (Maskarinec, Novotny, & Tasaki, 2000). Getting people in Hawaii to completely give up SPAM may be a near impossible task, but perhaps promoting healthier alternatives may be helpful. Suggestions such as turkey bacon instead of fried SPAM for breakfast and teriyaki chicken instead of SPAM in the popular Hawaiian dish SPAM-musubi may help frequent consumers find ways to cut back. While changes to consumption of processed meats in this population may be difficult due to cultural acceptance, the benefits are great. Many studies have demonstrated a strong relationship between consumption of processed meats in Hawaii and the onset of a number of different cancer types (Marchard, Wilkens, Hankin, Kolonel, & Lyu, 1997; Nomura, Hankin, Kolonel, Wilkens, Goodman, 2003).

The CHAID decision tree model identified three variables related to physical activity as barriers to weight management in our sample participants. The first variable identified was the number of days in which participants walked for at least 10 minutes in the last week. Nearly 80% of the participants who reported doing so for 3 or less days were overweight and/or obese. The American College of Sports Medicine and the American Heart Association (2007) recommends that Americans participate in moderate intensity physical activity, such as walking, for at least 30 minutes a minimum of 5 days per week. These guidelines were adopted by the USDHHS's *2008 Physical Activity Guidelines for Americans* (2008). As previously mentioned, Hawaii boasts a tropical climate with year-round warm weather. It is also the host of an abundant array of outdoor recreation activities. Additionally, research has identified Native Hawaiians as a relatively active ethnic group (Zou, Zhang, & Maddock, 2012). While climate, weather, and access to outdoor recreation opportunities have been acknowledged by Native

Hawaiians as facilitators for physical activity, limited use remains a barrier for weight management in Native Hawaiian women (Boyd & Brown, 2007). Perhaps the final two physical activity barriers identified in the CHAID decision tree analysis can explain why this is so.

The final two barriers regarding physical activity identified by the CHAID analysis were both related to “lack of time”. Lack of time has often been cited as a significant barrier to physical activity in published research (Andajani-Sutjahjo, Ball, Warren, Inglis, & Crawford 2004, Booth, Bauman, Owen, & Gore, 1997; Brownson, Baker, Housemann, Brennan, & Bacak, 2001; Chinn, White, Harland, Drinkwater, & Raybould, 1999; King, Castro, Wilcox, Eyler, Sallis, & Brownson, 2000). For individuals who reported eating high fat processed meats not having time to be physically active because of family commitments led to a terminal node. Of the women who felt this was a somewhat or very important barrier, 66.7% were overweight or obese. Interestingly, 100% of the women who felt family commitments were not a barrier or not applicable were overweight and/or obese highlighting the strong effect consumption of processed meats has on weight management. Research has indicated that women who live in rural settings and those that are of an ethnic/racial minority group report family commitments as a top barrier to physical activity (King, Castro, Wilcox, Eyler, Sallis, & Brownson, 2000; Wilcox, Castro, King, Housemann, & Brownson, 2000). However, it is important to keep in mind that this current study did not collect information on or look into factors such as residential setting and its effect on weight management.

The final barrier that appeared in our CHAID analysis was “not having time to be phyiscally active because of my job”. For women who walked atleast 4 days a week this

variable caused a final terminal node split. The group of women who felt this was a very important barrier had the highest rates of overweight and obesity (47.1%). So while these women are either meeting or nearly meeting recommendations for physical activity finding strategies to alleviate percieved time constraints due to job commitments could be beneficial in helping them increase physical activity thus leading to better weight maintenance.

Future studies are needed to probe deeper into determining the underlying causes that contribute to the perceived "lack of motivation" to eat healthier in this population. The information of these future studies as well as that of this current study should be used to inform the design of effective interventions aimed at mitigating lack of motivation as a barrier and improving weight maintenance among this population. While dietary interventions aimed at curbing obesity have been implemented, most have focused on diabetes prevention and have prescribed specific diets or aimed at dietary educational approaches (Kaholokula et al., 2013; Mau et al., 2001; Mau et al, 2010; Shintani, Hughes, Beckham, & O'Connor, 1991). Results of the current study suggest that knowledge is not a barrier to healthy eating and instead more focus needs to be place on approaches that motivate this population to eat what they already know they should be. Eliciting dietary and physical activity related behavior change is difficult. Many theories have been proposed to explain and/or understand the constructs that lead to successful behavior change. Past dietary interventions conducted with Native Hawaiians have used the Trans-theoretical Model to improve the likelihood for change in intervention participants (Mau, 2001). Based on result of the current study using theories such as Theory of Planned Behavior, Theory of Reasoned Action, or the Information-Motivation-Behavior Skills

Model as a basis for interventions may be more successful at improving intervention outcomes (Ajzen, 2012; Fishbein, & Ajzen, 2010; Fisher, Fisher, & Harman, 2003). These theories all focus on intention, a construct closely related to motivation, or motivation itself, which was identified by the CHAID analysis as the strongest barrier to weight management among participants in the current study. Additionally, efforts to curb the consumption of high-fat process meats such as SPAM are greatly needed. Research into the best course of action for this to occur is necessary to determine if policy level actions are needed to change this culturally ingrained practice.

Research on barriers to weight management among women is limited. However, this current study supports those conducted in the past that found motivation and lack of time to be key factors to weight management in women (Andajani-Sutjahjo, Ball, Warren, Inglis, & Crawford, 2004). This current study is unique in that it is one the first of its kind to focus not just on women but on the high-risk and under-research Native Hawaiian female population. Additionally, this study went beyond studying perceived barriers and also looked into identify key lifestyle/behavioral and demographic factors affecting weight management. The findings of this preliminary study that sought to identify barriers to healthy eating and physical activity has important implications for the development of well-tailored intervention and behavioral change programs. This information is especially vital for practitioners looking to effect real change in the weight status of Native Hawaiians.

In conclusion, results of this study indicate that lack of motivation to eat healthy is the most important perceived barrier to weight management in Native Hawaiian women. More strategies aimed at intrinsically and extrinsically motivating Hawaiian

women to eat healthy are needed. Additionally, these strategies need to also focus on curbing the consumption of high fat processed meats such as SPAM. Lastly, more research into time-efficient physical activity alternatives or worksite health promotion needs to be conducted to find realistic ways to help Native Hawaiian women who feel time constraints due to work and family commitments are key barriers to their personal weight management.

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APPENDICES

APPENDIX A

IRB Approval Letter

3/3/2015

Investigator(s): Poliala Mahoney Dickson
Department: HHP
Investigator(s) Email: poliala.dickson@mtsu.edu

Protocol Title: "Identifying barriers to weight management in native Hawaiian women "

Protocol Number: 15-194

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above. The MTSU IRB or its representative has determined that the study poses minimal risk to participants and qualifies for an expedited review under 45 CFR 46.110 and 21 CFR 56.110, and you have satisfactorily addressed all of the points brought up during the review.

Approval is granted for one (1) year from the date of this letter for 2,000 (TWO THOUSAND) participants.

Please note that any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918. Any change to the protocol must be submitted to the IRB before implementing this change.

You will need to submit an end-of-project form to the Office of Compliance upon completion of your research located on the IRB website. Complete research means that you have finished collecting and analyzing data. **Should you not finish your research within the one (1) year period, you must submit a Progress Report and request a continuation prior to the expiration date.** Please allow time for review and requested revisions. Failure to submit a Progress Report and request for continuation will automatically result in cancellation of your research study. Therefore, you will not be able to use any data and/or collect any data. Your study expires 3/4/2016.

According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to complete the required training. **If you add researchers to an approved project, please forward an updated list of researchers to the Office of Compliance before they begin to work on the project.**

All research materials must be retained by the PI or faculty advisor (if the PI is a student) for at least three (3) years after study completion and then destroyed in a manner that maintains confidentiality and anonymity.

Sincerely,

Institutional Review Board
Middle Tennessee State University

APPENDIX B

International Physical Activity Questionnaire – Short Version

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (August 2002)

SHORT LAST 7 DAYS SELF-ADMINISTERED FORMAT

FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health–related physical activity.

Background on IPAQ

The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

Using IPAQ

Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation

Translation from English is supported to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ

International collaboration on IPAQ is on-going and an ***International Physical Activity Prevalence Study*** is in progress. For further information see the IPAQ website.

More Information

More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective*. Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

APPENDIX C

Rapid Eating Assessment for Participants – Short Version

REAPS (Rapid Eating Assessment for Participants - Shortened Version)

CJSegal-Isaacson, EdD RD, Judy-Wylie-Rosett, EdD RD, Kim Gans, PhD, MPH

In an average week, how often do you:	Usually/ Often	Sometimes	Rarely/ Never	Does not apply to me
1. Skip breakfast?	O	O	O	
2. Eat 4 or more meals from sit-down or take out restaurants?	O	O	O	
3. Eat less than 2 servings of whole grain products or high fiber starches a day? **Serving** = 1 slice of 100% whole grain bread; 1 cup whole grain cereal like Shredded Wheat, Wheaties, Grape Nuts, high fiber cereals, oatmeal, 3-4 whole grain crackers, ½ cup brown rice or whole wheat pasta, boiled or baked potatoes, yuca, yams or plantain.	O	O	O	
4. Eat less than 2 servings of fruit a day? **Serving** = ½ cup or 1 med. fruit or ¾ cup 100% fruit juice.	O	O	O	
5. Eat less than 2 servings of vegetables a day? **Serving** = ½ cup vegetables, or 1 cup leafy raw vegetables.	O	O	O	
6. Eat or drink less than 2 servings of milk, yogurt, or cheese a day? **Serving** = 1 cup milk or yogurt; 1½ - 2 ounces cheese.	O	O	O	
7. Eat more than 8 ounces (see sizes below) of meat, chicken, turkey or fish per day? ***Note**: 3 ounces of meat or chicken is the size of a deck of cards or ONE of the following: 1 regular hamburger, 1 chicken breast or leg (thigh and drumstick), or 1 pork chop.*	O	O	O	Rarely eat meat, chicken, turkey or fish O
8. Use regular processed meats (like bologna, salami, corned beef, hotdogs, sausage or bacon) instead of low fat processed meats (like roast beef, turkey, lean ham; low-fat cold cuts/hotdogs)?	O	O	O	Rarely eat processed meats O
9. Eat fried foods such as fried chicken, fried fish, French fries, fried plantains, tostones or fried yuca?	O	O	O	
10. Eat regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts instead of pretzels, low-fat chips or low-fat crackers, air-popped popcorn?	O	O	O	Rarely eat these snack foods O
11. Add butter, margarine or oil to bread, potatoes, rice or vegetables at the table?	O	O	O	
12. Eat sweets like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day.	O	O	O	
13. Drink 16 ounces or more of non-diet soda, fruit drink/punch or Kool-Aid a day? ***Note**: 1 can of soda = 12 ounces*	O	O	O	
	YES			NO
14. You or a member of your family usually shops and cooks rather than eating sit-down or take-out restaurant food?	O			O
15. Usually feel well enough to shop or cook.	O			O
16. How willing are you to make changes in your eating habits in order to be healthier?	1 Very willing	2	3	4	5 Not at all willing

APPENDIX D

Barriers to Weight Management Survey

How important are the following as barriers to you keeping your weight at the level you want? (Please tick ONE box on each line)

How important is this as a barrier to you keeping your weight at the level you want?	**Not a barrier** $_1$	**A somewhat important barrier** $_2$	**A very important barrier** $_3$	**Not Applicable** $_4$
Not having enough information about how to increase my physical activity?				
Not having enough information about a healthy diet?				
Not having the motivation to do physical activity, exercise or sport?				
Not having the motivation to eat a healthy diet?				
Not enjoying physical activity, exercise or sport?				
Not enjoying eating healthy foods?				
Not having the skills to do physical activity, exercise or sport?				
Not having the skills to plan, shop for, prepare or cook healthy foods?				
Not having my partner's support to be physically active?				
Not having my partner's support to eat a healthy diet?				
Not having my children's support to be physically active?				
Not having my children's support to eat a healthy diet?				
Not having my friends' support to be physically active?				
Not having my friends' support to eat a healthy diet?				

cont'd... How important are the following as barriers to you keeping your weight at the level you want? (Please tick ONE box on each line)

How important is this as a barrier to you keeping your weight at the level you want?	**Not a barrier** $_1$	**A somewhat important barrier** $_2$	**A very important barrier** $_3$	**Not Applicable** $_4$
Not having access to places to do physical activity, exercise or sport?				
Not having access to healthy foods?				
Not being able to find physical activity facilities that are inexpensive?				
Not being able to buy healthy foods that are inexpensive?				
Not having time to be physically active because of my job?				
Not having time to prepare or eat healthy foods because of my job?				
Not having time to be physically active because of family commitments?				
Not having time to prepare or eat healthy foods because of family commitments?				
Other: (please specify) _____ _____				

What is the one thing that makes it the HARDEST for you to be physically active?

_____

_____

_____

_____

What is the one thing that makes it the HARDEST for you to eat a healthy diet?

_____

_____

_____

_____