A STUDY OF LIVING AND WORKING ON THE TOWBOAT:

WHAT ARE THE HEALTH & NUTRITION IMPLICATIONS?

by

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There is little published literature on the health and nutrition status of inland river towboat crew men. The purpose of the study was to better understand how life on the towboat affects health status, the crews' perceived benefits and barriers to good health, specifically eating practices and physical activity, and motivation to meet U.S.C.G. physical and BMI guidelines.

The study utilized a cross-sectional design to explore relationships among variables utilizing a survey and body composition measurements. One hundred ninety-four crew men participated. Findings indicate crew men are at increased risk of chronic disease related to anthropometric measurements, lack of aerobic activity, and unhealthy eating practices. Surprisingly, though, men indicated they like healthy foods and would eat them if served. Therefore, men are not as opposed to menu changes as originally thought. Additionally, the towboat environment must be more supportive of healthy behaviors to promote change. Furthermore, given the towboat culture and tradition, a successful intervention must be based on an ecological approach, addressing individual-level, socio-cultural and environmental-level influences.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

AHA	American Heart Association
ANOVA	Analysis of Variance
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CVD	Cardiovascular Disease
DHQ	Diet Habits Questionnaire
NHANES	National Health and Nutrition Examination Survey
SIUC	Southern Illinois University Carbondale
SPSS	Statistical Product and Service Solutions
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services

PREFACE

Have you ever been stopped on a draw bridge waiting for a barge to pass? While you were there, did you wonder what life would be like working on a barge, living day in and day out on the river? No? Me neither. We see barges and know they exist, but unless you work in the industry, you know very little about towboats, their crew, or what it's like to live on one for weeks on end.

In August 2010, I was approached to train inland barge cooks on food safety and nutrition while "on the tow." Since then, I have trained several groups of cooks from three towboat companies headquartered in Paducah, Kentucky. The implementation of more stringent BMI standards by the U.S.C.G. is an underlying current of the nutrition trainings, in conjunction with chronic disease risk reduction, increased number of healthy years working on the tow, and reduced health care costs. I have found the industry as a whole to be very fascinating; the cooks are great fun to work with, and the companies are extremely supportive and accommodating. Lastly, the lack of published literature on the industry solidified my decision to conduct my doctoral research in this area. I hope you enjoy reading about the "brown water" towboat industry as much I have enjoyed conducting my research.

CHAPTER 1

INTRODUCTION AND BACKGROUND

Working on a towboat can be a very stressful and dangerous occupation. The United States Coast Guard (U.S.C.G.), the regulatory agency of the tugboat, towboat, and barge industry, is taking a closer look at physical ability and body mass index (BMI) of merchant mariners on these boats. Current BMI requirements are unrestrictive at 40 or lower, which, according to the Centers for Disease Control, is classified as obese 3 or extreme obesity (Centers for Disease Control, 2009a). Obesity comes with increased risk of chronic diseases and health conditions (Centers for Disease Control, 2009e, 2010e). This study will take a holistic look at the health and nutrition status of the men who work on the "tow" in extremely close quarters for days on end without setting foot on the mainland. The results of this study will be applicable to working environments with similar living and working constraints, such as the railroad, off-shore oil rigs, and ocean-going vessels.

Statement of the Problem

The continued increase in the rate of obesity among U.S. men is frightening and has quickly become a major public health concern. The Centers for Disease Control and Prevention (CDC) defines obesity as a BMI of 30 or higher (Centers for Disease Control, 2010b). The prevalence of obesity in adult men in the U.S. has increased from 10.7% in 1960 to 30.2% in 2004 (American Heart Association, 2009). Furthermore, the obesity rate continues to climb, with

the 2005-2008 National Health and Nutrition Examination Survey (NHANES) reporting 34.6% obesity in men (Ogden, Lamb, Carroll, & Flegal, 2010).

Obesity is a tremendous burden on society in terms of economic costs resulting from direct costs of treating obesity-related illness and indirect costs of lost productivity (Colditz, 1999). Direct costs of obesity include the medical care costs of diseases related to obesity, such as certain cancers, coronary heart disease (CHD), stroke, type II diabetes, gallbladder disease, osteoporosis, and osteoarthritis. Hospitalization, outpatient visits, and medications are included in direct costs (Popkin, Kim, Rusev, Du, & Zizza, 2006).

Obesity is influenced by a myriad of factors including genetics, behavior, and environment. It is the result of a positive energy balance over a prolonged period of time (i.e., eating too many calories and not getting enough physical activity to burn off excess calories) (Centers for Disease Control, 2009e; Crawford, Jeffery, Ball, & Brug, 2010; Wilding, 2001). Although it is widely accepted that genetics play a role in obesity, research indicates this role is minimal as changes in genetic makeup occur far too slowly to account for the rapid increase in obesity (Centers for Disease Control, 2009h). It, therefore, seems that the obesity epidemic is more strongly related to an environment characterized by the availability and consumption of inexpensive, calorie-dense foods, large portion sizes, and the lack of physical activity (Crawford, et al., 2010; Wilding, 2001).

Food disappearance data along with the National Health and Nutrition Examination Surveys (NHANES), the Nationwide Food Consumption Survey

(NFCS), and the Continuing Survey of Food Intakes of Individuals (CSFII), all indicated a statistically significant increase in energy intake among males and females between 1971 and 2000 (Rolls, 2003; Wright, Kennedy Stephenson, Wang, McDowell, & Johnson, 2004). During that same time period, obesity rates more than doubled (National Institutes of Health, 2010).

Data from the Behavioral Risk Factor Surveillance System (BRFSS), a national telephone survey conducted by the CDC and state health departments, indicate only 50.7% of adult men meet physical activity recommendations of 30 minutes or more of moderate-intensity activity five or more days per week, or vigorous-intensity activity 20 minutes or more three days or more per week (Centers for Disease Control, 2010c). It is well-documented that regular physical activity lowers risk of early death, coronary heart disease, stroke, high blood pressure, high cholesterol or triglycerides, type 2 diabetes, metabolic syndrome, breast cancer, and colon cancer (World Health Organization, 2011). Physical activity is especially important in prevention of weight gain, weight loss when coupled with calorie reduction, and maintenance of weight loss (Centers for Disease Control, 2008a).

Towboat Industry

Barge transportation is critical to our nation's economy contributing over $5 billion per year. Additionally, barge transportation offers an economical and environmentally friendly way to transport grain, coal, other fuels, and a plethora of other materials. Towboats push barges fastened together to form a "tow" (U.S. Army Corps of Engineers, 2000). The cargo capacity of one 15-barge tow is

equal to that of two 100-car trains or 870 large semi-trucks (Alter Barge Line, 2011). The U.S. Congressional Budget Office deemed inland barge transportation the most fuel-efficient mode of transportation for moving bulk raw materials and the least energy-intensive mode of freight transportation when compared to other methods such as railway or semi-truck (Maritime Administration, 1994). Just one gallon of fuel can move one ton of cargo 576 miles via barge (Texas Transportation Institute, Center for Ports & Waterways, & Texas A&M University, n.d.).

According to Jennifer Carpenter of American Waterways Operators, there are 30,000 towboat crew men and women in U.S. inland barge transportation (Carpenter, 2011). Towboat crews consist of a captain, pilot, engineer, deckhands, and a cook. The captain and pilot are the wheelhouse officers, and must maintain the Merchant Mariner credential or license to navigate a vessel. Captains are in overall command of the vessel, navigating the towboat, supervising the work of all other crew, overseeing loading and unloading of cargo, and ensuring proper procedures and safety practices are followed. The pilot is second in command and navigates the vessel while the captain is off duty. The deckhands, or stand watch, maintain and operate standard equipment including skiff boats, handle lines when docking or departing, and perform routine maintenance on the towboat (Bureau of Labor Statistics, 2010). In addition to the wheelhouse officers and deckhands, most towboats also have an engineer and a cook.

The work itself is grueling, as are the shifts. Crew work 14 to 30+ days consecutively on the towboat, followed by 14 to 30 days off; shifts are six hours on, six hours off for a total of 12 hours working per day, seven days per week. The “front watch” is usually from 6am to 12pm and 6pm to 12am; the “back watch” is from 12pm to 6pm and 12am to 6am. Shifts allow for, at most, six consecutive hours of sleep, while the National Sleep Foundation recommends seven to nine hours per night for adults (National Sleep Foundation, 2010).

Towboat crews live and work in very confined spaces. The hallways and stairs are narrow, sometimes less than 36 inches, and the living and sleeping quarters are cramped. Additionally, deckhands often share rooms, so while one is on watch, the other is sleeping. The vessel itself lacks private spaces and can be very noisy. Moreover, once a crew member gets on the boat, they typically do not touch dry land again until the end of their 14 to 30-day shift. Working this demanding schedule under such conditions has potential health and wellness implications.

Need for the Study

Maintaining good health is critical to maintaining round-the-clock vessel operations. The Navigation and Vessel Inspection Circular (NVIC) 04-08 provides medical guidelines for evaluating the physical and medical condition of those holding the Merchant Mariner credentials (United States Coast Guard, 2009a). Credentialed mariners include towboat captains, pilots, and engineers, though credentials are not required for engineers (United States Coast Guard, 2009b).

Merchant Mariners must undergo a medical exam every five years to maintain their credentials. Currently, if a merchant mariner's BMI is 40 or higher, a medical practitioner must certify the mariner can meet physical ability guidelines as outlined in the NVIC, such as demonstrating "use of survival equipment, be able to carry and handle fire hoses and fire extinguishers, step over high door sills and coamings, move through restricted accesses, climb up and down vertical ladders and stairways, manipulate mechanical devices using manual and digital dexterity, and strength", etc (United States Coast Guard, 2009a).

To date, there is no known published research investigating the health status of inland barge towboat crews, the crew's perceived benefits and barriers to good health, or their motivation to meet BMI requirements. Additionally, there have been no studies of BMI in this occupational group or how the built environment, the towboat itself, affects health and physical activity of the crew.

Purpose of the Study

The purpose of the study is to better understand how life on the towboat affects health status, the crews' perceived benefits and barriers to good health, specifically eating practices and physical activity, and motivation to meet U.S.C.G. physical and BMI guidelines. The study is intended to assess what type of intervention would be most appropriate and most beneficial to inland barge towboat crew to assist them with leading healthier lives while on the tow. Moreover, results of this study will be applicable to working environments with similar living and working constraints, such as the railroad, off-shore oil rigs, long-

haul truck driving, and ocean-going vessels.

Research Questions

1. What are the perceived benefits among towboat crew regarding healthy eating practices and regular physical activity?

   Rationale: Although it is an older study, in 1977 Maiman and colleagues found the Health Belief Model components, including perceived benefits, to be correlated with dietary compliance (Maiman, Becker, Kirscht, Haefner, & Drachman, 1977). The belief that the perceived benefits of healthy eating practices and regular physical activity outweigh the barriers and sufficiently reduce disease threat impacts the decision of whether or not to engage in the healthy behavior (Janz & Becker, 1984).

2. What are the perceived barriers among towboat crew regarding healthy eating practices and regular physical activity?

   Rationale: Identification of barriers is an important predictor of behavior change and is also an important consideration for interventions (Wilson, Sisk, & Baldwin, 1997). Moreover, across various studies, perceived barriers proved to be the most powerful of the Health Belief Model components (Janz & Becker, 1984). The towboat itself presents a unique set of barriers, so it is especially important to know what they are to design an effective intervention.

3. What would motivate towboat crew to adopt healthier practices with regards to healthy eating practices and regular physical activity?

Rationale: Motivation is a multidimensional construct essential to behavior change, and according to Ryan and colleagues, is often cited as the key to effective treatment (Ryan, Lynch, Vansteenkiste, & Deci, 2011). In addition, in a random sample of 1,256 Irish adults, it was found that motivation toward healthy eating was positively related to dietary and lifestyle behaviors. Additionally, an increased intake of breakfast cereals, vegetables, fruit, and poultry combined with decreased intake of high-calorie beverages was associated with positive perceptions of healthy eating behaviors (Hearty, McCarthy, Kearney, & Gibney, 2007).

4. What would motivate towboat crew to meet U.S.C.G. physical ability and BMI guidelines?

   Rationale: Though current BMI regulations are unrestrictive at 40 (extreme obesity), there is speculation among industry leaders that the U.S.C.G. is considering lowering the regulation. Towboat management personnel have expressed concern they will lose captains and pilots (if lower BMI requirements are enforced) when there is already an industry-wide shortage of wheelhouse officers (Cohen, 2008). Identification of motivators for behavior change is important in designing an effective intervention.

5. Do differences exist between healthy eating practices and body composition (BMI and waist circumference) of towboat crew, controlling for age?

Rationale: A study of 330 middle-aged men, examining eating frequency and body fatness, found men eating five times per day, on average, were leaner than those who ate once or twice a day. Furthermore, a multivariate analysis determined additional factors, such as genetic, environmental, and psycho-social factors may play a role in body fatness (Ruidavets, Bongard, Bataille, Gourdy, & Ferrieres, 2002). Another study of obese individuals found that increased food intake before sleeping resulted in poorer weight loss outcomes (Gluck, Geliebter, & Satov, 2001). This fact is particularly important to this study since the six-hour on, six-hour off shift work encourages eating before going to bed. In addition, towboat deckhands and engineers have physically demanding jobs, while although the wheelhouse officers' jobs are mentally challenging, they require very little physical activity. The cook's job also requires little physical activity. Occupation on the towboat has the potential to be a predictor of body composition.

6. Do differences exist in regular physical activity based on occupation on the towboat (cook, deckhand, engineer, pilot, captain)?

   Rationale: A study by Galobardes and colleagues from Switzerland, examined the extent to which diet is affected by education and occupation. Results indicated participants with lower education and/or manual labor occupations ate less fish and vegetables, but more fried foods, pasta and potatoes, table sugar, and beer

(Galobardes, Morabia, & Bernstein, 2000). Occupations on the towboat require only a high school diploma and are considered manual labor, or blue-collar. To date, literature suggests there is no difference in exercise habits of shift workers compared to day workers (Croce, et al., 2007; Karlsson, Knutsson, Lindahl, & Alfredsson, 2003; Lasfargues, et al., 1996).

7. To what extent does towboat crew meet USDHHS 2008 Physical Activity Guidelines?

   Rationale: To reduce the risk of chronic disease, the USDHHS recommends, at minimum, adults engage in two and one-half hours per week or moderate intensity aerobic physical activity, or one hour and 15 minutes per week of vigorous physical activity. Additionally, adults should incorporate muscle-strengthening activities at least twice a week (United States Department of Health and Human Services, 2008). Data collected from this study will provide baseline data to determine the extent to which physical activity should be incorporated in health education interventions.

8. To what extent does the built environment influence healthy eating practices and regular physical activity of towboat crew while on the boat?

   Rationale: Current literature suggests the built environment may play a key role in the obesity epidemic. Since educational, behavioral, and pharmacological approaches have had limited

success in the prevention and treatment of obesity, Lake and colleagues suggest investigating environments that promote sedentary behaviors and high energy intakes (Lake & Townshend, 2006). We need to have an understanding as to how towboat crew interact with the built environment, the towboat, in terms of food intake and physical activity to design an effective intervention.

Research Design

A cross-sectional survey will be used to carry out this quantitative research design. The PRECEDE-PROCEED planning model, which provides a comprehensive structure for assessing health-related behaviors and environmental forces for designing, implementing, and evaluating health promotion interventions, will be used as the framework for this study. The independent variables include personal factors consisting of gender, age, and race/ethnicity. Additionally, perceived benefits of healthy eating practices, perceived barriers to healthy eating practices, perceived benefits of physical activity, and perceived barriers to physical activity, occupation, and built environment will be examined as independent variables. Eating practices and physical activity on the vessel will be studied as the dependent variables.

Sample

Convenience samples of inland barge towboat crews, employed by inland barge companies headquartered in Paducah, Kentucky, will be solicited to

participate in the study. Inclusion criteria included employment as towboat captain, pilot, engineer, deckhand, or cook, and the ability to read and write the English language.

Data Collection Procedures

Inland barge towboat crews participate in Crew Endurance Management training as well as other trainings provided by their employer throughout the year. The questionnaire will be distributed by myself and/or trained data collectors at crew trainings held at company headquarters and West Kentucky Community and Technical College (WKCTC). The nature of the research will be described to participants prior to administering the survey. Physical data will be measured and recorded by trained data collectors. Myself and trained data collectors may not be able to attend all crew trainings. In this case, surveys and physical data will be self-reported. Each participant will be given an informed consent form approved by Southern Illinois University Carbondale Office of Research Development.

Significance of the Study

This study is significant because it is the first to evaluate the health and nutritional status, perceptions of the crew, and the resources available to address needs of inland barge towboat crew. Results will be critical in designing an effective health education intervention. Additionally, this research is applicable to several other industries and occupations which have constrictive working

environments including railroad, off-shore oil rigs, long-haul truck driving, and ocean-going vessels.

Assumptions

This study is based on the following assumptions:

1. Participants are honest in their responses to survey items.
2. Although there are variations in who distributes the questionnaire (myself, a data collector, or a colleague), I assume we will obtain the same pattern of results.

Limitations

The following limitations should be considered when interpreting results of this study:

1. Issues concerning honesty and accuracy of self-reported data must be taken into consideration.
2. Body Mass Index may not be a valid measure of individuals with dense muscle mass, yet very little body fat.

Delimitations

The following delimitations should be considered when interpreting results of this study:

1. Study participants are limited to a convenience sample of inland barge companies headquartered in Paducah, Kentucky.

2. Study participants are limited to inland waterway (brown water) transportation.
3. This study focuses on behavior while on the tow, and does not take into account behaviors while off-river which can also significantly impact health.
4. A cross-sectional survey design was utilized, therefore, only association between variables can be established rather than cause and effect.

Definition of Terms

The following terms were utilized in the study and defined to provide an explanation:

Barge: Typically a large, flat-bottomed boat used primarily for transporting goods on inland waterways, usually propelled by towing (Merriam-Webster, 2010a).

Body Mass Index: “Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems” (Centers for Disease Control, 2009a).

Brown Water: Refers to inland river ways as opposed to the ocean, which is referred to as blue water.

Coaming: “A raised frame (as around a hatchway in the deck of a ship) to keep out water” (Merriam-Webster, 2009).

Inland: Refers to river ways on the interior part of the United States (Merriam-Webster, 2011a).

Licensed Merchant Mariner: “All mariners employed aboard U.S. merchant vessels greater than 100 Gross Register Tons (Domestic Tonnage), except operators of uninspected passenger vessels, are required to have a valid U.S. Merchant Mariner’s Credential (MMC)” (United States Coast Guard, 2010).

Navigation and Vessel Inspection Circular (NVIC): “A NVIC provides detailed guidance about the enforcement or compliance with a certain Federal marine safety regulations and Coast Guard marine safety programs. While NVIC's are non-directive, meaning that they do not have the force of law, they are important "tools" for complying with the law. Non-compliance with a NVIC is not a violation of the law in and of itself, however non-compliance with a NVIC may be an indication that there is non-compliance with a law, a regulation or a policy” (United States Coast Guard, 2011).

Navigation and Vessel Inspection Circular (NVIC) 04-08: NVIC 04-08 provides medical and physical evaluation guidelines for Merchant Mariners (United States Coast Guard, 2009b).

Personal factors: Personal factors refer to the socio-demographic variables of age, gender, race/ethnicity, and job assignment on the tow boat. Self-reported data was obtained from the demographic section of the survey instrument.

Shift Work: “Shift work refers to a job schedule in which employees work hours other than the standard hours of 8:00am to 5:00pm, or a schedule other

than the standard workweek – Monday through Friday in the United States" (Grosswald, 2004).

Southern-style cooking: Southern-style cooking is "home cooking" meaning it's made from scratch from recipes that have been handed down from one generation to the next (Arkansas, 2011). Southern-style cooking includes a lot of fried foods including fried fish and chicken, homemade meatloaf, macaroni and cheese, ham and beans, cornbread, cookies, and pies. According to olsouthrecipes.com, the number one rule for cooking southern food is "never put sugar in cornbread and always in iced tea" (Southern Recipes, 2007)

Tugboat: "A strongly built powerful boat used for towing and pushing" (Merriam-Webster, 2010b).

Towboat: "A compact shallow-draft boat with a squared bow designed and fitted for pushing tows of barges on inland waterways" (Merriam-Webster, 2011b).

U.S.D.A. Food disappearance data: The USDA's Economic Research Service estimates food disappearance data, also known as food supply data, based on the amount of major food commodities entering the market regardless of the food's final use, that is for domestic consumption, industrial uses, feed and seed use (United States Department of Agriculture's Economic Research Service, 2000).

Summary

Obesity is recognized by the American Heart Association to be a major independent risk factor for heart disease. However, obesity also comes with multiple co-morbidities including diabetes, hypertension, high cholesterol, sleep apnea, chronic headaches, liver disease, and arthritis. Weight loss can reduce risk of heart disease, as well as improve or even resolve co-morbidities. Furthermore, nutrition and physical activity can positively affect other controllable risk factors for heart disease including cholesterol levels, blood pressure, diabetes, and overweight/obesity (American Heart Association, 2011b).

Inland barge transportation employs over 30,000 crew men and women and is critical to the nation's economy (Carpenter, 2011). There is speculation among industry leaders that the U.S.C.G. is considering lowering the BMI requirement of 40 (extreme obesity). The towboat is a very unique environment given that the men and women work and live on the boat 14-30+ days at a time, without touching the mainland. This type of environment can significantly impact eating behaviors and physical activity habits. To date, no studies have looked at the health and nutrition status of inland barge towboat crew, the prevalence of obesity among towboat crew, nor have any studies identified perceived benefits and barriers to good health, or motivation to meet U.S.C.G. physical and BMI guidelines.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter presents a review of literature concerning the health and wellness of men in the workforce. Discussion includes prevalence of chronic disease in American men, and chronic disease risk reduction focusing on weight, physical activity, nutrition, and smoking. Literature exploring the impact of shift work on men in blue-collar occupations and risk of chronic disease, along with the health and nutrition status of men working in constricted environments, such as long-haul truck driving, offshore fishing, offshore oil industry, and railroad work are reviewed. Healthy Workforce 2010 objectives are discussed as well as worksite health programs for blue collar shift workers. Preliminary study data describing towboat crew, perceived benefits and barriers of healthy practices, and motivation to make healthy changes is also included.

Purpose of the Study

The purpose of the study is to better understand how life on the river affects health status, crews' perceived benefits and barriers to good health, specifically eating practices and physical activity, as well as motivation to meet U.S.C.G. physical and BMI guidelines. The study is intended to determine what type of intervention would be most appropriate and most beneficial to inland barge crew to assist them with leading healthier lives while on the tow. Moreover, results of this study will be applicable to similar constrictive working environments.

Chronic Disease among American Men

According to the Centers for Disease Control and Prevention, chronic disease is the leading cause of death and disability for men in the United States. Seven of every 10 deaths are attributed to chronic disease (Kung, Hoyert, Xu, & Murphy, 2008). Chronic diseases include heart disease, stroke, cancer, diabetes, and arthritis. Heart disease, cancer, and stroke are responsible for over 50% of deaths each year. Heart disease, cancer, stroke, and diabetes are within the top six leading causes of death for men, along with unintentional injuries and chronic lower respiratory diseases (Centers for Disease Control, 2010a). Four controllable health risk factors are to blame for much of the illness, disability, and premature death related to chronic disease. They are physical inactivity, poor nutrition, tobacco use, and excessive alcohol consumption (Centers for Disease Control, 2009b). By 2020, it has been estimated that chronic diseases will account for nearly three-fourths of all deaths (American Heart Association, 2004).

Heart Disease in Men

Heart disease continues to be the number one killer of American men of most races and ethnicities, including African American, American Indian, Caucasian, and Hispanic, responsible for 309,821 deaths in 2007 (Kung, et al., 2008). The average age of a heart attack in a man is 66, and nearly half of all men who have a heart attack before age 65 die within 8 years (Centers for Disease Control, 2011a). Moreover, 40% to 75% of those who have a heart attack die before reaching the hospital (*Integrated management of cardiovascular risk: Report of a WHO meeting Geneva, 9-12 July 2002*, 2002). In addition,

British studies have found premature death rate from coronary heart disease (CHD) is 58% higher for blue collar workers than for white collar workers (i.e., manual compared to non-manual laborers) (British Heart Foundation, 2007).

Strokes in Men

Cardiovascular disease (CVD) often is used to describe “conditions that involve narrowed or blocked blood vessels that can lead to heart attack, chest pain (angina), or stroke” (Mayo Clinic, 2011a). However, when examined separately from other CVDs, stroke ranks number five among all causes of death among U.S. men behind heart disease, cancer, unintentional injury, and chronic lower respiratory disease (Centers for Disease Control, 2010a). Smokers are at twice the risk of having a stroke as non-smokers, and according to the National Health Interview Survey, 21.9% of US men are smokers with blue collar workers having an especially high prevalence of smoking (Centers for Disease Control, 2000, 2009d).

Cancers in Men

Even though the rate of deaths from all cancers has declined since the 1990s, cancer remains the second leading cause of death in U.S. men. In men, incidence rates of lung, colon and rectum, oral cavity and pharynx, stomach, and brain (malignant only) have declined, while rates of kidney, pancreas, liver cancers, and melanoma of the skin have risen (National Cancer Institute, 2011). Research has concluded cancers of the colon, kidney, and esophagus are associated with obesity (National Cancer Institute, 2004; Samanic, Wong-Ho, Gridley, Jarvholm, & Fraumeni, 2006). In addition, pancreatic cancer also has

been linked to obesity. Research consistently reports men with high BMIs are at greater risk of colon cancer and there is evidence abdominal obesity may be a predictor of risk. That being said, research is inconclusive as to whether intentional weight loss decreases cancer risk (National Cancer Institute, 2004).

Diabetes in Men

Type 2 diabetes is the result of the body not being able to effectively utilize the hormone insulin to convert blood glucose to energy for the cells in the muscles, liver, and fat. Eventually, the pancreas is unable to make enough insulin for the body's needs and the cells starve (National Diabetes Information Clearinghouse, 2008). The primary risk factor for type 2 diabetes is overweight and obesity because the more fatty tissue one has, the more resistant body cells become to insulin. Additional risk factors for type 2 diabetes include physical inactivity, family history of Type 2 diabetes, age (risk increases with age), prediabetes, and being of Black, Hispanic, American Indian, or Asian American race. Prediabetes is a condition where one's blood glucose is higher than it should be, but not high enough to diagnose diabetes. Often times, if left untreated, prediabetes will advance to diabetes (Mayo Clinic, 2011b).

Of men aged 20 years and older, 11.8%, or 13 million, have diabetes. Diabetes is a debilitating disease contributing to 231,404 deaths in 2007, and is the sixth leading cause of death in men. The heart disease death rate of adults with diabetes is two to four times higher than adults without diabetes, and the risk for stroke is two to four times higher. Diabetes is responsible for more than 60% of non-traumatic lower-limb amputations due to nerve damage and reduced

blood flow (American Diabetes Association, 2011; Mayo Clinic, 2009). Additionally, amputation rates are 1.4 to 2.7 times higher in men. Of those diagnosed with diabetes, 67% have hypertension and 60% to 70% have mild to severe forms of nervous system damage. It is the leading cause of blindness and kidney failure (American Diabetes Association, 2011).

Arthritis

The prevalence of arthritis and arthritis-attributable activity limitation (AAAL) are expected to increase significantly by 2030. Arthritis is already the most common cause of disability in the U.S. Results of the 2007-2009 National Health Interview Survey indicate nearly 30% of men and women aged 45-64 have been diagnosed with arthritis, and 50% of those 65 and older. The prevalence of diagnosed arthritis is higher for women (25.9%), White non-Hispanic (25.4%) and Black non-Hispanic (20.2%), for those with no higher education (25.5% high school dropout; high school diploma 25.2%), and for those who are current (21.8%) and former smokers (33.6%). The prevalence of arthritis increased proportionately with increase in BMI: underweight/normal weight=16.4%, overweight=21.4%, obese=31.1%, obese class I=28.3%, obese class II=33.7%, and obese class III=38.5%. Additionally, only 17.2% of those meeting physical activity recommendations have been diagnosed with arthritis compared to 23.8% of those who were insufficiently active and 27.2% who were inactive (Centers for Disease Control, 2010d).

Chronic Disease Risk Reduction

Obesity and BMI

It is well established that obesity is a risk factor for chronic disease and disability (Crawford, et al., 2010). Body Mass Index, or BMI, often is used to assess body weight. BMI is “an index of a person’s weight in relation to height that correlates with total body fat content” (Boyle & Long, 2010). Normal weight is defined as a BMI of 18.5-24.9; overweight is defined as a BMI of 25-29.9; obese is defined as a BMI of $\geq$30; and severely obese is defined as a BMI of $\geq$40 (Centers for Disease Control, 2010b). An estimated 72.3% of American men are overweight, obese, or extremely obese (Centers for Disease Control, 2010b; Weight-control Information Network, 2010). In addition, Non-Hispanic Black men (37.3%) and Hispanic men (34.3%) have higher age-adjusted prevalence rates of obesity than Non-Hispanic White men (31.9%) (Weight-control Information Network, 2010).

The primary assumption of BMI guidelines is that BMI “is closely associated with body fatness and consequent morbidity and mortality” (Gallagher, et al., 2000). That being said, BMI should be interpreted with caution since some individuals with BMI over 25 (classified as overweight or obese) are not overfat, such as bodybuilders; or those who are classified as normal weight even though they have much less muscle, such as the elderly. Additionally, epidemiological studies have confirmed BMI cannot discriminate CVD very well in individuals with normal to overweight BMI classification. Therefore, additional measurements must be utilized to better assess health risk (Lopez-Jimenez,

2009).

The amount and distribution of body fat along with current health status are important measurements of health risk. People carry body fat differently. Some carry more around their abdomen (apple-shaped), called central adiposity, while others carry more fat in their hips, thighs, and buttocks (pear-shaped). Those with central adiposity, or apple-shaped figures, are at increased risk of developing diabetes, hypertension, elevated lipid levels, and heart disease (Boyle & Long, 2010). Consequently, it is important to use additional clinical measurements, such as waist circumference to assess health risk.

Waist Circumference

Waist circumference (WC) can provide “an independent prediction of risk over and above that of BMI” (National Heart Lung and Blood Institute, 1998). WC measurements provide information about central adiposity distribution. This measurement is particularly useful for those whose BMI is classified as normal or overweight as epidemiological studies have confirmed BMI cannot discriminate CVD very well in these individuals (Lopez-Jimenez, 2009). Risk of disease increases significantly with a WC of 35 inches or greater in women, and 40 inches or greater in men (Boyle & Long, 2010; National Heart Lung and Blood Institute, 1998). That being noted, WC is not warranted when a BMI is $\geq$35 since it will add little predictive power of disease risk (National Heart Lung and Blood Institute, 1998).

Studies indicate WC values are significantly correlated with abdominal fatness (Wang, et al., 2003; Zhu, et al., 2002). In fact, it has been recently

proposed that WC is a simpler, better method of measuring of health risks associated with central adiposity over the traditional waist-to-hip circumference ratio (Crawford, et al., 2010; Lean, Han, & Seidell, 1998). Waist-to-hip circumference ratio calculates the ratio between waist, in inches, at the narrowest point and hip, in inches, at the widest point. For men, if the ratio is more than 1.0, they are at greater health risk due to central adiposity distribution (Weight-control Information Network, 2008).

Percent Body Fat

Estimates that directly measure body composition without regard to weight or height may be more useful in understanding the relationship between weight and health. Body fat percent may provide more meaningful information (Ihmels, Welk, McClain, & Schaben, 2006). However, at this time, there are no published body fat ranges or guidelines (Gallagher, et al., 2000). Metabolic rate is influenced by body composition and muscle tissue is more active than fat. Therefore, a person with more muscle, or lean body mass, will have a higher basal metabolic rate (BMR), than a person with less muscle, meaning they will need to consume more calories to maintain daily energy needs (Boyle & Long, 2010). Higher amounts of lean body mass may be related to physical activity, such as weight lifting and aerobic activity (Boyle & Long, 2010; Wannamethee, Shaper, & Whincup, 2005).

Physical Activity

The U.S. Department of Health and Human Services (USDHHS) 2008 Physical Activity Guidelines for Americans recommend adults participate in a

minimum of two and one-half hours per week of moderate-intensity activity or one and one-quarter hours per week of vigorous intensity activity. Moderate-intensity activities include walking briskly, water aerobics, or ballroom dancing. Vigorous-intensity activities include race-walking, jogging, running, or jumping rope. In addition, it is recommended that adults incorporate muscle-strengthening exercises at least twice a week, such as weight-lifting, push-ups, and sit-ups (United States Department of Health and Human Services, 2008).

Physical inactivity doubles the risk of developing cardiovascular disease, doubles the risk of dying from cardiovascular disease or stroke, and increases risk of developing hypertension by 30% (American Heart Association, 2004). Data from the 2000 Behavioral Risk Factor Surveillance System (BRFSS) showed only 22.2% of male respondents ages 18-74 reported getting regular physical activity (defined as light-moderate intensity exercise 30 minutes, at least five times per week; or vigorous intensity exercise 20 minutes, at least three times per week) (American Heart Association, 2010; Centers for Disease Control, 2009d). A 2008 National Health Interview Survey found 34.8% of males 18 and older reported getting regular leisure-time physical activity. Leisure-time physical activity was defined as exercises, such as running, gardening, golf, walking, calisthenics (Centers for Disease Control, 2009d).

Studies clearly indicate an association between physical activity and chronic disease. Paffenbarger and colleagues (1993) conducted a longitudinal study of 10,269 men who were alumni of Harvard College. Taking part in moderately vigorous activity resulted in a 23% lower risk of death than those who

did not. In addition, maintenance of lean body mass also was associated with lower mortality rate (Paffenbarger, et al., 1993). A follow-up study in 2000 revealed total physical activity and vigorous activities had the strongest impact on reducing risk of CHD. Additionally, the reduction in risk extended to men with multiple CHD risk factors (Sesso, Paffenbarger, & Lee, 2000). Furthermore, a 2006 review of evidence-based research revealed the health benefits of physical activity in preventing chronic diseases including CVD, diabetes, cancer, hypertension, obesity, depression, and osteoporosis to be “irrefutable”, and also to be associated with reduced risk of premature death (Warburton, Nicol, & Bredin, 2006).

Nutrition

A healthy diet often is cited as a way to reduce risk of chronic diseases by positively affecting various controllable risk factors including cholesterol levels, blood pressure, and overweight/obesity (American Heart Association, 2011a, 2011b; U.S. Department of Health & Human Services & U.S. Department of Agriculture, 2010) . The 2010 Dietary Guidelines for Americans were recently released. The guidelines provide evidence-based nutrition information and advice regarding healthy eating patterns, with an emphasis on nutrient-dense foods and beverages, to achieve or maintain a healthy body weight. The guidelines offer key recommendations for managing weight by balancing calories and physical activity, foods and food components to reduce, and foods and nutrients to increase in one’s diet.

According to the Dietary Guidelines, a healthy diet includes adequate fruit

and vegetable intake, incorporating a variety of different fruits and vegetables (especially those dark-green leafy and red and orange vegetables), as well as beans, peas, and other legumes (U.S. Department of Health & Human Services & U.S. Department of Agriculture, 2010). At least half of all grains eaten (breads, rice, cereal, etc.), should be whole grain. Whole grain foods include 100% whole wheat bread, 100% whole grain bread, brown rice, oatmeal, whole wheat cereals, whole wheat pasta, etc. Refined grains, such as white bread and regular pasta should be limited (U.S. Department of Health & Human Services & U.S. Department of Agriculture, 2010).

A variety of protein-rich foods, such as seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds are recommended (U.S. Department of Health & Human Services & U.S. Department of Agriculture, 2010). Meats that have little solid fat are preferred, since solid fat is high in saturated fat. Also, seafood is a good protein choice since it is often lower in fat and saturated fat than many other meat sources, and also is higher in omega-3 fatty acids. Protein is important for tissue growth, maintenance, and repair, and also has several regulatory roles in the body including facilitating chemical reactions as enzymes, acting as hormone and antibodies, regulation of fluid balance, and transporting nutrients into and out of cells. Protein also is used as an energy source (Boyle & Long, 2010).

Fat-free or low-fat dairy products, such as milk, yogurt, and cheese are recommended. They are good sources of calcium, vitamin D, and phosphorus, which are important for bone health and other calcified tissues (U.S. Department

of Health & Human Services & U.S. Department of Agriculture, 2010).

The 2010 Dietary Guidelines recommend reducing intake of foods high in total fat, saturated fat, sugar, and sodium (U.S. Department of Health & Human Services & U.S. Department of Agriculture, 2010). Fats that are monounsaturated and polyunsaturated should be chosen since they may decrease total cholesterol, and decrease low-density lipoprotein (LDL) cholesterol, if they are replacing saturated fat in the diet (Boyle & Long, 2010). For most healthy individuals, daily sodium intake should be reduced to 2,300 milligrams (mg) of sodium. African Americans, or those with hypertension, diabetes, or chronic kidney disease are encouraged to limit sodium to 1,500 mg per day (U.S. Department of Health & Human Services & U.S. Department of Agriculture, 2010).

Smoking

According to the Centers for Disease Control and Prevention (CDC), tobacco use is the leading preventable cause of death in the US. Although smoking in the U.S. has declined over 50% since 1965, the National Center for Health Statistics report 23.1% of men smoke, placing them at increased risk for heart attack and stroke (Centers for Disease Control, 2009f). On average, adult smokers die 14 years earlier than non-smokers. Men who smoke increase their risk of dying from emphysema by almost 10 times, by bronchitis almost 10 times, and from lung cancer by over 22 times. Middle-age men who smoke are at three times the risk of dying from heart disease (Centers for Disease Control, 2008b). Furthermore, smoking prevalence among blue-collar workers, overall, is almost

twice that of white-collar workers (37% versus 21%) (Giovino, Pederson, & Trosclair, 2000). That being noted, a longitudinal study of 10,269 men found a 41% lower risk of death associated with quitting smoking, but a 23% higher risk than for those who never smoked (Paffenbarger, et al., 1993).

Impact of Shift Work on Men in Blue-Collar Occupations and Risk of Chronic Disease

To date, there is no known published research on the health and nutrition status or physical activity levels of towboat crew. Because of this, a search for literature on the impact of shift work on the health of men in blue-collar occupations, particularly male-dominated occupations, and literature on other occupations with similar environmental, space, and time constraints as those in the towboat industry was conducted. The specific constraints endured by towboat crew were identified in preliminary research of the towboat industry and are discussed later in this chapter.

Recent studies indicate an association between shift work and an increased prevalence of obesity, as well as greater risk for chronic fatigue, anxiety and depression, adverse gastrointestinal effects, metabolic syndrome, and cardiovascular disease (Antunes, Levandovski, Dantas, Caumo, & Hidalgo, 2010; Atkinson, Fullick, Grindey, & Maclaren, 2008; Esquirol, et al., 2009; Harrington, 2001). Shift work schedules differ by occupation in terms of timing and duration of each shift, for example police officers, nurses, and firemen may work 3:00pm to 11:00pm or 11:00pm to 7:00am, while towboat crew may work

6:00am to 12:00pm and then again from 6:00pm to 12:00am. For the purposes of this study, this section focuses on four controllable risk factors of CVD: weight, nutrition, physical activity, and smoking.

An extensive literature review by Eberly and Feldman revealed shift workers are at higher risk of obesity. The exact mechanism of weight gain was not identified, however, eating habits, physical activity habits, and a disturbance in circadian rhythm appear to contribute (Eberly & Feldman, 2010). Circadian rhythms are “physical, mental and behavioral changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism’s (person’s) environment” (National Institutes of Health, 2008).

Di Lorenzo and colleagues studied the effect of shift work on metabolic and cardiovascular risk factors in 319 men aged 35-60 years old. Independent of age and work duration, shift workers had higher BMI than traditional day workers (Di Lorenzo, et al., 2003). In addition to higher BMIs, among 27,485 studied, Karlsson and colleagues found higher triglyceride levels, low high-density lipoprotein (HDL) cholesterol levels in shift workers, both of which are risk factors for CHD (Karlsson, Knutsson, & Lindahl, 2001). Antunes and colleagues (2010) reviewed literature summarizing chronobiological aspects of shift work and obesity. Based on their findings, the authors suggested the increased risk for obesity and CVD might be related to “maladaptation to chronically sleeping and eating at abnormal circadian times” (Antunes, et al., 2010). Karlsson and colleagues suggested metabolic disturbances leading to weight gain in shift workers could be related to a mismatch of circadian rhythm, behavioral changes,

or social stress (Karlsson, et al., 2003). Atkinson and colleagues (2008) supported this finding, reporting metabolic responses to food are altered due to disruptions in sleep and circadian rhythm (Atkinson, et al., 2008). Shift workers suffer from sleepiness during early morning shifts as well as night shifts (Akerstedt, 1995).

Shift work disrupts “normal” eating patterns, decreasing meal frequency and increasing frequency of snacking (Atkinson, et al., 2008). In 2004, Reeves and colleagues analyzed the food diaries of 36 shift workers to reveal night workers do not eat any more food than day workers. However, night workers ate smaller meals and more snacks over time than day workers (Reeves, Newling-Ward, & Gissane, 2004). This is corroborated through a study of 50 day workers and 43 night workers conducted by Waterhouse and colleagues. Night workers had significantly altered food intake, with type and frequency of food more influenced by time availability and habit, and less by hunger. In addition, night workers were more reliant on snacks (Waterhouse, Buckley, Edwards, & Reilly, 2003).

A study analyzing 24-hour recalls of 96 participants, assessing the diet for intake of energy, 14 nutrients, and coffee and tea, found energy and nutrient intake were not affected by shift work. The shift work affected the distribution of food intake and beverage consumption, but not overall 24 hour intake (Lennernas, Akerstedt, & Hambraeus, 1995). This study was corroborated by de Assisi and colleagues (2003) where they found no significant differences in total intake of protein, carbohydrate, or fat calories among three shift groups of

garbage collectors in Brazil. Different work schedules affected daily distribution of food intake, with night workers having significantly more eating events than day workers, but this did not affect overall calorie intake (de Assis, Kupek, Nahas, & Bellisle, 2003). Study results are intriguing since research indicates an association between shift work and an increased prevalence of obesity (Antunes, et al., 2010; Atkinson, et al., 2008; Esquirol, et al., 2009; Harrington, 2001).

Shift work is thought to decrease opportunities for physical activity and participation in sports. In a study of 665 day workers and 659 shift workers, all men, in paper and pulp manufacturing plants in Sweden, 46% of shift workers reported they sometimes exercised, and 25.1% reported they regularly exercised; while 42.6% of day workers reported they sometimes exercised and 29.6% regularly exercised. Therefore, there was no significant difference between shift workers and day workers in terms of physical activity (Karlsson, et al., 2003). International studies have found no difference in exercise habits of shift workers and day workers (Croce, et al., 2007; Lasfargues, et al., 1996).

Smoking is a controllable risk factor for CVD, and according to the Centers for Disease Control, the leading preventable cause of death in the US, yet many still smoke (Centers for Disease Control, 2008b). For example, in a 2006 study of 2,039 shift workers, after adjusting for age, gender, educational level, and job strain, significantly more shift workers than day workers smoked. Furthermore, shift workers were 46% more likely to start smoking than day workers (van Amelsvoort, Jansen, & Kant, 2006).

Impact of Constrictive Work Environments on

Health, Nutrition, and Physical Activity of Men

For the purposes of this study, I focused on long-haul truck driving, offshore fishing, offshore oil rigs, and railroad work.

Long-Haul Truck Driving

Commercial, or long-haul, truck drivers work long hours, a rigorous work schedule, spend a great deal of time alone, are sedentary for long periods of time, and are often on the road for days at a time, if not weeks (Dahl, et al., 2009). In the U.S., truck driving is one of the largest occupations, with 3.2 million jobs (Bureau of Labor Statistics, 2010). A Polish study of road transport drivers found 62.6% of the drivers were overweight or obese, and 36.7% had been diagnosed with hypertension, both of which are risk factors for diabetes and CVD (Marcinkiewicz & Szosland, 2010). In a 2007 study of 91 long-haul truck drivers in the U.S., 86.8% were overweight or obese, with 57% being obese or extremely obese. Additionally, drivers reported poor nutrition, as evidenced by a diet low in fruits and vegetables, and lack of physical activity (Whitfield Jacobson, Prawitz, & Lukaszuk, 2007). Another study linking overweight and obesity is that of Dahl and colleagues. A study of 5,506 baseline truck drivers, 2,175 follow-up long haul truck drivers and 15,060 other truck drivers in Denmark, found all truck drivers had increased risk of hospitalization due to obesity and diabetes (Dahl, et al., 2009). Moreover, the average life expectancy for a commercial truck driver is 61 years, 16 years lower than the national average. Furthermore, the U.S. Department of Transportation reports 54% of truck drivers use tobacco, and only

eight percent exercise (United States Department of Transportation, 2010). Studies suggest truck drivers are at high risk of chronic diseases related to overweight and obesity, tobacco use, physical inactivity, and poor nutrition.

Offshore Fishing

Similar to work on the towboat, offshore fisherman endure long hours, extreme weather conditions, and long periods of time on the boat. In the year 2001, 33 boats were lost and 10 fishermen were killed in United Kingdom waters (Lawrie, Matheson, Ritchie, Murphy, & Bond, 2004). Offshore fishing is one of the most dangerous occupations in the world, and like the barge industry, there has been little research done on the relationship between the environment and fishermen's health (Matheson, et al., 2001).

The incidence of alcoholism was two and one-half times higher for fishermen than non-fishermen in a study done in the United Kingdom between 1966 and 1970 (Rix, Hunter, & Olley, 1982). A Polish study of 2,417 fishermen from trawler factory ships and 2,822 seafarers from cargo ships revealed 72.9% of fishermen smoked and 59.7% of seafarers smoked (Tomaszunas, 1989). A study conducted in Spain corroborated the findings on smoking, indicating 60% of fishery workers smoked. Additionally, the researchers found diets on board were "poorly balanced" (Novalbos, Nogueroles, Soriguer, & Piniella, 2008).

The lack of literature related to the health of fishermen may be due to the fact that many boats are privately owned and operated. Matheson suggests health issues common to the world's fishing industry are: "being at sea in a confined space, thus increasing passive smoking; limited storage for fresh food;

and working long hours with disrupted sleep patterns" (Matheson, et al., 2001). These issues parallel those found in my preliminary research on the towboat industry.

Offshore Oil Industry

A 1995 study conducted by Parkes investigated the prevalence of overweight and obesity among 1,581 male workers on 17 North Sea installations in the United Kingdom (UK). Using BMI standards for overweight and obese, 47.3% of the men were overweight, and 7.5% were obese. A follow-up study in 2000 revealed 54.5% were overweight and 14.4% were obese. Like towboats, the dining room is the center of social interaction and "substantial" meals are available around the clock (Parkes, 2003).

Another British study conducted in 1986 discovered similar results as Parkes. BMI and skinfold measurements (to asses percent body fat) were taken in 419 men working in the UK offshore oil industry. Men were grouped based on age: 20 to 29, 30 to 39, and 40 to 49. The prevalence of overweight was 31.6% of men aged 20 to 29, 50% of men aged 30 to 39, and 66.2% of men aged 40 to 49. The prevalence of overweight is higher offshore than that of age-matched men in the onshore population. Additionally, the offshore men had higher percentage of body fat than did their onshore peers (Light & Gibson, 1986).

Railroad Work

No current published studies were found describing the health, diet, or physical activity of freight train or Amtrak employees. This is unfortunate as the working conditions on a freight train would be similar to that of a towboat.

Railroad crew members don't work a standard 40-hour workweek, and crew members are always on-call, even on weekends and holidays. When traveling on the train, crew members will sometimes spend a day or more away from their home terminal. Crew members must be physically strong, similar to towboat deckhands, and be accustomed to working outdoors in all weather conditions. Just like the barge captain and pilot, the conductor is responsible for the train, the freight, and the crew (Union Pacific, n.d.).

Although there are no recent studies on the health of railroad crew, the Federal Railroad Administration of the U.S. Department of Transportation commonly cites fatigue as a health concern and estimates it is responsible for 25% of accidents related to human causes (Federal Railroad Administration, 2008).

An older study conducted in the 1960s with railroad workers, assessed hypertension body weight as risk factors for coronary heart disease. In 1962, Taylor and colleagues found that among 191,609 railroad workers, those with sedentary jobs were at greater risk of dying from coronary heart disease than those with physically active jobs. Moreover, they found that men rarely changed jobs within the railroad industry because of "brotherhood" or labor agreements. Therefore, if they started in a sedentary job, they would likely retire in that job. (Taylor, et al., 1962). A follow-up study of 3,043 workers, published in 1989, confirmed the original results (Slattery, Jacobs, & Nichaman, 1989). Another study in 1963 of 527 railroad workers found "definite hypertension and relative

body weight seemed to be significantly prognostic of subsequent coronary heart disease" (Dimond, 1963).

Literature from the long-haul truck driving, offshore fishing industry, offshore oil industry, and railroad industry indicate similar work environments and constraints as noted in my previous research on the inland barge towboat industry.

Healthy Workforce 2010 Objectives

Chronic disease and disability drives the cost of health care in the U.S. The CDC reports 45% of the population has a chronic disease, which accounts for 75% of healthcare spending (Centers for Disease Control, 2009c). Obesity is a risk factor for chronic disease and accounts for almost 10% of healthcare expenses annually in the US (Finkelstein, Trogdon, Cohen, & Dietz, 2009). Premiums for employer-sponsored insurance plans increased 131% between 1999 and 2009; premiums employees paid increased 128.5% (The Kaiser Family Foundation and Health and Research & Education Trust, 2009). Lowered productivity, on-the-job accidents, and absenteeism are the most problematic health-related problems in the workplace (Ricci, Chee, Lorandeau, & Berger, 2007). Most importantly, though, chronic disease can be reduced by as much as 80% if individuals will engage in a healthy lifestyle including maintaining a healthy weight, eating a healthy diet, getting regular physical activity, and not smoking (Ford & Bergmann, 2009). Creating a healthier U.S. workforce would benefit not only the employee, but also would reduce health care costs and increase

productivity. Therefore, the Partnership for Prevention and the U.S. Chamber of Commerce worked together to create *Healthy Workforce 2010* objectives and strategies for programming (Partnership for Prevention & U.S. Chamber of Commerce, n.d.). The major objectives follow.

Major Worksite Objectives

1. At least three quarters of US employers, regardless of size will offer a comprehensive employee health promotion program that includes health education, supportive social and physical environments, integration of the worksite program into organization structure, linkage to related programs such as employee assistance programs, and worksite health screening programs.
2. At least three quarters of US employees will be participating in employer-sponsored health promotion activities.

Health Behaviors

1. Reduce tobacco use by adults.
2. Reduce the cost of lost productivity due to alcohol and drug use.
3. Increase the proportion of adults who engage in regular, preferably daily, moderate physical activity for at least 30 minutes per day.
4. Increase the proportion of adults who are at a healthy weight."

   (Partnership for Prevention & U.S. Chamber of Commerce, n.d.)

Worksite Health Programs for Blue-Collar Shift Workers

It is well documented that healthy employees correlate with less absenteeism, higher productivity, and lower costs associated with health insurance (The Wellness Councils of America, 2011). Numerous studies can be found on factors influencing participation in health education programs among women, however, not nearly as many are focused on men (Campbell, et al., 2002). Additionally, in a thorough review of literature on worksite health promotions Glasgow and colleagues reported men and blue collar workers are less likely to participate in worksite wellness programs (Glasgow, McCaul, & Fisher, 1993).

A study of the effects of two worksite health interventions involving 599 firefighters yielded positive results for both the short-term and long-term. A team-centered peer-taught curriculum and an individual motivational interviewing intervention were utilized for the interventions. At the one-year follow-up, both interventions demonstrated positive effects on BMI; whereas, the team-centered intervention demonstrated positive effects on nutrition behavior and physical activity in addition to BMI. A three-year follow-up indicated the intervention results were not continued, however, the worksites were still healthier as a whole (Mackinnon, et al., 2010). This study is particularly important as the demographics of this study are similar to those gathered in preliminary research of the towboat industry discussed later in this chapter: 90.5% White male, average age of 40.7, and an average of 15.4 years experience as a firefighter.

Prior and colleagues (2004) assessed the influence of a multi-component worksite health promotion program aimed at reducing CVD risk factors among a cohort of 4,198 blue-collar employees (27% women). The intervention was short in duration, consisting of a 15-minute CVD risk screening (BMI, lipid panel, history of smoking) and individualized counseling for those at medium- to high-risk; physician referral was made to those at high-risk. Even with a short intervention, high-risk participants improved their diastolic blood pressure, decreased total cholesterol, and smokers decreased number of cigarettes smoked per day. Those who were screened as “low-risk” did not receive counseling, and their BMI and total cholesterol increased. Findings suggest future interventions must be geared toward all employees, even those with normal BMI and who engage in regular physical activity, to encourage them to maintain low risk of obesity and co-morbidities (Prior, et al., 2004).

Built Environment Influence upon Physical Activity and Eating Behaviors

Research suggests the built environment may play a key role in the relationship between physical activity, or lack thereof, and obesity. However, when referring to the “built environment”, researchers are usually referring to community design, such as street connectivity, sidewalks, aesthetics, reducing physical and psychological barriers (Frank, Engelke, & Schmid, 2003; Gordon-Larsen, Nelson, Page, & Popkin, 2006; Handy, Boarnet, Ewing, & Killingsworth, 2008). The link between the built environment and travel behavior (such as the

likelihood to walk, riding bicycles, or riding in a car), is a central element in this research (Handy, et al., 2008).

Frank and colleagues examined the relationship between the built environment around individual residence along with self-reported travel patterns (walking and time in car), BMI, and obesity for 10,878 participants in the Atlanta, Georgia region. Findings indicate time spent in the car was positively associated with obesity, with each additional hour in the car per day there was a six percent increase in the likelihood of obesity. On the other hand, walking was associated with a reduction in the likelihood of obesity, for each additional kilometer walked per day there was a 4.8% reduction.

Lake and Townshend suggest investigating environments that promote high energy intake and sedentary behavior, or obesogenic environments (Lake & Townshend, 2006). Obesogenic is defined by the CDC as “characterized by environments that promote increased food intake, non-healthful foods, and physical inactivity” (Centers for Disease Control, 2011b). Ard says “we have evolved from a society of hunter-gatherers to a society of drive-through picker-uppers” (Ard, 2007). Obesity prevention and treatment have focused on education, behavior, and medication, all with limited success. A more promising approach might be focusing on the environment to better understand how individuals interact with their environments, in terms of food intake and physical activity, so that the environment could be shaped to better support healthful decisions (Lake & Townshend, 2006).

The prevalence of obesity and the number of deaths and disabilities related to preventable risk factors continues to rise, even though we have increased knowledge, awareness, and education about obesity, diet, and exercise. According to Egger, a paradigm shift is necessary, and we need to seriously look at environmental factors (Egger, 1997).

Theoretical Framework

The PRECEDE-PROCEED planning model, developed by Green, Kreuter, and associates, was chosen as the framework for this research because it provides a comprehensive structure for assessing health-related behaviors and environmental forces for designing, implementing, and evaluating health promotion programs and interventions. Since health behavior is influenced by both individual and environmental forces, the PRECEDE-PROCEED model has two distinct components: an “educational diagnosis” (PRECEDE) and an “ecological diagnosis” (PROCEED) (Green & Kreuter, 1999). Assessing is critical since health behavior is influenced by both factors and also because of the nature of this research (National Cancer Institute, 2005).

In addition to the PRECEDE-PROCEED planning model, Prochaska’s Stages of Change construct of the Transtheoretical Model was chosen. The Stages of Change construct essentially suggests that behavior change is a process, not an event. A person moves through five stages as they attempt a behavior change: precontemplation, contemplation, preparation, action, and maintenance (National Cancer Institute, 2005). Precontemplation proposes a

person has no intention to make a behavior change within the next six months. Contemplation suggests a person intends to make a behavior change within the next six months. Preparation implies a person intends to make a behavior change within the next 30 days and has taken some behavioral steps toward the change. Action indicates a person has made a behavior change for less than six months. Finally, maintenance indicates a person has made a behavior change for more than six months (Glanz, Rimer, & Lewis, 2002). Research suggests tailoring programs to the stage of change will enhance program outcomes and ultimately the success of the program (Prochaska & Norcross, 2001).

Preliminary Research

Since there are no existing studies, and I was intrigued by the industry and the possibility of lowered BMI requirements, I conducted preliminary research on the inland barge towboat industry. I looked at the dimensions of the problems within the industry to determine whether or not I thought the issues were substantial enough to pursue additional research. The preliminary study results led to the elements discussed in the literature review. The research has been accepted for publication in the Eta Sigma Gamma Health Education Monograph Series Fall 2012. Highlights of the research article follow, however, the article in its entirety can be found in Appendix A along with SIUC Human Subjects Approval.

The U.S.C.G. requires a BMI of 40 or less for licensed towboat crew, but has discussed lowering this requirement (i.e., decreasing the required BMI). The purpose of the study was to describe characteristics of the towboat crew and

their work environment, and to collect initial information about their perceptions of the benefits and barriers to a healthy diet and exercise during time on the towboats, and motivation to make healthy changes. A qualitative approach was utilized informed by the PRECEDE-PROCEED planning model.

The study included four components to examine how life on the river affects perceived health status, and perceived benefits and barriers to good health, as well as motivation to meet physical standards. The first component consisted of interviews with key informants in upper management with barge transportation companies, towboat cooks, pilots, and captains. The second component consisted of a tour of two towboats and observation. The third component of the study was a focus group with towboat captains and pilots. The fourth component was a review of U.S.C.G. documents and regulations regarding body weight, nutrition, and physical activity. The study was conducted in Paducah, Kentucky, the hub of river barge industry in the U.S., and was completed in fall 2010. All research received Human Subjects Approval through the Office of Research Development and Administration at Southern Illinois University Carbondale.

Analytic Strategy

Using thematic analysis, field notes from interviews and towboat tours were examined and coded into key themes. The focus group recording was analyzed and key themes were identified and coded. Through theoretical comparison, categories of key themes were identified. Appendices B and C include towboat tour and observation field notes and pictures. To ensure the

accuracy of this report, feedback was obtained from two knowledgeable informants (Shank, 2002). Microsoft Excel was used to calculate mean number of years on the river, and means and standard deviations of BMI (National Heart Lung and Blood Institute, 2011).

Key Findings

All 20 wheelhouse officers who participated in the focus group were male. Mean years working on the river was 24.6 ± 7.3 years. Mean BMI was 30.05 ± 2.85. Ten (50%) were between the ages of 45 and 54; 6 (30%) were between the ages of 35 and 44; 3 (15%) were between the ages of 55 and 64; and only one was between the ages of 25 and 34. All but one officer were Caucasian.

Five primary categories of themes emerged: commitment to healthy practices, southern-style cooking tradition is a barrier to healthy eating, the built environment is a barrier to physical activity, shift work is a barrier to healthy eating and physical activity, and the industry is anticipating change with regard to BMI requirements.

Commitment to Healthy Practices

Although few participants reported healthy eating practices and regular physical activity while on the tow, those who did, consistently indicated “you must make the activity routine and you must be dedicated”. Strategies to stay active included bringing equipment, such as mini-stair steppers, mini-trampolines, and exercise bands.

Southern Cooking Tradition Barrier to Healthy Eating

The men who work on the tow spend 14-30+ days together, work grueling schedules, are in limited company, and have very limited amenities. One thing the men look forward to is the “great southern-style” food. Breakfast may include biscuits and sausage gravy, bacon and/or sausage, pancakes or French toast, and hot and cold cereals. Lunch is traditionally a big, hot meal, such as meatloaf, mashed potatoes and gravy, corn, and green beans. Supper is lighter and might consist of sloppy joes, tacos, or chicken strips. There are typically two desserts at each meal. Furthermore, the cooks and the crew emphasized repeatedly, that the cook’s job depends on satisfying their captain and crew.

When focus group participants were asked what makes it easy to eat healthily on the boat, one chuckled, “you won’t have much down for that one.” Conversely, when asked what makes it harder to eat healthily on the boat, there were numerous responses. Participants said it is hard to turn away from good food, and they always want seconds. Others indicated easy access to snack foods and desserts made it hard to watch what they eat, while some indicated that the crew “does not want to adopt healthy eating practices”. Limited refrigerator and freezer storage also was cited as a constraint for eating healthily, as well as having to “re-train” the cooks. The observation revealed towboat galleys are similar in size and equipment to home kitchens, confirming the notion of limited space.

Built Environment Barrier to Physical Activity

Throughout the interviews and focus group, the crew verbalized that physical activity gives them more energy, aids in weight loss, decreases stress levels, decreases blood pressure and cholesterol levels, and inspires those around them to exercise. Even so, the perceived barriers tend to prevail over the perceived benefits. The towboat itself is not conducive to promoting physical activity due to limited space as well as obstructions, wires, deck fittings, and hatches. Outside walkways are narrow and are too dangerous to run on, and the weather often prevents walking on the tow. Interior space is also limited with both bedrooms and common rooms being too small for exercise, and walkways and stairs are narrow. Noise of engines and lack of privacy and equipment also were cited as deterrents to physical activity.

Shift Work Barrier to Healthy Eating and Physical Activity

Crew members, with the exception of the cook and engineer, work 6 hours on, 6 hours off, working 12 hours per day. Working a swing shift makes it difficult to incorporate physical activity, according to the captains and pilots. The “front watch” is usually from 6am-12pm and 6pm-12am; the “back watch” is from 12pm-6pm and 12am-6am. During their 6 hours off, the crew finds time to sleep, eat, socialize, exercise, and fit in “down time.”

Wheelhouse officers’ jobs are mentally challenging, but require very little physical activity. Conversely, the deckhand’s job is physically demanding requiring a great amount of energy. Wheelhouse officers often start off as deckhands. As they transition through the ranks, though, they tend to not

decrease the number of calories they are taking in to account for the decrease in physical activity, which leads to significant weight gain.

Industry is Anticipating Change

The prospect of the U.S.C.G. implementing more restrictive BMI standards was a frequently expressed concern, and towboat companies are anticipating change. The industry as a whole would like crews to be healthier to be able to work longer disability-free. This will reduce sky-rocketing health care costs, time and cost of training, and employee turnover at a time when there is an industry-wide shortage of qualified mariners (Cohen, 2008). Wheelhouse officers indicated they would be motivated to incorporate more healthy practices if it would enable them to keep their Merchant Mariner license and allow them to work longer.

In the focus group, only 5 of the 20 captains and pilots viewed themselves as healthy. This is corroborated by the fact that the mean BMI was 30.05, obese by the CDC standards (Centers for Disease Control, 2009a). Towboat crew were knowledgeable about benefits of healthy eating practices and physical activity, however barriers appear to prevail. This is unfortunate since physical inactivity, poor diet, and obesity are three of the major modifiable risk factors for heart disease (American Heart Association, 2009).

Summary

Although studies have been conducted on blue-collar and shift workers, few studies have researched the health and nutrition status of men in occupations with restrictive environments such as the railroad industry, offshore

fishing industry, offshore oil industry, or the inland barge towboat industry. The studies that have been done indicate there is a high prevalence of obesity and smoking in these industries, two major modifiable risk factors for chronic disease. Results from my preliminary research also suggest a high prevalence of obesity, lack of physical activity, and food intake based on taste, not nutrition or health. Clearly, studies are needed for more in-depth exploration of the health status and health risks among men in occupations with constrictive environments, as well as what will motivate the men to engage in healthier behaviors. A healthy lifestyle is key to reducing risk factors for chronic disease and disability. Employers will also benefit from a healthier workforce through decreased health care costs, increased productivity, and decreased absenteeism.

CHAPTER 3

METHODOLOGY

This chapter describes the methodological procedures used to conduct the study about the health and nutrition implications of living and working on inland barge towboats. Strategies for research design, sampling, data collection, statistical analysis, and protection of human subjects are detailed.

Purpose of the Study

The purpose of the study is to better understand how life on the towboat affects health status; towboat crews' perceived benefits and barriers to optimal health, specifically eating practices and physical activity; and motivation to meet U.S.C.G. physical and BMI guidelines. The study is intended to determine what type of intervention would be most appropriate and most beneficial to inland barge crew to assist them with leading healthier lives while on the tow. Moreover, results of this study will be applicable to similar working environments.

Research Questions

1. What are the perceived benefits among towboat crew regarding healthy eating practices and regular physical activity?
2. What are the perceived barriers among towboat crew regarding healthy eating practices and regular physical activity?
3. What would motivate towboat crew to adopt healthier practices with regards to healthy eating practices and regular physical activity?

4. What would motivate towboat crew to meet U.S.C.G. physical ability and BMI guidelines?
5. Do differences exist between eating practices and body composition (BMI and waist circumference) of towboat crew, controlling for age?
6. Do differences exist in regular physical activity based on occupation on the towboat (cook, deckhand, engineer, pilot, captain)?
7. To what extent does towboat crew meet USDHHS 2008 Physical Activity Guidelines?
8. To what extent does the built environment influence healthy eating practices and regular physical activity of towboat crew while on the boat?

Study Setting

Paducah, Kentucky is widely recognized as the epicenter of the commercial river industry because of its proximity to the confluence of the Ohio and Tennessee Rivers, and the number of inland barge companies that call Paducah home. Additionally, Paducah is often called the Four-Rivers Area due to its proximity to the Ohio, Tennessee, Mississippi, and Cumberland Rivers ("City of Paducah," 2007). Over 30 barge companies are headquartered in or near Paducah.

Research Design

The study utilizes a cross-sectional design to explore relationships among variables utilizing a survey and body composition measurements. Eating practices and physical activity on the vessel, and body composition will be studied as dependent variables. The independent variables include personal factors consisting of gender, age, and race/ethnicity. Additionally, perceived benefits of healthy eating practices, perceived barriers to healthy eating practices, perceived benefits of physical activity, and perceived barriers to physical activity, occupation, and built environment will be examined as independent variables.

A cross-sectional design is appropriate for the purposes of the study, to explore and better understand relationships among the selected variables. This type of design allows for the ability to analyze relationships among a large number of variables in a single study, and to look at interactions between multiple variables at the same time to see which of them vary together (Brink & Wood, 1998). Results of correlational research have implications for decision making, which is important, since the results of this research will provide guidance for future health education interventions (Shaughnessy, Zechmeister, & Zechmeister, 2002).

Sample

Inland barge towboat crew men, employed by barge transportation companies headquartered in Paducah, Kentucky, will be solicited to participate in

the study. Inclusion criteria include male gender, employment as towboat captain, pilot, engineer, deckhand, or cook, and the ability to read and write in the English language. Most towboat crew members are male, aged 18 to 64.

Eliciting towboat crew to complete research surveys is challenging since many towboats do not have Internet access, towboats are constantly on the move, and crew come from all over the United States regardless of where their company headquarters are located. However, since many companies offer ongoing crew training, this time is opportune to request research participation and reach a significant number of towboat crew. Merchant Mariners plus the engineer and deckhands attend Crew Endurance Management (CEMS) trainings, while the cooks attend food safety and nutrition workshops. The trainings often are mandatory. They are scheduled during the crew's "off" 14-30 days, and are repeated every few weeks to ensure all crew members receive the training. Thus, the survey will be administered at towboat crew trainings, and body composition data including height, weight, and waist circumference will be gathered at the same time.

Sample Size and Power Analysis

Three components were taken into consideration when calculating the required sample size for this study: 95% confidence level, sampling error, and population estimate of 30,000 (Carpenter, 2011). A sample size of 381 participants is required for a ±5% sampling error, or a sample size of 96 is needed for a ±10% sampling error (Dillman, 2007). I anticipate obtaining a sample size of approximately 200.

Protection of Human Subjects

All research materials received Human Subjects Approval through the Office of Research Development and Administration at Southern Illinois University Carbondale. Human Subjects Approval and letters of permission to request participation from barge companies are available in Appendix D.

Data Collection Procedures

Data was collected during pre-arranged crew trainings. Prior to administering the survey, the purpose of the research was introduced to participants. The survey was administered by myself and/or trained data collectors. Participants were given approximately 20 minutes to complete the survey. Upon completion, participants went through three body composition stations with one to two data collectors positioned at each. The participants proceeded through the stations in the following order: (1) waist circumference, (2) height, and (3) Tanita bioelectric impedance analysis (BIA). Body composition data was measured and recorded by myself and the trained data collectors.

Surveys were checked by the data collectors for completeness and legibility prior to participant leaving the site. Verbal clarification was elicited as needed and participants will be asked to supply any missing information. Data collectors initialed all questionnaires in which we take measurements. If there are no researcher initials and no body composition measurement slip, the information is self-reported and will be coded as such. Additionally, when data collectors were not able to attend crew training, surveys and body composition data were

self-reported and coded as such. Each participant will be given an informed consent form, which was approved by Southern Illinois University Carbondale Office of Research Development. Return of the surveys and participation in the body composition measurements constituted willingness to participate in the study.

Data Collector Training and Body Composition Measurement

All data collectors were trained in their respective body composition station. Trained data collectors are essential in obtaining accurate waist circumference measurements and reliable data (Klein, et al., 2007). Data collectors were trained to accurately measure waist circumference, height, weight, and percent body fat. Lynn Gill, MS, RD, Nutrition Coordinator at the SIUC Wellness Center, trained data collectors to accurately measure waist circumference. To accurately measure waist circumference, you must first locate the top of the hip bone. Then, place the tape measure evenly around the abdomen, horizontal to the floor and measure in inches. The tape measure should be snug, but tight enough to push in on the skin. Also, the measurement should be taken after the participant breaths out normally and does not “suck in” his/her stomach (McKinley Health Center, 2009). Measurements should be taken around the bare midriff; however, to prevent embarrassment, measurements will be taken over the participants’ t-shirt.

Waist circumference measurements were taken with the MyoTape body tape measure. The MyoTape measure is made of non-stretchable vinyl, has a push-button retraction and locking mechanism to ensure a snug measurement

and increased accuracy of measurement. The tape measures waists up to 60” in circumference. In the event a trained data collector wasn’t available to measure waist circumference, the participants were asked to record their pant waist size.

The PE-AIM-101 portable adult stadiometer, made by Perspective Enterprises, was utilized to measure height. The stadiometer has a sliding head piece that is perpendicularly latched to the stationary base to ensure repeatable and accurate measurements. The stadiometer is accurate to 1/8”, can measure an adult up to 78”, and has unlimited weight capacity (Perspective Enterprises, n.d.). With bare feet, legs straight, arms relaxed at the sides, and heels close together, participants should stand with their back against the stadiometer. Participants were asked to “stand tall”, take a deep breath, and look straight ahead. The data collector then lowered the beam to touch the crown of the participant’s head, and recorded the measurement, in inches, on number 98 of the survey instrument.

To measure weight and percent body fat, the C-300 Tanita body composition analyzer and scale was used. Bioelectric impedance analysis machines (BIA), such as the Tanita BIA, offer valid and reliable means of measuring body composition (Ihmels, et al., 2006; Jackson, Pollock, Graves, & Mahar, 1988). For the BIA measurement, participants’ clothes weight (estimate two pounds), gender and body type, age, and height were entered into the Tanita prior to testing. Body type is selected from one of four options: standard male, standard female, athletic male, athletic female. Tanita defines athletic as a person who engages in vigorous physical activity at least 10 hours per week and

who has a resting heart rate of 60 beats per minute or less (Tanita, n.d.). Participants were then asked to step on the scales with bare feet, heels on posterior electrodes and the front part of the feet on the anterior electrodes. Participants remained on the scale until the weight stabilized and impedance measurement is completed. Weight and body fat percent were displayed on the LCD screen and detailed results automatically printed out (Tanita, n.d.).

Nutrition, Health & Physical Activity Assessment Instrument

The Nutrition, Health & Physical Activity Assessment instrument has seven sections designed to assess current practices, perceptions, and motivations, and a section to enter demographic information and body composition data. Section one assesses current physical activity level. Sections two through five assess perceptions regarding eating healthy and exercising on the tow, how the built environment influences eating behaviors and physical activity, and motivation to meet U.S.C.G. physical ability guidelines. I developed sections two through five based on preliminary research discussed in the previous chapter. Due to the uniqueness of the towboat industry and the lack of research, food frequency instruments with established reliability and validity were not available, with the exception of Kristal's Fat-Related Diet Habits Questionnaire, which has been adapted to assess nutritional intake on the towboat (section six). Demographics (section seven) will be collected to provide a snapshot of social and physical aspects of the environment, diversity, and health status.

Section One: Physical Activity on the Towboat Assessment

Using the U.S. Department of Health and Human Services (USDHHS) 2008 Physical Activity Guidelines for Americans, four questions were designed to assess physical activity habits of towboat crew for one week while on the boat. The USDHHS recommends adults participate in two and one-half hours per week of moderate-intensity activity or one and one-quarter hours per week of vigorous intensity activity. Moderate-intensity activities include walking briskly, water aerobics, or ballroom dancing. Vigorous-intensity activities include race-walking, jogging, running, or jumping rope. In addition, it is recommended that adults incorporate muscle-strengthening exercises at least twice a week such as weight-lifting, push-ups, and sit-ups (United States Department of Health and Human Services, 2008).

Section Two: Perceptions about Exercising

The wheelhouse officers in the focus group were asked to describe the pros and cons of exercising on the boat, and what makes it easier and harder to exercise on the boat. Positive factors included weight loss, feeling better, increased energy, decreased stress, “inspiration to those around”, decreased blood pressure, and decreased cholesterol. What made exercise easier, is dedication to exercise, making it a daily routine, and availability of exercise equipment (some towboats have treadmills). Potential for injury was cited as a negative factor to exercising, along with having to purchase new clothes due to weight loss. Shift work, limited space available, noise, lack of privacy, lack of

equipment, and constrictive environment (inside and outside) were indicated when asked what makes it harder to exercise while on the boat. Eleven statements were developed for section two of the instrument based on these findings. Each statement requires the participant to rate the degree of agreement regarding perceptions about exercising to meet physical guidelines on a five-point Likert-type scale from strongly agree to strongly disagree.

Section Three: Perceptions about Eating Healthy

During the focus group conducted for preliminary research, the wheelhouse officers were asked to describe the pros and cons of healthy eating on the boat, and what makes it easier and harder to eat healthy on the boat. The positive aspects of eating healthy included living longer, and feeling better. When asked what made it easier to eat healthy, their only response was “portion control”. In fact, one captain said “there won’t be anything listed under ‘easy’.” Crew in the focus group listed the negative aspects of eating healthy to be not tasting good, cost, re-training cooks, tradition of southern cooking would be difficult to change, refrigerator space insufficient for storing fresh fruits and vegetables, and limited freezer space. When asked what makes it harder to eat healthy, responses included unlimited access to unhealthy snack foods, desserts, hard to turn away from good food, desire for second helpings, a lot of crew members don’t want to adopt healthy eating practices, and the way the food is prepared makes it hard to eat healthy. Eighteen statements were devised for section three of the instrument based on these findings. Each statement requires the participant to rate the degree of agreement regarding perceptions about

eating healthy on a five-point Likert-type scale from strongly agree to strongly disagree.

Section Four: Motivation to Meet U.S.C.G. Physical Guidelines

During the focus group conducted for preliminary research, the wheelhouse officers were asked what would motivate them to adopt healthier eating practices and partake in regular physical activity. Health, longevity, and family were the dominant responses, along with keeping their Merchant Mariner certification. The possibility of company incentives were also mentioned as potential motivators for healthy behaviors. Based on these findings, nine statements were developed for section four. Each statement requires the participant to rate the degree of agreement regarding motivation to meet physical guidelines on a five-point Likert-type scale from strongly agree to strongly disagree.

Section Five: Perceptions of How the Built Environment Influences Physical Activity and Eating Behaviors

When the wheelhouse officers were asked about the benefits and barriers to healthy eating and physical activity, the towboat itself often was mentioned. The tradition of southern-style cooking, availability of calorie-dense snack foods, 24-hour accessibility to food were cited as barriers to healthy eating. The limited space, the noise, and the lack of privacy on the towboat make it difficult to regularly exercise. Additionally, the weather may prevent outdoor exercise on the tow. Lastly, not all towboats are equipped with a treadmill or other exercise equipment. Twelve statements were devised for section five of the instrument

based on these findings. Each statement requires the participant to rate the degree of agreement regarding environmental influences on a five-point Likert-type scale from strongly agree to strongly disagree. Items 43, 45 through 49, 51, 52, and 54 were reverse coded so that high scores equal a better environment for exercising and encouraging healthy eating practices.

Section Six: Nutrition on the Towboat Assessment

Southern cooking is a tradition on the towboat. Breakfasts are hearty consisting of biscuits and gravy, bacon and sausage, pancakes, and cereals. Lunch is customarily a big meal such as meatloaf, mashed potatoes and gravy, two vegetables, and one or two desserts. Supper is lighter and may be a BBQ sandwich, tacos, or chicken strips plus side dishes. Fresh fruit is usually available. Snack foods such as Poptarts®, snack cakes, and chips also are readily available. Milk, sweet tea, cola, and water are accessible at all times to drink.

To assess the eating practices of towboat crew, I used a food frequency questionnaire (FFQ). FFQs are not appropriate to assess individual calorie and nutrient intake; however, are appropriate to characterize groups of individuals on very broad dietary habits (Kristal & Potter, 2006). In addition, since the FFQ is self-reported, it is subject to bias because we cannot separate actual behavior versus reported behavior (Kristal, Beresford, & Lazovich, 1994).

Because of the nature of the menus served on the boat, it was difficult to find a food frequency questionnaire to utilize in its entirety. Kristal and colleagues' Fat-Related Diet Habits Questionnaire most closely fits this study.

The Fat-Related Diet Habits Questionnaire is a 22-item survey which has been tested for reliability and validity in numerous studies (Gray-Donald, O'Loughlin, Richard, & Paradis, 1997; Kristal, Shattuck, & Henry, 1990; Shannon, Kristal, Curry, & Beresford, 1997). Reliability has been established through Cronbach's coefficient alpha and test-retest methods. In a telephone survey of 93 adults, Gray-Donald and colleagues found the Kristal's instrument's test-retest reliability at 0.72-0.90. While testing the instrument in a worksite setting with 178 men and women, Spoon and colleagues found the test-retest correlation coefficient r=0.74 and the Cronbach's coefficient alpha to be 0.83 (Spoon, et al., 2002).

With input from towboat cooks during trainings, I modified the Fat-Related Diet Habits Questionnaire to be more consistent with the towboat population. Of the original 22 items, 18 were kept with minor wording changes. Also, 19 items were added to capture additional food-related behaviors typical on the towboat not addressed by the original instrument. Examples include "when you ate breakfast, how often did you eat biscuits and sausage gravy? and "when you drank tea, how often was it sweetened?" Responses are categorized by frequency of behavior (usually or always, often, sometimes, rarely or never, or not applicable). Eighteen items were directly related to healthier eating practices such as eating fruits and vegetables, eating whole grain foods, drinking skim milk, omitting salt, and reducing fat (questions 56, 59, 61, 63, 64, 66, 67, 69, 74-78, 80, 82-83, 85, 89). Sixteen items were related to unhealthy eating habits such as eating fried foods, eating white bread, adding butter or margarine to foods, adding salt, eating high-fat calorie-dense snack foods, drinking regular soda and

sweet tea (questions 55, 57, 60, 62, 65, 70-73, 79, 81, 84, 86-87, 90-91). Permission to adapt Kristal and colleagues' Diet Habits Questionnaire is found in Appendix E. The instrument identifying Kristal and colleagues' Diet Habits Questionnaire original items and those added to represent the towboat industry can be found in Appendix F.

Section Seven: Demographics & Body Composition Measurements

The study analyzed items including perception of health, age, gender, occupation, BMI, percent body fat, and waist circumference. Additional demographic information was used for descriptive purposes only. This includes stage of change in relation to healthy behaviors, ethnicity, diagnosis of chronic disease, whether or not the participant smokes, and number of years working on the tow. The instrument, the coded instrument, and correspondence with the participants can be found in Appendix F.

Instrument Readability

The Nutrition, Health & Physical Activity Assessment Instrument was tested for readability using the Flesch-Kincaid Grade Level scores and Flesch Reading Ease scores calculated by Microsoft Word. The Flesch-Kincaid Grade Level score is 6.4, which is equivalent to 6th grade reading level in the United States. The Flesch Reading Ease score rates text on a 100-point scale with higher scores indicating easier understand of the document. The instrument scored 71.3, suggesting the document was easy to read and understand (Microsoft, 2011).

Pilot Test

To examine and maximize validity and reliability of the instrument, the Nutrition, Health and Physical Assessment instrument was pilot tested at a barge company's mandatory health fair for towboat crew on March 26, 2011. Upon completion of the survey, participants were asked questions about the clarity and appropriateness of the instrument. In addition, physical measurements including height, weight, percent body fat, and waist circumference were taken. Data was input into Statistical Package for Social Sciences (SPSS) for analysis.

Validity

To validate the FFQ, or nutrition assessment portion of the questionnaire, it is important to test it on a sub-sample of the main population being studied. Additionally, examination of the food frequency questionnaires prior to use is especially useful when working with groups whose dietary practices are not well documented (Cade, Thompson, Burley, & Warm, 2001). The FFQ was reviewed by eight towboat cooks for face validity. The cooks indicated that foods named on the instrument were representative of what is often served on the towboat. The only change suggested was to add cold cereal as a snack food since it is often eaten between meals. Moreover, content validity was established by the dissertation committee in addition to towboat cooks.

Reliability

To establish reliability of the instrument, Cronbach's coefficient alphas were run on the pilot test sample (n=82), and test-retest was utilized (n=19). To examine the instrument's internal consistency reliability, Cronbach's coefficient

alpha was run for each section of the instrument was analyzed. A Cronbach's coefficient alpha result of ≥ 0.70 is considered good (Morgan, Leech, Gloeckner, & Barrett, 2007). A Cronbach's coefficient alpha was run for each section of the instrument separately. Since sections two and three of the instrument include benefit and barrier statements, the statistic is run separately for each. For the FFQ section, the "healthy" items were run together and the "unhealthy" items were run together. A Cronbach's coefficient alpha is an appropriate measurement of reliability since the FFQ will be treated as a scale in the data analysis. The Cronbach's coefficient alpha measured .792 to .847, suggesting each section of the instrument has good internal consistency reliability. Results for each instrument section are found in Table 1.

Test-retest is being used to examine the instrument's reliability. To measure reproducibility, a regression analysis and Spearman rho will be computed to assess linear association between the two measurements obtained from the test-retest (Morgan, et al., 2007). Time frame of the reference method also needs to be taken into consideration for instrument reliability (Cade, et al., 2001). The FFQ assesses intake over the past month. Therefore, the questionnaire should be administered a second time one month after the first administration. However, given the 21-day work periods of the towboat company, it was difficult to administer exactly one month from the initial data collection.

At the beginning of the pilot test survey, participants were asked to complete a second questionnaire within the next two to three weeks for the test-retest. One week following the health fair, the Nutrition, Health and Physical

Assessment instrument was mailed to the individuals who agreed to complete the questionnaire a second time. A self-addressed, stamped envelope was included with the instrument. Those completing and returning the second questionnaire were entered into a drawing for a $99 Wal-Mart gift card. The drawing was held May 6, 2011. The response rate for the retest was low, with only 19 participants returning their questionnaire. For the test-retest, a sample size of at least 50 is desirable to establish reliability (Cade, et al., 2001). Both sets of test-retest data were entered into SPSS and Pearson's correlation (*r* value) was run to evaluate similarities. Generally, *r* values are considered good if $r \geq 0.70$.

Finally, to check for coding error of the pilot data, data input for every tenth survey was reviewed for accuracy. Therefore, of the 82 pilot surveys of 103 questions each, three errors were found establishing accurateness.

Table 1

Summary Table for Cronbach's Coefficient Alpha and Test-Retest Results for the Pilot Test of the Health, Nutrition & Physical Activity Assessment Instrument

Instrument Section	Cronbach's Alpha *n* =82	Test-Retest *n*=19
Section 1: Physical Activity Assessment (4 questions)	.717	.483
Section 2: Perceptions about Exercising-Benefits (9 statements)	.932	.285
Section 2: Perceptions about Exercising-Barriers (2 statements)	.460	.449
Section 3: Perceptions about Eating Healthy-Benefits (6 statements)	.941	.488
Section 3: Perceptions about Eating Healthy-Barriers (9 statements)	.675	.769
Section 4: Motivation to Meet U.S.C.G. Physical Ability Guidelines (9 statements)	.885	.354
Section 5: Built Environment Influences Upon Eating and Physical Activity (12 statements)	.633	.448
Section 6: Food Frequency–Healthy Practices (18 statements)	.864	.683
Section 6: Food Frequency–Unhealthy Practices (16 statements)	.833	.652

Data Management and Analysis

Data Management

Data was collected between March 2011 and April 2012. The study collected non-sensitive data from a predominately male cohort, ranging from 18 to 65 years old. No personal identifiers were collected during the study. Completed surveys were kept in a secure location.

The survey were paper and pencil and given by myself or a colleague. Labels were assigned to each item on the questionnaire and entered into a codebook. Section one is coded zero through seven signifying the number of days per week the crew exercises on the boat. Sections two through five include a Likert scale with strongly agree, agree, neutral, disagree, and strongly disagree (coded two, one, zero, negative one, negative two respectively). Section six, the food frequency portion of the questionnaire, has the options “usually or always”, “often”, “sometimes”, “rarely or never”, and “not applicable”. Items are coded four through zero respectively. Additionally, “not applicable” (coded zero) will be omitted from analysis. The instrument codebook is in Appendix H. Data entry was performed manually. Questionnaires with missing data were coded as such in the data analysis program.

Data Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS), version 18.0 (SPSS Inc., Chicago, IL). Analyses was interpreted at a significance level of .05. Cronbach’s alpha coefficients and Pearson’s correlations were calculated for the Nutrition, Health and Physical Assessment

instrument to evaluate the internal consistency reliability and validity of the instrument and its subscales.

Descriptive statistics including percentages were calculated to describe the study sample. The body composition variables, including BMI, waist circumference, and percent body fat, were described separately based on occupation on the boat. The distribution of each variable was appropriately evaluated based on the measurement level (i.e., nominal, ordinal, or interval). Descriptive statistics utilizing measures of central tendency were used to answer research questions one through four and seven.

Analysis of Covariance (ANCOVA) was used to answer research question five exploring differences between eating practices and body composition of towboat crew, controlling for age, and investigating the association between occupation and body composition of towboat crew, controlling for age. Age-adjusted rates are best used when making comparisons, since populations vary by region with respect to age (McDermott & Sarvela, 1999). Analysis of Variance (ANOVA) was used to answer research question six identifying if differences exist in regular physical activity, based on occupation on the towboat. Pearson correlation was used to answer research question number eight identifying whether or not there is an association between the built environment and eating practices and regular physical activity. A summary of statistics used is presented in table 2.

Table 2

Summary of Statistics used for each Research Question

Research Question	Instrument components used to answer research question	Statistics Utilized
1. What are the perceived benefits among towboat crew regarding healthy eating practices and regular physical activity?	Healthy Eating: 28-33 Physical Activity: 5-11, 13-14	Descriptive statistics - Percentages
2. What are the perceived barriers among towboat crew regarding healthy eating practices and regular physical activity?	Healthy Eating: 16-18, 21-26 Physical Activity: 12, 15	Descriptive statistics – Percentages
3. What would motivate towboat crew to adopt healthier practices with regard to healthy eating and regular physical activity?	Motivation for Healthy Eating: 34-35, 38 Motivation for Physical Activity: 36-37, 42	Descriptive statistics – Percentages
4. What would motivate towboat crew to meet U.S.C.G. physical and BMI guidelines?	Motivation: 39-41	Descriptive statistics - Percentages
5. Do differences exist between eating practices and body composition of towboat crew occupation, controlling for age?	Healthy Eating: *Average of items* questions 56, 59, 61, 63, 64, 66, 67, 69, 74-78, 80, 82-83, 85, 89. Unhealthy Eating: *Average of items* 55, 57, 60, 62, 65, 70-73, 79, 81, 84, 86-87, 90-91 Demo: 95, 100-104	ANCOVA
6. Do differences exist in regular physical activity based on occupation on the towboat?	Healthy Eating: *Average of items* 56, 59, 61, 63, 64, 66, 67, 69, 74-78, 80, 82-83, 85, 89. Physical Activity: 1-4 Demo: 99	ANOVA
7. To what extent does towboat crew meet USDHHS 2008 Physical Activity Guidelines?	Physical Activity: 1-4	Descriptive statistics - Percentages
8. To what extent does the built environment influence healthy eating practices and regular physical activity of towboat crew while on the boat?	Healthy Eating: *Average of items* questions 52-54, 56, 59, 61, 63, 64, 66, 67, 69, 74-78, 80, 82-83, 85, 89. Physical Activity on Boat: 43-51	Pearson Correlation

CHAPTER 4

FINDINGS

This chapter outlines the results of data analyses pertinent to the research questions and the demographic characteristics of the towboat crew participants. The first section provides a description of sample characteristics including age, race/ethnicity, education, occupation, and number of years on the river. In the second section, the reliability of the research instrument and relevant subscales are provided. The third section consists of descriptive analyses of study variables including cigarette use, body mass index, waist circumference, perception of health and desire to make health-related behavior changes, as well as diagnoses of chronic disease. Finally, the fourth section consists of findings from analyses of the research questions.

Description of the Sample

A total of 194 towboat crew men participated in the study. Demographic characteristics of the sample are displayed in Table 3. The majority of participants were between the ages of 35 and 54 (62.2%), with a range of 18 to over 65. Most participants were White, non-Hispanic (87.8%), with a high school diploma or General Educational Development (GED) (61.9%). The mean number of years on the river was 17.4; however this varied greatly among participants from two months to 45 years. The largest single group of participants (42.5%) held the rank of wheelhouse officer, either captain or pilot, while the remainder of

the sample consisted of engineers, deckhands and mates, and cooks. Wheelhouse officers were the largest group because I was invited to their trainings to solicit participation. Whereas, the number of trainings I was able to attend with deckhands and engineers were limited. In addition, although I train towboat cooks on chronic disease and nutrition, the number of men who cook on the boats is low in number. It is not uncommon to only have one male in attendance at each cooks' training. Wheelhouse officers were on the river longest with an average of 24.6 years on the river.

Table 3

Demographic Characteristics of the Sample (*n*=194)

Characteristic	*n*	%
Age group	*n*=193	
18-24 years	9	4.7
25-34 years	37	19.2
35-44 years	58	30.1
45-54 years	62	32.1
55-64 years	24	12.4
65+ years	3	1.6
Race/ethnicity	*n*=188	
White, non-Hispanic (includes Middle Eastern)	165	87.8
Black, non-Hispanic	10	5.3
Hispanic or Latino/a	3	1.6
Asian or Pacific Islander	0	0.0
American Indian, Alaskan Native, or Native Hawaiian	3	1.6
Biracial or Multiracial	2	1.1
Other	5	2.7
Education	*n*=113	
Less than high school	3	2.7
High school/GED	70	61.9
Some college	33	29.2
College degree (Associates, Bachelors, Masters)	7	6.2

Table 3 continued

Occupation	*n*=193	
Wheelhouse officer	82	42.5
Engineer	38	19.7
Deckhand/Mate	48	24.9
Cook	17	8.8
Other	8	4.1
Years on the River	*n*=193	
0-5 years	33	17.1
6-10 years	37	19.2
11-15 years	32	16.5
16-20 years	19	9.9
21-25 years	24	12.4
26-30 years	10	5.2
31-35 years	18	9.3
35+ years	20	10.4

Instrument Reliability

Cronbach's coefficient alpha was used to assess the internal consistency of the Health, Nutrition & Physical Activity Assessment Instrument and subscales. As seen in Table 4, the reliability estimates ranged from .484 for the Perceptions about Exercising-Barriers subscale to .941 for Perceptions about Eating Healthy-Benefits subscale. The internal consistency for Perceptions about Exercising-Barriers (.484) and Built Environment Influences upon Eating and Physical Activity (.604) are lower than the recommended .70, suggesting the inter-item correlation are low and the items do not group well together. The Perceptions about Exercising-Barriers subscale only has two items, which may account for the weak Cronbach's coefficient alpha. The remaining coefficients indicate acceptable internal consistency within the scales and subscales in the instrument used in the study.

Table 4

Number of Items and Cronbach's Alpha Coefficient for the Health, Nutrition & Physical Activity Assessment Instrument and subscales (n=194)

Instrument Section	Cronbach's Alpha *n*
Section 1: Physical Activity Assessment (4 questions)	.717 *n*=188
Section 2: Perceptions about Exercising-Benefits (9 statements)	.898 *n*=177
Section 2: Perceptions about Exercising-Barriers (2 statements)	.484 *n*=186
Section 3: Perceptions about Eating Healthy-Benefits (6 statements)	. 926 *n*=191
Section 3: Perceptions about Eating Healthy-Barriers (9 statements)	.675 *n*=185
Section 4: Motivation to Meet U.S.C.G. Physical Ability Guidelines (9 statements)	.878 *n*=189
Section 5: Built Environment Influences Upon Eating and Physical Activity (12 statements)	.604 *n*=133
Section 6: Food Frequency–Healthy Practices (18 statements)	.800 *n*=109
Section 6: Food Frequency–Unhealthy Practices (16 statements)	.783 *n*=124

Descriptive Analyses of the Study Variables

Descriptive statistics, including means, medians, modes, percentages, and standard deviations for Stages of Change, description of health by participants, reported diagnosis of chronic disease, prevalence of smoking, BMI, waist circumference, and body fat percent are described in tables 5 to 14.

In terms of Stage of Change, 47.1% of participants are in the action stage indicating they “have made health changes but still have trouble following through”, while 8.9% are in the maintenance stage, indicating they “have had a healthy lifestyle for years”. Nearly 8% are “not interested in making lifestyle changes”. Results are summarized in table 5 and 6.

Table 5

Stage of Change Classification (n=191)

Stage	Statement	Towboat Crew Participants	
		n	%
Pre-contemplation	I’m not interested in making any changes to my lifestyle.	15	7.9
Contemplation	I have been thinking about changing some of my health behaviors.	46	24.1
Preparation	I am planning on making health behavior change within the next 30 days.	23	12.0
Action	I have made some health behavior changes but I still have trouble following through.	90	47.1
Maintenance	I have had a healthy lifestyle for years.	17	8.9

Table 6

Stage of Change Classification by Occupation on the Towboat (n=185)

	Towboat Crew Participants			
	Wheelhouse Officer *n*=82	Engineer *n*=38	Deckhand *n*=48	Cook *n*=17
Pre-contemplation	3 3.8%	5 13.2%	6 12.5%	0 0.0%
Contemplation	19 24.1%	11 28.9%	11 22.9%	3 17.6%
Preparation	8 10.1%	4 10.5%	5 10.4%	5 29.4%
Action	42 51.2%	17 44.7%	20 41.7%	8 47.1%
Maintenance	7 8.9%	1 2.6%	6 12.5%	1 5.9%

All four occupations were very similar in their description of their own health. As seen in table 7, nearly three-quarters of participants described their health as good, and approximately 20% described their health as fair.

Table 7

Description of Health by Occupation on the Towboat (n=185)

	Towboat Crew Participants			
	Wheelhouse Officer *n*=82	Engineer *n*=38	Deckhand *n*=48	Cook *n*=17
Excellent	3 3.7%	1 2.6%	2 4.2%	0 0.0%
Good	58 70.7%	28 73.7%	36 75%	13 76.5%
Fair	18 22.0%	7 18.4%	10 20.8%	3 17.6%
Poor	3 3.7%	2 5.3%	0 0.0%	1 5.9%

In terms of chronic conditions, participants most often reported being diagnosed with high cholesterol and/or high blood pressure. Deckhands reported the fewest diagnoses of chronic conditions, with only 12.5% being diagnosed with high cholesterol and 14.6% being diagnosed with high blood pressure, and no reported diagnoses of heart disease or diabetes. Wheelhouse officers and engineers had similar results with approximately 30% reporting diagnoses of high cholesterol and/or high blood pressure. In addition, wheelhouse officers and engineers were the only participants who reported being diagnosed with heart disease. Diabetes was reported by 23.5% of cooks, 11% of wheelhouse officers, and 5.3% of engineers. Results are summarized in table 8.

Table 8

Diagnosed Chronic Condition by Occupation on the Towboat (n=194)

	Towboat Crew Participants			
	Wheelhouse Officer *n*=82	Engineer *n*=38	Deckhand *n*=48	Cook *n*=17
High Cholesterol	25 30.5%	11 28.9%	6 12.5%	6 35.3%
High Blood Pressure	24 29.3%	12 31.6%	7 14.6%	5 29.4%
Heart Disease	5 6.0%	3 7.9%	0 0.0%	0 0.0%
Diabetes	9 11.0%	2 5.3%	0 0.0%	4 23.5%

As seen in table 9, cooks and deckhands reported the highest prevalence of smoking among the occupations with 35.3% and 33.3% respectively. Wheelhouse officers followed closely behind with 25.6% reported smoking. Only

15.8% of engineers reported that they were smokers. Conversely, deckhands had the highest percentage of smokers who were trying to quit at 14.6%, followed by engineers at 10.5%, and 7.3% of wheelhouse officers. No cooks reported that they are trying to quit smoking.

Table 9

Prevalence of Smoking by Occupation on the Towboat

		Towboat Crew Participants			
		Wheelhouse Officer	Engineer	Deckhand	Cook
		n=82	*n*=38	*n*=48	*n*=17
1. Do you smoke?	Yes	21 25.6%	6 15.8%	16 33.3%	6 35.3%
	No	55 67.1%	28 73.7%	25 52.1%	11 64.7%
	Yes, but trying to quit.	6 7.3%	4 10.5%	7 14.6%	0 0.0%
		n=54	*n*=16	*n*=21	*n*=12
2. Have you smoked at least 100 cigarettes in your lifetime?	Yes	35 64.8%	8 21.1%	17 35.4%	9 75%
	No	19 35.2%	8 21.1%	4 8.3%	3 25%

The majority of participants (68.5%) were obese, with 9% of the participants exceeding the USCG Merchant Mariner guideline of a BMI less than 40. The mean BMI for all participants was categorized as obese with a BMI of 32.2. Only 12 (6.7%) of the 178 were categorized as having a normal BMI, and 50 (28%) were categorized as overweight. In terms of occupation, cooks had the highest percentage of obesity with 82.4% being classified as obese. Engineers

followed closely behind with 77.8% of participants classified as obese, then wheelhouse officers (65.4%) and deckhands (61.7%). The percentage of participants in each BMI category is presented in Table 10.

Table 10

Body Mass Index (kg/m^2) Classification for Towboat Crew Participants (n=178)

		Towboat Crew Participants *n* (Percent)			
	Principal BMI cut-off points	Wheelhouse Officer *n*=78	Engineer *n*=36	Deckhand *n*=47	Cook *n*=17
Underweight	<18.50	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Normal Range	18.50 – 24.99	5 (6.4%)	1 (2.6%)	6 (12.8%)	0 (0.0%)
Overweight	25.00 – 29.99	22 (28.2%)	7 (19.6)	18 (38.3%)	3 (17.6%)
Obese	≥30.00	51 (65.4%)	28 (77.8)	29 (61.7%)	14 (82.4%)
Obese class I	30.00 – 34.99	28 (35.9%)	15 (41.7)	18 (38.3%)	5 (35.7%)
Obese class II	35.00 – 39.99	13 (16.7%)	9 (25%)	4 (8.5%)	8 (57.1%)
Obese class III	≥40.00*	10 (12.8%)	4 (11.1%)	1(2.1%)	1 (7.14%)

Source: Adapted from Centers for Disease Control (2009)
*USCG BMI cut-off

The mean waist circumference across four occupations is 42.6 inches. As presented in tables 11 and 12, the majority of three of the four occupations had a waist circumference greater than 40 inches. All occupations on the towboat are at greater risk for cardiovascular disease, Type 2 diabetes, and hypertension due to high BMI and waist circumferences over 40 inches.

Table 11

Waist Circumference Risk Classification for Towboat Crew Participants by Occupation (n=142)

	Towboat Crew Participants *n* (percent)	
Inches	≤40	≥40*
Wheelhouse Officer, *n*=63	23 (36.5%)	40 (63.5%)
Engineer, *n*=30	9 (30%)	21 (70%)
Deckhand, *n*=39	20 (51.3%)	19 (48.7%)
Cook, *n*=10	2 (10%)	8 (90%)

*Increased risk for Type II diabetes, hypertension, and CVD.

In the event a trained data collector was not available to measure waist circumference, participants were asked to record their pant waist size. Additionally, some participants who had their waists measured, also reported their pant waist size. The mean difference between measured waist circumference and reported pant waist size was five and one-half inches suggesting pant waist size is not an accurate measurement of waist circumference. Results are presented in table 14.

Table 12

Means, Medians, Modes, and Standard Deviations of Waist Circumference Compared to Reported Pant Waist Size

Study Variable	Mean	Median	Mode	SD
Waist Circumference, *n*=150	42.4	41.5	41.5	6.4
Pant Waist Size, *n*=124	37.1	36.0	36.0	4.5

Body fat percentage was collected only on participants when a data collector was present. Based on age, the youngest men, the 18 to 24 year olds had the lowest mean body fat percentage (19.6%), while the 45 to 54 year olds had the highest body fat percentage with a mean of 32.7%. In terms of occupation on the towboat, deckhands have the lowest mean body fat percent (26.7), followed by wheelhouse officers (30.7), then cooks (32.1) and engineers (33.7). Results are presented in tables 13 and 14.

Table 13

Body Fat Percent of Towboat Crew Participants by Age (n=141)

Age	Minimum	Maximum	Mean	SD
18-24, *n*=6	11.8	30.3	19.6	7.2
25-34, *n*=25	14.5	41.0	27.1	7.3
35-44, *n*=43	16.9	47.2	29.5	6.8
45-54, *n*=48	21.6	46.1	32.7	5.9
55-64, *n*=17	16.2	43.7	32.1	6.2
65 and over, *n*=2	26.2	31.4	28.8	3.7

Table 14

Body Fat Percent of Towboat Crew Participants by Occupation (n=142)

Study Variable	Mean	Median	Mode	SD
Wheelhouse Officer, *n*=61	30.7	30.8	27.0	7.4
Engineer, *n*=36	33.7	32.1	31.2	6.5
Deckhand, *n*=35	26.7	28.8	29.0	7.4
Cook, *n*=10	32.1	32.7	23.4	4.6
Combined occupations, *n*=142	29.9	30.3	31.5	7.2

Findings Related to Research Questions

This section presents the findings of the study organized by research questions. Research questions one through four and seven are answered using descriptive statistics. Analysis of Covariance (ANCOVA) was used to answer research question five exploring differences between eating practices and body composition of towboat crew, controlling for age, and investigating the association between occupation and body composition of towboat crew, controlling for age. Analysis of Variance (ANOVA) was used to answer research question six identifying if differences exist in healthy practices, including healthy eating and regular physical activity, based on occupation on the towboat. Pearson correlation was used to explore whether or not there was an association between the built environment and healthy eating practices and regular physical activity to answer research question eight.

Research Question 1

What are the perceived benefits among towboat crew regarding healthy eating practices and regular physical activity?

Responses and percentages for statements regarding healthy eating and physical activity are presented in table 15. Participants responded favorably to all six statements in regards to healthy eating and wellbeing. The highest four strongly agreeing or agreeing were eating healthy will help lower my cholesterol (95.4%), eating healthy will help control my weight (93.3%), eating healthy will help me lower my blood pressure (88.6%), and eating healthy will make me feel better (87%). Results suggest participants are aware of the connection between healthy eating behaviors and overall health and wellbeing.

Table 15

Perceived Benefits of Towboat Crew Regarding Healthy Eating Practices

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
28	Eating healthy will make me feel better. *n*=193	66 34.2%	102 52.8%	21 10.9%	3 1.6%	1 0.5%
29	Eating healthy will help me live longer. *n*=193	67 34.7%	92 47.7%	29 15.0%	5 2.6%	0 0.0%
30	Eating healthy will make me more alert. *n*=192	53 27.6%	92 47.9%	38 19.8%	9 4.7%	0 0.0%

Table 15 continued

31	Eating healthy will help lower my cholesterol. *n*=193	69 35.8%	115 59.6%	9 4.7%	0 0.0%	0 0.0%
32	Eating healthy will help me control my weight. *n*=193	72 37.3%	108 56.0%	12 6.2%	1 0.5%	0 0.0%
33	Eating healthy will help me lower my blood pressure. *n*=192	65 33.9%	105 54.7%	22 11.5%	0 0.0%	0 0.0%

As presented in Table 16, participants responded favorably to all nine statements in regards to exercise and wellbeing. The top five statements were “exercise will help me feel better” (97.4%), “exercise will help me be more fit” (97.4%), “exercising is good for my blood pressure” (96.4%), “exercise will help me lose weight” (95.7%), and “exercise will increase my energy level” (95.3%). Results suggest participants are aware of the connection between exercise, or physical activity, and overall health and wellbeing as well as healthy eating behaviors.

Table 16

Perceived Benefits of Towboat Crew Regarding Regular Physical Activity

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5	Exercising is good for my blood pressure. *n*=191	117 61.3%	67 35.1%	6 3.1%	1 0.5%	0 0.0%
6	Exercising will decrease my cholesterol. *n*=190	104 54.7%	69 36.3%	17 8.9%	0 0.0%	0 0.0%
7	Exercising will inspire crew working with me. *n*=185	39 21.1%	48 25.9%	71 38.4%	23 12.4%	4 2.2%
8	Exercise will increase my energy level. *n*=191	102 53.4%	80 41.9%	7 3.7%	2 1.0%	0 0.0%
9	Exercise will help me feel better. *n*=191	111 58.1%	75 39.3%	3 1.6%	2 1.0%	0 0.0%
10	Exercise will reduce my stress level. *n*=190	90 47.4%	75 39.5%	21 11.1%	4 2.1%	0 0.0%
11	Exercise will help me lose weight. *n*=188	111 59.0%	69 36.7%	5 2.7%	3 1.6%	0 0.0%
13	Exercise will help me be more fit. *n*=188	99 52.7%	84 44.7%	5 2.7%	0 0.0%	0 0.0%
14	Exercise will help me live longer. *n*=189	85 45.0%	71 37.6%	30 15.9%	2 1.1%	1 0.5%

Research Question 2

What are the perceived barriers among towboat crew regarding healthy eating practices and regular physical activity?

Responses and percentages for statements regarding barriers to healthy eating practices and physical activity are presented in tables 17 and 18. Of the nine statements regarding barriers to healthy eating practices on the boat, one received an overwhelming response. Over 70% of participants strongly agreed or agreed to the statement “food is accessible all of the time, so it is easy to over eat.” Over half of the participants strongly agreed or agreed that it’s hard not to take seconds when there is such good food available (53.6%), and 49.8% strongly agreed or agreed that the cooks would have to be re-trained to cook healthy foods. Conversely, 48.4% of participants strongly disagreed or disagreed that preparing fresh veggies as a snack would be a waste of time and money since they wouldn’t get eaten, and 48% also strongly disagreed or disagreed that healthy food doesn’t taste good. This suggests participants are not opposed to healthy food options. Furthermore, 44.6% strongly disagreed or disagreed that there is limited space to store fresh fruits and vegetables. Results suggest constant access to food and appealing food make it difficult to eat healthy on the boat. However, participants do like the taste of healthy foods and they would eat fresh vegetables as a snack if available. Participants also perceive that cooks would need to be re-trained to learn how to cook healthy foods.

Table 17

Perceived Barriers of Towboat Crew Regarding Healthy Eating Practices

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
16	Healthy food doesn't taste good. *n*=194	9 4.6%	27 13.9%	65 33.5%	76 39.2%	17 8.8%
17	Healthy food costs too much. *n*=189	10 5.3%	42 22.2%	75 39.7%	50 26.5%	12 6.3%
18	The cooks would have to be re-trained to cook healthy foods. *n*=191	32 16.8%	63 33.0%	51 26.7%	39 20.4%	6 3.1%
21	It's hard not to take seconds when there is such good food available. *n*=194	16 8.2%	88 45.4%	52 26.8%	35 18.0%	3 1.5%
22	Food is accessible all of the time, so it is easy to over eat. *n*=194	39 20.1%	98 50.5%	40 20.6%	16 8.2%	1 0.5%
23	All of the good desserts available make it hard to eat healthy. *n*=194	18 9.3%	59 30.4%	59 30.4%	48 24.7%	10 5.2%
24	The crew doesn't want a healthy diet. *n*=193	8 4.1%	55 28.5%	82 42.5%	46 23.8%	2 1.0%
25	There is limited space to store fresh fruits and vegetables. *n*=193	17 8.8%	47 24.4%	43 22.3%	71 36.8%	15 7.8%
26	Preparing fresh veggies would be a waste of time and money since they wouldn't get eaten. *n*=194	5 2.6%	42 21.6%	53 27.3%	78 40.2%	16 8.2%

The majority of participants strongly agreed or agreed that it is difficult to make time to exercise (63%). However, only 12.3% strongly agreed or agreed that they are worried they will get injured if they exercise. Of the two statements, lack of time or desire to make time to exercise appears to be a leading barrier of regular physical activity.

Table 18

Perceived Barriers of Towboat Crew Regarding Regular Physical Activity

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
12	I worry that I will get injured if I exercise. *n*=187	10 5.3%	13 7.0%	32 17.1%	98 52.4%	34 18.2%
15	It is hard to make time to exercise. *n*=189	40 21.2%	79 41.8%	34 18.0%	26 13.8%	10 5.3%

Research Question 3

What would motivate towboat crew to adopt healthier practices with regards to healthy eating practices and regular physical activity?

The greatest motivator to adopt healthy eating practices on the towboat is the possibility of losing one's job. Just over 70% of participants strongly agreed or agreed that they would change their diet if they had to, to keep their job. Family encouragement was also a motivator, but, for only 29.9 percent of

participants. Only 21.1% of participants agreed or strongly agreed that crew encouragement would motivate them to eat healthy while on the tow. Findings suggest family and crew encouragement are not enough to facilitate healthy eating behavior changes; however, the possibility of job loss may. Results are presented in tables 19 and 20.

Table 19

Motivation to Adopt Healthy Eating Practices on the Towboat

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
34	I would eat healthier if my family would encourage me to. *n*=194	8 4.1%	50 25.8%	89 45.9%	41 21.1%	6 3.1%
35	I would eat healthier more if my crew would encourage me to. *n*=194	6 3.1%	35 18.0%	99 51.0%	49 25.3%	5 2.6%
38	I would reduce fat in my diet to reduce my cholesterol, if I had to, to keep my job. *n*=190	50 26.3%	84 44.2%	40 21.1%	11 5.8%	5 2.6%

The majority of participants were neutral when asked what would motivate them to engage in regular physical activity. None the less, of the three options, other crew members exercising while on the boat was the strongest motivation with 31.1% strongly agreeing or agreeing. Family encouragement followed

closely with 30.9% strongly agreeing or agreeing. Only 22.7% of participants strongly agreed or agreed that crew encouragement would motivate them to engage in regular physical activity. Results indicate external motivators may not be sufficient to encourage participants to engage in regular physical activity.

Table 20

Motivation to Engage in Regular Physical Activity on the Towboat

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
36	I would exercise more if my family would encourage me to. *n*=194	6 3.1%	54 27.8%	91 46.9%	38 19.6%	5 2.6%
37	I would exercise more if my crew would encourage me to. *n*=194	7 3.6%	37 19.1%	97 50.0%	49 25.3%	4 2.1%
42	I would be more likely to exercise if other crew members on the boat would exercise. *n*=190	21 11.1%	38 20.0%	83 43.7%	40 21.1%	8 4.2%

Research Question 4

What would motivate towboat crew to meet U.S.C.G. physical ability and BMI guidelines?

As presented in table 21, the strongest motivation to meet U.S.C.G. physical ability and BMI guidelines was the possibility of losing one's job.

Seventy-one point seven percent of participants strongly agreed or agreed that they would lose weight if they had to, to keep their job. In addition, over half (57.6%) of participants strongly agreed or agreed that company incentives would motivate them to meet guidelines, while only 31.9% indicated competition would motivate them to meet guidelines. Findings suggest external motivators such as company incentives and/or competition may not be enough to facilitate healthy behavior changes, however, the possibility of job loss may.

Table 21

Motivation to Meet U.S.C.G. Physical Ability and BMI Guidelines

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
39	I would lose weight if I had to, to keep my job. *n*=191	51 26.7%	86 45.0%	40 20.9%	9 4.7%	5 2.6%
40	If there were company incentives, I would eat healthier and exercise more. *n*=191	46 24.1%	64 33.5%	64 33.5%	11 5.8%	6 3.1%
41	If there was a friendly competition among tow boats on who has the healthiest crew, myself and my crew would eat healthier and exercise more to win. *n*=191	23 12.0%	38 19.9%	92 48.2%	29 15.2%	9 4.7%

Research Question 5

Do differences exist between eating practices and body composition (BMI and waist circumference) of towboat crew, controlling for age?

A total of 180 participants completed the food frequency questionnaire (FFQ) portion of the survey. The FFQ had the options “usually or always”, “often”, “sometimes”, “rarely or never”, and “not applicable”. Items were coded four through zero respectively, and “not applicable” was coded zero and omitted from analysis. As presented in table 22, the mean scores for the wheelhouse officers (2.05) and the engineers (2.01) were very similar and suggest they eat healthy “sometimes”. Deckhands (1.89) and cooks (1.87) also had similar mean scores suggesting they eat healthy “sometimes” as well. The means across all occupations appear comparable. However, to statistically determine if there are significant differences, an ANCOVA was run.

Table 22

Healthy Eating: Descriptive Statistics by Occupation on the Towboat (n=180)

Study Variable	Mean	SD
Wheelhouse Officer, *n*=82	2.05	0.44
Engineer, *n*=38	2.01	0.48
Deckhand, *n*=47	1.89	.35
Cook, *n*=13	1.86	.32

The ANCOVA revealed no significant differences in healthy eating practices across the four occupational groups after controlling for age, $F(3,175) = 1.15$, $p = .332$, *partial* $\eta^2 = .019$, power = .305. Results, as presented in table 23, indicate healthy eating practices are similar among all occupations on the towboat. However, this could be due to low statistical power. Statistical power could be increased by a larger sample size.

Table 23

ANCOVA Comparing Healthy Eating Across Occupational Groups Controlling for Age

	Type III Sum of Sq	df	Mean Sq	F Ratio	Sig	*Partial* η^2	Power
Intercept	21.74	1	21.74	1056.93	.000	.858	1.0
Age	.178	1	.178	8.673	.004	.047	.834
Occupation	.066	3	.022	1.077	.360	.018	.288
Error	3.60	175	.021				
Total	357.49	180					

The mean BMI of each occupation, with the exception of deckhands, categorizes the participants as obese. Cooks have the highest BMI, followed by engineers and wheelhouse officers. Although deckhands are categorized as overweight, the mean BMI is 29.9, just under the obese category beginning at 30. Results are summarized in table 24.

Table 24

BMI: Descriptive Statistics by Occupation on the Towboat (n=173)

Study Variable	Mean	SD
Wheelhouse Officer, *n*=78	32.6	6.35
Engineer, *n*=36	33.7	6.0
Deckhand, *n*=46	29.9	4.43
Cook, *n*=13	34.3	5.07

As presented in table 25, the ANCOVA revealed differences in BMI across the four occupational groups, after controlling for age, that approached significance, $F(3,168) = 2.12$, $p = .099$, *partial* $\eta^2 = .037$, power = .535. Because the omnibus test approached significance, and because power was only 54%, post-hoc tests were used to explore possible differences among occupations. Least Significant Difference (LSD) post-hoc tests indicated a significant difference between deckhands and engineers ($p = .018$) with the former group having a lower BMI. Thus, the results suggest engineers have a BMI that is significantly higher than deckhands, and occupational differences account for 3.7% of the variance in BMI. However, the results must be interpreted with caution since omnibus *p*-value was not less than .05.

Table 25

ANCOVA Comparing BMI Across Occupational Groups Controlling for Age

	Type III Sum of Sq	df	Mean Sq	F Ratio	Sig	*Partial* η^2	Power
Intercept	11528.134	1	11528.13	353.313	.000	.678	1.0
Age	80.601	1	80.601	2.47	.118	.014	.346
Occupation	207.868	3	69.289	2.12	.099	.037	.535
Error	5481.616	168	32.629				
Total	185926.440	173					

The mean waist circumference across all four occupations is 42.6 inches. All occupations except deckhands had waist circumferences greater than 40 inches. Deckhands have a mean waist circumference of 39.6, narrowly missing the 40 inch mark, as presented in table 26. In men, a waist circumference greater than 40 inches increases their risk for Type II diabetes, hypertension, and cardiovascular disease. An ANCOVA was run to determine if there were significant differences among the means.

Table 26

Waist Circumference in Inches: Descriptive Statistics by Occupation on the Towboat (n=141)

Study Variable	Mean	SD
Wheelhouse Officer, *n*=63	42.7	6.32
Engineer, *n*=30	44.3	6.98
Deckhand, *n*=38	39.6	4.79
Cook, *n*=10	44.2	5.96

The ANCOVA revealed differences in waist circumference across the four occupational groups, after controlling for age, that approached significance, $F(3,136) = 2.44$, $p = .067$, *partial* $\eta^2 = .051$, power = .597. Because the omnibus test approached significance, and because power was 60%, post-hoc tests were used to explore possible differences among occupations. LSD post-hoc tests indicated a significant difference between deckhands and engineers ($p = .009$) with the former group having a lower waist circumference. Results indicate engineers have a waist circumference that is significantly higher than deckhands, and occupational differences account for 5.1% of the variance in waist circumference. However, interpret this statistic with caution since omnibus *p*-value was not less than .05. Results are presented in table 27.

Table 27

ANCOVA Comparing Waist Circumference Across Occupational Groups Controlling for Age

	Type III Sum of Sq	df	Mean Sq	F Ratio	Sig	*Partial* η^2	Power
Intercept	16359.591	1	16359.591	447.773	.000	.767	1.0
Age	91.385	1	91.385	2.501	.116	.018	.349
Occupation	267.270	3	89.090	2.438	.067	.051	.597
Error	4968.824	136	36.535				
Total	257604.728	141					

Research Question 6

Do differences exist in regular physical activity based on occupation on the towboat (cook, deckhand, engineer, pilot, captain)?

Participants were asked how many days per week they engaged in moderate to vigorous intensity exercise and strengthening exercises while on the boat. Table 28 presents means and standard deviations which indicate deckhands reported the most regular exercise per week with an average of 3.46 days per week. Engineers reported 2.66 days per week, followed by wheelhouse officers reporting 2.03 days per week. Cooks only reported an average of 1.88 days per week of exercise. An ANOVA was run to determine if significant differences existed between occupations on the towboat.

Table 28

Regular Physical Activity: Descriptive Statistics by Occupation on the Towboat (n=141)

Study Variable	Mean	SD
Wheelhouse Officer, *n*=80	2.03	1.72
Engineer, *n*=37	2.66	1.75
Deckhand, *n*=48	3.46	2.09
Cook, *n*=13	1.88	2.38

The ANOVA matrix as seen in table 29 revealed significant differences in physical activity between occupational groups, $F(3,174) = 6.38$, $p < .001$, *partial* $\eta^2 = .099$, power = .966. LSD post-hoc tests indicated significant differences between deckhands and wheelhouse officers ($p < .001$), cooks ($p < .01$), and a difference that approached significance with engineers ($p = .055$). The difference between engineers and wheelhouse officers also approached significance ($p = .09$) with engineers reporting physical activity more often. Thus, the results suggest deckhands exercise more regularly than all other occupations, with occupational differences accounting for 9.9% of the variance in physical activity.

Table 29

ANOVA Comparing Regular Physical Activity Across Occupational Groups

	Type III Sum of Sq	df	Mean Sq	F Ratio	Sig	*Partial* η^2	Power
Intercept	732.813	1	732.813	206.633	.000	.543	1.0
Occupation	67.827	3	22.609	6.375	.000	.099	.966
Error	617.082	174	3.546				
Total	1827.611	177					

Research Question 7

To what extent does towboat crew meet USDHHS 2008 Physical Activity Guidelines?

USDHHS 2008 Physical Activity Guidelines suggest adults aged 18 to 64 engage in moderate physical activity for 150 minutes per week or 75 minutes of vigorous activity per week, and engage in muscle-strengthening exercises twice a week (Department of Health and Human Services, 2008). The mean number of days participants reported engaging in moderate physical activity for 30 minutes was three, equating to 90 minutes per week. The mean number of days participants reported engaging in vigorous intensity exercise was two point seven, equating to 54 minutes per week of physical activity. Participants are not meeting guidelines for aerobic activity. Participants did, however, meet guidelines for muscle-strengthening exercises. Results are summarized in table 30.

Table 30

Mean and Standard Deviations of Number of Days Towboat Crew Engage in Physical Activity

Item	Statement	Mean	Standard Deviation
1	In a typical **week** on the boat, how many times do you exercise for at least 20 minutes that makes you sweat and breathe hard? *n*=189	2.7	2.4
3	In a typical **week** on the boat, how many times do you do muscle-strengthening activities? *n*=190	2.0	2.2
4	In a typical **week** on the boat, how many times do you walk for at least 30 minutes at a time? *n*=190	3.0	2.6

Research Question 8

To what extent does the built environment influence healthy eating practices and regular physical activity of towboat crew while on the boat?

Results are presented in tables 31 through 34. Participants were asked if healthy snacks like fresh fruit and vegetables were available most times on the boat. The majority (68.5%) indicated that there are fresh fruits and vegetables available. Only 9.6% disagreed with the statement, suggesting healthy options are offered.

Table 31

Perceptions of Towboat Crew Regarding Healthy Eating Practices related to the Built Environment

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
52	The good southern cooking on the boat makes it easy for me to over eat. *n*=191	19 9.9%	71 37.2%	58 30.4%	39 20.4%	4 2.1%
53	There are healthy snacks like fresh fruit and vegetables available most times. *n*=187	28 15.0%	100 53.5%	41 21.9%	15 8.0%	3 1.6%
54	Snack foods like Little Debbie snack cakes are hard to resist. *n*=189	12 6.3%	50 26.3%	59 31.1%	60 31.6%	9 4.7%

In regards to the build environment, 60% of participants strongly agreed or agreed they can walk on the tow to get exercise. Another 23.7% were neutral. However, only 18.8% of participants agreed that bringing their own exercise equipment made it easier to exercise on the boat, while 38.4% disagreed with the statement. Results are shown in table 32.

Table 32

Perceptions of Towboat Crew Regarding Regular Physical Activity related to the Built Environment

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
44	I can usually walk on the tow to get exercise. *n*=190	20 10.5%	94 49.5%	45 23.7%	23 12.1%	8 4.2%
50	Bringing my own exercise equipment makes it easier to exercise on the boat. *n*=138	10 7.2%	16 11.6%	59 42.8%	41 29.7%	12 8.7%

Perceived barriers of participants regarding regular physical activity related to the built environment results are presented in table 33. Most participants were either neutral (42.8%) or disagreed (38.4%) with the statement “bringing my own exercise equipment makes it easier to exercise on the boat.” In terms of the built environment, the top three barriers identified to regular physical activity are “there is limited space on the boat to exercise” (68.6%), “it’s harder to exercise if there is no equipment on the boat” (61.2%), and “it’s hard to exercise on the boat because of my shifts” (41.9%). Conversely, participants strongly disagreed or disagreed that noise made it hard for them to exercise (70.2%) or the lack of privacy made it hard for them to exercise (56%).

Table 33

Perceived Barriers of Towboat Crew Regarding Regular Physical Activity related to the Built Environment

		Level of Agreement/Disagreement				
Item	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
43	There is limited space on the boat to exercise. *n*=191	46 24.1%	85 44.5%	25 13.1%	34 17.5%	1 0.5%
45	The weather often prevents me from walking on the tow. *n*=188	12 6.4%	51 27.1%	64 34.0%	51 27.1%	10 5.3%
46	The most exercise I get is going from the wheelhouse down the stairs to the galley to eat and back up. *n*=188	13 6.9%	29 15.4%	37 19.7%	67 35.6%	42 22.3%
47	It's hard to exercise on the boat because of my shifts. *n*=191	22 11.5%	58 30.4%	50 26.2%	50 26.2%	11 5.8%
48	It's harder to exercise if there is no equipment (treadmill, a stationary bicycle, and/or weights, etc.) on the boat. *n*=191	43 22.5%	74 38.7%	39 20.4%	28 14.7%	7 3.7%
49	The noise on the boat makes it hard for me to exercise. *n*=191	1 0.5%	8 4.2%	48 25.1%	105 55.0%	29 15.2%
51	The lack of privacy on the boat makes it hard for me to exercise. *n*=191	4 2.1%	22 11.5%	58 30.4%	88 46.1%	19 9.9%

A Pearson's Correlation was run to detect relationships between the built environment and regular physical activity and healthy eating behaviors. To accomplish this, mean scores were run for physical activity, exercise environment, eating environment, and healthy eating behaviors. All mean scores, with the exception of healthy eating behaviors, followed a normal distribution. The mean score of healthy eating behaviors was positively skewed, therefore, a square root transformation was applied to normalize the data.

The correlation matrix, as seen in table 34, revealed very strong relationships between the built environment and regular physical activity and healthy eating behaviors. The exercise environment is positively correlated with regular physical activity, $r(182) = .329$, $p < .001$, and positive perceptions of the eating environment on the boat, $r(185) = .377$, $p < .001$. The eating environment is positively correlated with healthy eating behaviors on the boat, $r(185) = .154$, $p < .05$. Regular physical activity is significantly associated with healthy eating behaviors, $r(185) = .242$, $p < .01$. Findings suggest participants are more likely to exercise in environments conducive to regular physical activity. Likewise, participants are more likely to engage in healthy eating practices when the eating environment is promotes healthy eating. Also, participants who regularly exercise are also more likely to engage in healthy eating practices.

Table 34

Correlations between the Built Environment and Regular Physical Activity and Healthy Eating Behaviors

		Regular Physical Activity	Exercise Environment	Eating Environment	Healthy Eating Square Root
Regular Physical Activity	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	187			
Exercise Environment	Pearson Correlation	.329**	1		
	Sig. (2-tailed)	.000			
	N	184	187		
Eating Environment	Pearson Correlation	.140	.377**	1	
	Sig. (2-tailed)	.057	.000		
	N	184	184	187	
Healthy Eating Square Root	Pearson Correlation	.242**	.086	.154	1
	Sig. (2-tailed)	.001	.241	.035	
	N	187	187	187	190

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

CHAPTER 5

CONCLUSIONS, DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

This chapter presents the discussion, conclusions, implications, and recommendations based on the results. The first section provides a summary of the study. Conclusions are next followed by a discussion of the key findings including their strengths, limitations, and consistency with previous research. In addition, relevant interpretations and possible explanations are presented. Implications for health promotion practice are offered in the fourth section, and recommendations for future research are presented in the final section.

Summary of the Study

The alarming increase in the rate of obesity among U.S. men has become a major public health concern (Centers for Disease Control, 2010b). Those who live and work in obesogenic environments, or environments that promote high energy intake and sedentary behavior, are at greater risk of obesity (Lake & Townshend, 2006). Few studies have been conducted exploring the health status and health risks among men who work in occupations with obesogenic environments. This study investigates the health and nutrition status of crew men who work on towboats in the inland barge transportation industry. Given the large number of men (over 30,000) that are employed in this environment, it is prudent that the health behaviors of this population be evaluated.

A non-experimental, cross-sectional design was utilized to explore the associations among eating practices and physical activity in relation to the constrictive work environment, the towboat, body composition measurements, and personal factors. The purpose of the study is to better understand how life on the river affects crews' health status, their perceived benefits and barriers to good health, specifically eating practices and physical activity, as well as motivation to meet U.S.C.G. physical and BMI guidelines.

Between March 2011 and February 2012, 194 men towboat crew men from six different companies were surveyed to assess current practices, perceptions, and motivations as well as gather body composition data. The Nutrition, Health & Physical Activity Assessment Instrument consisted of seven sections and a total of 109 items. Section one assessed current physical activity level. Sections two through five assessed perceptions regarding eating healthy and exercising on the tow, how the built environment influences eating behaviors and physical activity, and motivation to meet U.S.C.G. physical ability guidelines. Kristal's Fat-Related Diet Habits Questionnaire was adapted to assess nutritional intake on the towboat (section six). Finally, demographics (section seven) were collected to provide a snapshot of social and physical aspects of the environment, and diversity and health status of the crew. The study was used to answer the following research questions:

1. What are the perceived benefits among towboat crew regarding healthy eating practices and regular physical activity?

2. What are the perceived barriers among towboat crew regarding healthy eating practices and regular physical activity?
3. What would motivate towboat crew to adopt healthier practices with regards to healthy eating practices and regular physical activity?
4. What would motivate towboat crew to meet U.S.C.G. physical ability and BMI guidelines?
5. Do differences exist between eating practices and body composition (BMI and waist circumference) of towboat crew, controlling for age?
6. Do differences exist in regular physical activity based on occupation on the towboat (cook, deckhand, engineer, pilot, captain)?
7. To what extent does towboat crew meet USDHHS 2008 Physical Activity Guidelines?
8. To what extent does the built environment influence healthy eating practices and regular physical activity of towboat crew while on the boat?

Data was analyzed using the Statistical Package for Social Sciences (SPSS), version 18.0 (SPSS Inc., Chicago, IL). Findings were interpreted as significant at a level of .05. Cronbach's alpha coefficients and Pearson's correlations were calculated for the Nutrition, Health and Physical Assessment instrument to evaluate the internal consistency reliability and validity of the instrument and its subscales.

Descriptive statistics including percentages were calculated to describe the study sample. The body composition variables including BMI, waist circumference, and percent body fat, were analyzed by occupation on the boat. The distribution of each variable was appropriately evaluated based on the measurement level (i.e., nominal, ordinal, or interval). Descriptive statistics utilizing measures of central tendency were used to answer research questions one through four and seven. Analysis of Covariance (ANCOVA) was used to answer research question five exploring differences between eating practices and body composition, and occupation and body composition of towboat crew, controlling for age. Analysis of Variance (ANOVA) was used to answer research question six, ascertaining whether differences exist in regular physical activity, based on occupation on the towboat. Pearson correlation was used to answer research question number eight, identifying whether or not there is an association between the built environment, particularly barriers, and eating practices and regular physical activity.

Conclusions

Towboats are not designed to promote physical activity among its crew outside of their job duties. Boats are designed to push upwards of 40,000 tons of cargo up and down the river as efficiently as possible. Additionally, the industry is well known for its tradition of “great southern cooking” on the boat, which does not usually translate to healthy, low-fat, nutrient-dense meals. The combination of living on a towboat for extended lengths of time, having homemade meals and

snack foods accessible at any given time, and an environment that provides limited opportunities for physical activity outside one's work tasks, can wreak havoc on one's health especially given that the crew live and work 14-30+ days continuously on the boat. The CDC refers to environments such as this as "obesogenic", meaning the environment promotes increased eating, unhealthful eating, and physical inactivity (Centers for Disease Control, 2011b).

Based on the findings of this study, the following conclusions were ascertained:

1. The primary motivation identified that would encourage crew men to engage in healthy eating practices and/or regular physical activity, is the possibility of job loss.
2. Towboat crew men are at increased risk of chronic disease due to anthropometic measurements, lack of physical activity, and unhealthy behaviors.
3. Even deckhands, the "healthiest" and youngest, are at risk of chronic disease due to anthropometic measurements, lack of physical activity, and unhealthy behaviors.
4. Cooks are the "unhealthiest" crew member on the boat because of diagnosis of chronic disease, anthropometic measurements, and unhealthy behaviors.
5. Shift work (six hours on, six hours off) does not appear to significantly impact BMI, contrary to the literature.

6. Wheelhouse officers were expected to have the most risk factors and be the “unhealthiest” because of their sedentary job. This was not the case.
7. An environment that is conducive to physical activity and healthy eating is significantly associated with regular exercise and healthy eating. In addition, regular physical activity is significantly associated with healthy eating.

Discussion

Upon completion of this research, I found the results to be both expected and surprising. Discussion includes risk factors for chronic disease among study participants, reported diagnoses of chronic disease, perceived benefits and barriers of healthy eating and physical activity, how the built environment affects eating practices and physical activity, and motivations to adopt healthier practices and meet USCG regulations.

Risk Factors for Chronic Disease

Obesity and BMI

It has been well established that obesity is a modifiable risk factor for a myriad of chronic diseases, including cardiovascular disease (mainly heart and stroke), type II diabetes, some cancers, and musculoskeletal disorders (WHO, 2011). An estimated 72.3% of American men are overweight or obese (Centers for Disease Control, 2010b; Weight-control Information Network, 2010). Findings

from this study are even higher with 92.9% of participants being overweight (28.6%) or obese (64.3%). In addition, Dr. Sallie Scovill, Assistant Professor at University of Wisconsin Stevens Point, conducted a study on health characteristics of 388 inland waterway Merchant Marine male wheelhouse officers. In her study, she found 89.4% of the men to be overweight or obese further confirming the results found in this study (Scovill, 2012).

The United States Coast Guard (USCG) currently requires a BMI of 40 or lower, to maintain Merchant Mariner credentials, a necessity for wheelhouse officers. Should a mariner's BMI exceed 40, the mariner must pass physical ability tests. This study found 12.8% of wheelhouse officers exceed requirements. Similarly, Scovill's study found 10.3% of wheelhouse officers exceed requirements (Scovill, 2012). At this time, credentials are only renewed every five years, and health-wise a lot can happen in five years.

Waist Circumference

Realizing BMI is an important measure of health risk, it does not, however, take into account muscle mass or where people carry fat. Men with a waist circumference of 40 inches or greater, suggesting central adiposity, are at greater risk of chronic disease. The mean waist circumference in this study was 42.4 inches with a median of 41.5 and a mode of 41.5. This suggests that the high BMIs are not related to high muscle mass, but are related to abdominal fatness. Abdominal fatness significantly increases risk of cardiovascular disease (Boyle & Long, 2010; National Heart Lung and Blood Institute, 1998).

Although no significant differences in body composition measurements by occupation on the boat, the ANCOVA did reveal differences that approached significance ($p < .10$). In particular, engineers have a significantly higher BMI and waist circumference than deckhands. Deckhands have a much more physical job than the engineers, which may account for weight differences. And, as cited previously, no significant differences in healthy eating practices were identified in the two groups, again suggesting that the difference lies in the physicality of the job.

Body Fat Percent

To date, there are no published body fat percentage guidelines for healthy adults. Therefore, results have been compared to the U.S. Army's Standards of Medical Fitness. The "maximum allowable body fat percentage to join" the U.S. Army for men aged 17-27 is 26%, 28-39 is 28% and age 40 and over is 30%. Once men join the Army they are expected to maintain their body fat percent four percentage points below the "allowable body fat percentage to join" standards (Department of the Army, 2008).

Based on age, the mean body fat percent of 18 to 24 year old and the 25 to 34 year old study participants meet the Army's allowable body fat percentage to join. It must be noted that the sample sizes for 18 to 24 year old and 25 to 34 year old are small (6 and 25 respectively) and may not accurately reflect the population. Moreover, standard deviations for most age groups are large indicating a wide range of variability among body fat percentages within age

groups. The 45 to 54 year old and 55 to 64 year old age group participants mean body fat percent is too high to meet Army standards.

In terms of occupation on the towboat, deckhands have the lowest mean body fat percent (26.7), followed by wheelhouse officers (30.7), then cooks (32.1) and engineers (33.7). It is not surprising that deckhands have the lowest percent body fat as they tend to be the younger men on the boat and they report more physical activity.

Physical Activity

Physical activity is one of the modifiable risk factors for chronic disease and is also one of the most critical. Regular physical activity can prevent the development of coronary artery disease (CAD), and reduce risk of Type II diabetes, osteoporosis, hypertension, depression, and some cancers (Thompson, et al., 2003).

Deckhands reported the most physical activity per week (3.46 days/week). This was significantly more exercise than wheelhouse officers (2.03 days/week), engineers (2.66 days/week), and cooks (1.88 days/week). As reported, deckhands' jobs are more physical than any other occupation on the boat, and deckhands on average are younger than other occupations on the boat. In this industry, one starts out as a deckhand and works his or her way up to captain. And, since deckhands do have a physical job, it is more conducive to younger, stronger men. That being said, it is unclear if the exercise reported is part of the job, or leisure physical activity. The survey questions could be interpreted either way, and would need to be revised if used again.

This study found towboat crew men do not get the recommended amount of exercise per week for aerobic activity. USDHHS recommends 75 minutes per week of vigorous-intensity activity or 150 minutes per week of moderate-intensity activity, along with two days per week of strengthening exercises (U.S. Department of Health and Human Services, 2008). Study participants did meet recommendations for strengthening exercises. It is also worth mentioning, the Scovill study included a treadmill test as a fitness assessment where only 13.2% of the 388 participants had a “good, excellent, or superior” fitness level, whereas 50.4% were categorized as “very-poor”, 21.2% as “poor”, and 15% as “fair”. This further reinforces the findings that reveal towboat crew men do not engage in adequate levels of physical activity.

Nutrition

No significant differences existed between the occupations on the towboat and their eating practices while controlling for age. All participants responded that they “sometimes” engage in healthy eating practices. As previously noted, participants are not averse to healthier options, they enjoy the taste of healthy foods, and would snack on fruits and vegetables if available. Whether they know it or not, cooks’ are the “nutritional gatekeepers” on the boat. They have the ability to facilitate a culture change. And, contrary to what cooks have said, the crew men would eat healthy food if it was readily available.

Smoking

Over one-third of the study participants (36.3%) reported smoking. In terms of occupation cooks had the highest rate of smoking (35.3%), then

deckhands (33.3%). What is particularly interesting is that none of the cooks were trying to quit smoking, while 14.6% of the deckhands reported they were trying to quit. Deckhands as a whole appear to have a healthier lifestyle in terms of physical activity and anthropometic measurements which may be why they are trying to quit smoking.

Results from this study are higher than the National Center for Health Statistics report indicating 23.1% of men smoke (Centers for Disease Control, 2009f). However, results are similar to Giovino and colleagues results that found blue collar workers prevalence of smoking was nearly twice that of white collar workers (37% versus 21%) (Giovino, et al., 2000). And, shift workers are significantly more likely than day workers to smoke (van Amelsvoort, et al., 2006). Smoking triples the risk of dying from heart disease (Centers for Disease Control, 2008b).

Chronic Disease among Towboat Crew

Heart Disease

Heart disease is the number one killer of men in the United States (U.S.), followed by cancer. In 2010, data from the National Health Statistics Survey indicated 12.7% of the male population in the U.S. over the age of 18 was diagnosed with heart disease (CDC, 2012b). Yet, only 4.2% of the participants in this study reported a diagnosis of heart disease. This is surprising given the number of chronic disease risk factors these men possess. Moreover, Scovill's study only found 3.9% of the sample to be diagnosed with heart disease (Scovill,

2012). Therefore, while this study is consistent with Scovill's findings, it is amazingly lower than the national average. This brings up the question as to whether the participants were completely honest in their answers, as I have been told by company personnel the crew men were skeptical about completing the survey for fear of repercussions related to high BMI and chronic disease risk factors.

Breaking down statistics by occupation, engineers and wheelhouse officers were the only occupations reporting heart disease with (7.9%) and (6.0%) respectively. Age could be a factor in the diagnosis of heart disease since our risk increases as we get older. More than half of the wheelhouse officers (57.3%) were 55 or older, with another 30.5% between 35 and 44 years of age. On the other hand, over half of the engineers (63.2%) who participated in the study were 44 years or younger. Therefore, other chronic disease risk factors may also play a role in the diagnosis of heart disease.

High Blood Pressure

One in three adult Americans has high blood pressure (31.3%) which is a major risk factor for heart disease, stroke, congestive heart failure, and kidney disease (CDC, 2008). Nearly 28% (27.8%) of the participants in this study reported a diagnosis of high blood pressure. Interestingly though, only 12.1% in Scovill's study were diagnosed with high blood pressure. This study relied upon participant honesty, whereas Scovill's study relied upon biometric data (Scovill, 2012). Wheelhouse officers (29.3%), engineers (31.6%), and cooks (29.4%) reported high blood pressure, while only 14.6% of deckhands reported the

diagnosis. This may be related to age since deckhands as a whole were younger than the other occupations with 80.9% 44 years or younger.

High Cholesterol

One in six adult Americans has high cholesterol (17%). High cholesterol significantly increases risk of heart disease (CDC, 2012a). Nearly one-third of the participants (28.5%) in this study reported high cholesterol. Similar to high blood pressure, deckhands had the lowest rate (12.5%) of reported high cholesterol. Not surprising since the rates of high cholesterol also increase with age. Scovill's study found 16.8% to have high cholesterol with another 28.4% borderline high (Scovill, 2012).

High cholesterol can be related to a number of factors: genetics, a diet high in fat, saturated fat, and cholesterol, inadequate physical activity, obesity, and smoking. Many of modifiable factors affect the towboat population. For example, the "southern-style" cooking includes a lot of fried foods, calorie-dense breakfasts of biscuits and sausage gravy, and eggs and bacon, and then the traditional foods, i.e., fried fish on Friday, steak (as big as the plate) on Saturday, and fried chicken on Sunday. Therefore, the meals provided are high in calories, fat, saturated fat, and cholesterol. In addition, this study found the mean BMI to be 32.2 which is considered obese, most do not get the recommended amount of physical activity, and 36.3% are smokers. Consequently, given the number of risk factors these men have, a diagnosis of high cholesterol is not surprising.

Diabetes

Diabetes is the sixth leading cause of death in American men. Furthermore, the death rate of heart disease is two to four times greater with diabetes and the risk of stroke is two to four times higher as well (American Diabetes Association, 2011; Mayo Clinic, 2009). Risk factors for diabetes include people over age 45, overweight and obesity, sedentary lifestyle, high cholesterol, low HDL cholesterol, high triglycerides, people with impaired glucose tolerance, and certain racial and ethnic groups (ADA, 2012).

Only 7.9% of the total sample size reported a diagnosis of diabetes which is actually lower than the national data suggesting 11.8% of men aged 20 and older have diabetes (American Diabetes Association, 2011; Mayo Clinic, 2009). However, when looked at across occupation, the numbers are not nearly as promising (wheelhouse officers 11.0%; engineers 5.3%; deckhands 0.0%; cooks 23.5%). Scovill's study of wheelhouse officers found 6.2% to have a diagnosis of diabetes (Scovill, 2012).

Given the number of risk factors for diabetes study participants' exhibit, it is surprising that the number of diagnosed cases of diabetes is not much higher. Almost half (45%) of the participants are 45 and older, 92.9% were considered overweight or obese and 64.3% were considered obese, nearly one-third of participants get no aerobic exercise, and 28.5% have high cholesterol. That being said, 88.6% were White, non-Hispanic men which is not a risk factor for diabetes.

The reported diagnosis of diabetes among cooks is alarming (23.5%). This is double national data statistics. Cooks are in somewhat of a precarious position. They are responsible for making delicious homemade foods and desserts, and as discussed earlier, these foods are often calorie-dense unhealthy choices. Furthermore, cooks are surrounded by these foods all day, every day for 14 to 30+ days at a time. Studies show we mindlessly, or unconsciously, eat more than we think we do. Our stomachs are not good barometers, nor is our memory (Wansink & Linder, 2003). We simply lose track of how many bites we've taken or how many ounces of regular soda we've drank. And, this study found cooks to be the "unhealthiest" on the boat due to high BMI (82.4% classified as obese), waist circumference, physical inactivity, and poor diet. Consequently, it stands to reason the cooks would have more participants diagnosed with diabetes. Then again, the sample size was only 17 for the cooks. Therefore, there is not sufficient data to generalize this to the entire population of cooks on the towboat. Additionally, male cooks only make up approximately a third of the cooks on the tow.

Perceived Benefits of Healthy Eating and Physical Activity

Results indicate the crew is aware of the benefits of healthy eating and physical activity. The overwhelming majority ($\geq$ 88%) of towboat crew responded that eating healthy would help them lower their cholesterol, lower their blood pressure, help them lower their weight, and make them feel better. Similarly, the majority of the crew (>90%) identified that exercise is good for their blood

pressure, will decrease cholesterol, will increase energy levels, reduce stress, and help them feel better, be more fit, and lose weight. Even so, participants reported they “sometimes” eat healthy.

When comparing participant responses to the American Heart Association’s recommendations on how to reduce risk of chronic disease, the crew, in general, has sufficient knowledge of the benefits of eating healthy and regular physical activity (American Heart Association, 2011a). That being said knowledge does not usually equal behavior. Previous research indicates nutrition knowledge and food beliefs among, play only a modest role in determining food choices (Tepper, Choi, & Nayga, 1997). Furthermore, research also indicates knowledge regarding the benefits of physical activity is not associated with physical activity (Trost, et al., 2002). This study is consistent with previous literature suggesting that although participants are knowledgeable about the benefits of healthy food choices and physical activity, most are still not eating healthy or getting the recommended amount of aerobic activity.

Perceived Barriers of Healthy Eating and Physical Activity

Healthy Eating

Four main barriers to eating healthy on the towboat were identified. The first three barriers, “food is accessible all of the time, so it is easy to over eat” and “it’s hard not to take seconds when there is such good food available,” along with the “good southern cooking on the boat makes it easy for me to over eat” were expected. On the towboat, food is available at all times. The cooks are up at

4:00am cooking a hot breakfast to accommodate shift change, and they make sure a hot meal is available at most shift changes with the exception of the midnight shift change. The galley is open for the crew at any time, and is stocked with leftovers, snacks, and a variety of beverages. Therefore, regardless of the time of day, crew has access to food.

The fourth barrier that the crew identified was the cooks. Almost half of the participants strongly agreed or agreed cooks would need to be re-trained to cook healthier. This perception may be related to the tradition of “southern-style” cooking on the river. Besides the pay, historically, food is one of the main advantages to working on the river. Since the crew is on the boat 14 to 30+ days at a time, and is working a grueling six hours on six hours off shift, food is one of the few things they have to look forward to. And, going back to tradition, there are customary foods that are served. For example, fried fish is served on Fridays, steak on Saturday, and fried chicken on Sunday. This was consistent across companies. Also, in my cooks training sessions, the cooks themselves have verbalized that they are reluctant to move away from these food customs because the men wanted and expected to eat this way. In addition, I’ve heard from crew men from various companies, “the more I eat, the more I get paid,” suggesting food consumption patterns correlate with money spent by the company. Lastly, the cooks on the boats are not formally trained. Of the male cooks, some were former deckhands, others had worked in restaurants, and others had no cooking experience outside of the home. It should be noted that approximately one-third of the cooks on the river are men.

Surprisingly, potential barriers were not seen as important factors. The majority of participants strongly disagreed or disagreed that “there is limited space to store fresh fruits and vegetables,” and that “preparing fresh vegetables as a snack would be a waste of time and money since they wouldn’t get eaten.” This suggests the crew would eat healthy snacks if they were readily available. It should be noted that the cooks indicated that limited space was a barrier and cooks made up a very small percentage of this study (8.7%).

Physical Activity

Barriers to regular physical activity were identified by assessing perceptions about exercise in general, and also by assessing perceived barriers to regular physical activity related to the built environment, the towboat. The majority of participants agreed that making time to exercise is a barrier (63%). Shift work may be a possible explanation for this as 41.9% of participants strongly agreed or agreed that it’s hard to exercise on the boat because of their shifts. Wheelhouse officers and deckhands work six hours on, six hours off. During their time off, they must fit in eating, sleeping, exercising, and relaxing. At no point while on the river will they get a full seven to eight hours sleep, which may lead to chronic fatigue and impact their desire to exercise (Antunes, et al., 2010). Previous research has shown no significant difference in exercise habits between shift workers and day workers (Antunes, et al., 2010; Croce, et al., 2007); however, shift workers studied worked day or night shift and were able to go home when they were off. Towboat crew men stay on the boat for 14 to 30+ days at a time, so previous findings may not apply to them.

The physical environment was also identified as a barrier to exercise. The majority of participants indicated there is limited space on the boat to exercise (68.6%), and it's harder to exercise if there is no equipment on the boat (61.2%). The towboat is not conducive to promoting physical activity due to limited space as well as obstructions, wires, deck fittings, and hatches. Interior space is limited with both bedrooms and common rooms too small for exercise, and walkways and stairwells are narrow. Outside walkways are also narrow, are too dangerous to run on, and the weather often prevents walking on the tow.

That being said, crew men committed to exercise were able to overcome barriers. One towboat captain lost 80 pounds and trained for a full marathon. Another said he walked on the treadmill every day to keep his weight healthy so that he could work as long as possible on the tow. And, yet another brought an exercise bike on the boat and placed it in the wheelhouse. He rode the bike while navigating the vessel. Therefore, although the barriers are tremendous, the barriers are the same for all crew and some are able to overcome them. In terms of stages of change, those in action and maintenance face the same barriers as those in contemplation and preparation stages, yet they have adapted to maintain their health.

Additionally, 41.9% of participants strongly agreed or agreed that it's hard to exercise on the boat because of their shifts. Wheelhouse officers and deckhands work six hours on, six hours off. During their time off, they must fit in eating, sleeping, exercising, and relaxing. At no point while on the river will they get a full seven to eight hour sleep which may lead to chronic fatigue and impact

their desire to exercise (Antunes, et al., 2010). Research has shown no significant difference in exercise habits of shift workers and day workers (Antunes, et al., 2010; Croce, et al., 2007). However, the shift workers studied work day or night shift and were able to go home when they were off, whereas towboat crew stays on the boat for 14 to 30+ days at a time. This would not be an equal comparison.

The Towboat Environment

The built environment is very influential in terms of eating practices and physical activity. A healthy eating environment was correlated with healthy eating behaviors, suggesting participants are more likely to eat healthy in an environment that promotes healthy eating practices. However, the good tasting southern-style cooking was cited by 47.1% of participants as making it easy to overeat, while only 22.5% disagreed with the statement. And, the majority of participants (53.7%) indicated it's hard not to take seconds when such good food is available. At the same time, participants also indicate healthy foods taste good. Therefore, if traditional southern-style cooking recipes are modified to be healthier and/or tasty healthy options are introduced, it is likely the crew will eat this food as well.

Crew members often eat together while on the boat. Studies suggest 35% more food is consumed when eating with another person compared to when eating alone. Moreover, if you are eating with a large group, seven or more, you will eat 96% more – nearly twice as much (DeCastro, 1994). Additionally, the

pace at which people eat and amount eaten is influenced by those you are eating with. Research indicates when one person (the pacesetter) eats two cookies the second person will eat two cookies. If the pacesetter eats six cookies, the second person will eat five or six cookies (Herman, Roth, & Polivy, 2003). This may be especially relevant to the towboat setting since the crew often eat and snack together.

Similarly, perceived exercise environment was positively correlated with regular physical activity, indicating participants are more likely to exercise when the environment is conducive to exercise. Most participants cited lack of exercise equipment, limited space, and shift work as primary barriers to regular physical activity. I expected noise on the boat and lack of privacy to be a barrier to exercise based on discussions with towboat crew men, however, this was not the case. Unfortunately, limited space for exercising and shift work is not a modifiable barrier.

Motivations to Adopt Healthier Practices

The only motivation strongly endorsed by the participants that would facilitate healthy eating practices and regular physical activity was the fear of losing one's job. The USCG is discussing the possibility of lowering the current BMI regulation of 40 for credentialed Merchant Mariners, the wheelhouse officers (captains and pilots). This is of great concern for towboat crew since 12.8% in this study could potentially lose their job. In addition, these are particularly desirable occupations in terms of salary. Working six months a year, deckhands

earn $25,000 a year, while cooks earn $33,000, mates $50,000, engineers $70,000, pilots $85,000, and captains $100,000. Moreover, job security is excellent due to the shortage of pilots and captains, and new hires have the potential to move up in the ranks quickly.

Most the men (61.9%) who work on the towboat have only a high school education. I suspect the men report they would engage in healthier behaviors to keep their job because they make an excellent salary for their level of education, and have good benefits in terms of health insurance and retirement.

Ironically, though, the primary motivation, fear, may be irrelevant. Upon communicating with a large carrier's Vice President of Human Resources and Safety, I discovered that the National Maritime Center who credentials Merchant Mariners reports only a 0.1% failure rate on licenses annually. Therefore, only about 0.1% of the 4,400 credentialed inland river mariners fail to renew their license annually due to medical issues (Brown, 2012). This is due to passing the physical ability tests and/or receiving an exemption. Unfortunately, this is not surprising because towboat companies have lobbied against more strict guidelines due to the industry-wide shortage of wheelhouse officers. They are aware of the widespread prevalence of obesity among their crew men, however, also need to keep their captains and pilots on the river. Some companies have been proactive in encouraging healthy lifestyles by having yearly health fairs, incorporating nutrition and chronic disease trainings, cooks trainings, putting exercise equipment on the boats, and having the men undergo physicals yearly.

Motivation to meet U.S.C.G. Physical Ability and BMI Guidelines

In addition to fear of losing one's job, company incentives were cited by 57.6% of participants as incentives to eat healthier and exercise more, and another 33.5% were neutral and therefore might be reachable depending on the incentive offered. Also, while only 31.9% of participants agreed a competition among towboat crews would encourage them to engage in healthier behaviors, another 48.2% were neutral. Again, suggesting they might be swayed depending on the nature of the competition.

Limitations

Generalizability of this study may be limited due to the overall sample size (*n*=194), and small sample size of each occupation on the towboat. According to Dillman, based on a population of 30,000, the sample size for a ±5% sampling error was 381, and for a ±10% sampling error 96 (Dillman, 2007). In addition, crew men from only six companies were utilized. In addition, there was no random assignment. Future studies should include a larger sample size representing more towboat companies.

The survey instrument was long and cumbersome. Therefore, participants often skipped questions, which affected the sample size. In addition, the Cronbach's coefficient alpha was not optimal for two scales. If the current instrument is utilized again, it should be re-designed to include more white space and made more visually interesting to ensure completion of the entire survey. Also, the researcher should consider deleting sections and/or items not needed

as well as deleting items that lower the reliability. Specifically, the two statements regarding perceptions about barriers of exercise should be deleted due to low reliability. The FFQ should be made clearer for discussion purposes. For example, the scale might read: rarely or never (0-25%), sometimes (26-50%), often (51-74%), usually or always (75-100%). Lastly, I would make age an interval variable. Limiting the age to groups prevented age comparisons to other studies or making conclusions based on age.

Implications for Health Promotion and Practice

In this section, implications for health education promotion and practice are presented.

1. Place more emphasis on blue collar men's health. Men die at a younger age (life expectancy 76.2 years), and more die annually in the U.S. from cancer, diabetes, and heart disease (Murphy, Xu, & Kochanek, 2012). In addition, more blue collar men are smokers and are more likely to be overweight or obese (The Kaiser Family Foundation, 2008).
2. Health promotion programs designed specifically for blue collar workers who have constrictive work environments.

Considerations for USCG and Towboat Companies

1. New hire health and physical ability guidelines (for all crew members) similar to that of the military, i.e, BMI requirements, physical ability and

endurance testing. Employees should be required to maintain a certain degree of health and physical ability to continue to work on the river.

2. Setting physical ability guidelines for all crew, not just credentialed Merchant Mariners. In case of emergency, such as a fire, all crew should be physically able to “jump ship”. Study results indicate cooks and engineers are the “unhealthiest” on the boat yet are not required to maintain any type of health requirements such as BMI or pass physical ability guidelines.
3. Require yearly or bi-yearly BMI and physical ability testing to maintain Merchant Mariner credential as opposed to once every five years. This would encourage the mariners to maintain health throughout the year.
4. Hire chefs or cooks with the understanding that healthy cooking is a requirement of the position. Provide training as needed. It is easier to change the environment than it is to change than the minds of the crew. And, whether they realize it or not, they powerfully shape the eating practices of the crew.
5. The environment needs to become more supportive of healthy behaviors. Exercise equipment must be available and healthy food options must be readily available.
6. Implement a worksite wellness program focusing on the wheelhouse officers and cooks. Wheelhouse officers and the cooks are the decision-makers when it comes to food. They must be invested in a program for it to work on their boat. Creating a healthier crew would not only benefit the

employee, but also would reduce health care costs, increase productivity, and keep trained towboat crew on the river longer.

7. Due to the culture on the tow and the rich sense of tradition, small changes must be implemented gradually to initiate significant changes in the future.

Recommendations for Future Research

Based on the findings, conclusions, and implications, the following recommendations are made:

1. In future studies with towboat crew, additional research is needed to identify motivations we have not yet identified to initiate and sustain health-related behavior changes.
2. Compare and contrast behavioral risk data, anthropometic measurements, diagnoses of chronic disease, and biochemical indices of towboat crew men from companies embracing and promoting healthier lifestyles on the boat to those who are not being proactive. Investigate percent pass rate for Merchant Mariner credentials, and whether or not the yearly physicals and health promotion activities made an impact.
3. Cooks are critical when it comes to setting the tone of the day on the towboat and cooking healthy desirable meals. That being said, they are also the “unhealthiest” on the boat. This study investigated only a small sample size of male cooks (17) however males comprise only about 1/3 of the cooks on the river. Additional research is needed investigating the

health and nutrition status of female cooks on the river, as well as their perceptions of benefits and barriers to eating healthy and physical activity in comparison with the male cooks.

4. Additional research is needed in the area of men's health specifically in blue collar occupations. To date, little research was found investigating eating habits, nutrition knowledge, physical activity levels, and motivations to make healthy behavior changes, yet blue collar workers are at higher risk of obesity and have higher rates of smoking.
5. Design, implement, and evaluate an intervention based ecological approach. The towboat industry has a very unique culture and is tied to tradition, therefore, recognizing individual-level, socio-cultural and environmental-level influences is critical (Crawford, et al., 2010; Green & Kreuter, 1999).

Summary

The purpose of this study was to better understand how life on the river affects health status, and perceived benefits and barriers to good health, specifically eating practices and physical activity; as well as motivation to meet USCG BMI and physical ability guidelines.

The results of this study indicate work on the towboat is demanding both mentally and physically, and comes with very unique challenges when it comes to designing an effective health education intervention. The men are blue collar workers who exhibit several major risk factors for chronic disease, many of them

modifiable. And, while the crew men are aware of the benefits of physical activity and healthy eating, the barriers are tremendous. A successful intervention must be tailored to current worksite behaviors and the culture of the tow, specifically, the family-like atmosphere, the wheelhouse officer being in charge of daily operations, and the cook setting the tone of the day, and (Gottlieb, Weinstein, Baun, & Bernacki, 1992). The wheelhouse officers and the cook are key decision-makers and role models. Lastly, interventions must be geared toward all crew men, even those with normal anthropometric measurements, who eat healthy, and who engage in regular physical activity, to encourage them to maintain low risk of obesity and co-morbidities (Prior, et al., 2004).

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APPENDIX A

ETA SIGMA GAMMA HEALTH EDUCATION MONOGRAPH

MANUSCRIPT SUBMISSION MAY 2011

AND

SIUC HUMAN SUBJECTS APPROVAL

A Preliminary Study of Living and Working on the Towboat:

What are the Health Implications?

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Abstract

The United States Coast Guard requires a BMI of 40 or less to be a member of a licensed towboat crew, however there has been much discussion regarding lowering this requirement. The purpose of this study was to describe towboat crew, perceived benefits and barriers of healthy practices, and motivation to make healthy changes. A qualitative approach following the PRECEDE-PROCEED planning model was utilized. Five primary categories of themes emerged: commitment to healthy practices, southern-style cooking tradition is a barrier to healthy eating, the built environment is a barrier to physical activity, shift work is a barrier to healthy eating and physical activity, and the industry is anticipating change. Findings suggest an ecological approach tailored to current worksite behaviors and the culture of the tow is essential in mounting a successful intervention.

A Qualitative Study of Living and Working on the Towboat:

What are the Health Implications?

Working on a towboat can be a very stressful and dangerous occupation. The United States Coast Guard (USCG), the regulatory agency of the tugboat, towboat, and barge industry, is taking a closer look at physical ability and body mass index (BMI) of merchant mariners. Current BMI requirements are unrestrictive at 40 or lower, which, according to the Centers for Disease Control (CDC), is classified as obese 3 or extreme obesity (Centers for Disease Control, 2009a). Obesity comes with increased risk of chronic diseases and health conditions including hypertension, type 2 diabetes, stroke, coronary heart disease, some cancers, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems (Centers for Disease Control, 2009g). This study takes a holistic look at the health and nutrition status of the men and women who work on the “tow” in extremely close quarters for days on end without setting foot on the mainland. The results of this study will be applicable to working environments with similar living and working constraints such as the railroad, off-shore oil rigs, and ocean-going vessels.

Obesity

The prevalence of obesity among U.S. men is frightening and has quickly become a major public health concern as the rate continues to climb, now at 34.6% (Ogden, et al., 2010). Defined as a BMI of 30 or higher, obesity is a tremendous burden on society in terms of economic costs resulting from direct costs of treating obesity-related illness and indirect costs of lost productivity

(Centers for Disease Control, 2010b; Colditz, 1999). Direct and indirect costs associated with obesity are estimated to be $147 billion annually (Centers for Disease Control, 2010e). Although it is widely accepted that genetics plays a role in obesity, research indicates the role is minimal as changes in genetic makeup occurs far too slowly to account for the rapid increase in obesity (Centers for Disease Control, 2009h). Therefore, it seems that the obesity epidemic is more likely related to an environment characterized by the availability of inexpensive, calorie-dense foods, and lack of physical activity (Wilding, 2001).

Shift Work and Obesity

Recent studies indicate an association between shift work and an increased prevalence of obesity, as well as a greater risk for metabolic syndrome, diabetes, and cardiovascular disease (Antunes, et al., 2010; Atkinson, et al., 2008; Esquirol, et al., 2009). Shift work disrupts “normal” eating patterns, decreasing meal frequency and increasing frequency of snacking (Atkinson, et al., 2008). Nutritional intake is also less healthy (Zhao & Turner, 2008). Moreover, metabolic responses to food are altered due to disruptions in sleep and circadian rhythm (Atkinson, et al., 2008). International studies have found no difference in exercise habits of shift workers and day workers (Croce, et al., 2007; Lasfargues, et al., 1996).

Towboat Industry

Over 30,000 towboat crew work in US inland barge transportation alone. If we included those working on ocean-going vessels, it would be much higher. Towboat crew consists of a captain, pilot, engineer, deckhands, and cook. The

captain and pilot (wheelhouse officers) are responsible for navigating the vessel and are in charge of the crew. Crew work 14-30+ days on the towboat, 14-30 days off; shifts are 6 hours on, 6 hours off for a total of 12 hours per day. Working this type of schedule has potential health and wellness implications. Even so, maintaining good health is critical to maintaining round-the-clock vessel operations.

The Navigation and Vessel Inspection Circular (NVIC) 04-08 provides medical guidelines for evaluating physical and medical condition of those holding the Merchant Mariner credentials (United States Coast Guard, 2009b). Credentialed mariners include towboat captains and pilots (United States Coast Guard, 2009a). Currently, if a merchant mariner's BMI is 40 or higher, a medical practitioner must certify the mariner can meet physical ability guidelines as outlined in the NVIC, such as demonstrating "use of survival equipment, be able to carry and handle fire hoses and fire extinguishers, step over high door sills and coamings, move through restricted accesses, climb up and down vertical ladders and stairways, manipulate mechanical devices using manual and digital dexterity, and strength", etc. to have their license approved (United States Coast Guard, 2009a). Merchant Mariner licenses are renewed every 5 years.

To date, there is no published research describing the health status of river towboat employees, perceived benefits and barriers to good health, and motivation to meet BMI requirements. Additionally, there have been no studies of BMI in this occupational group or how the built environment, the towboat, affects health and physical activity of the crew.

Methods

Due to lack of published literature about the phenomenon, a qualitative approach was used to obtain a richer, thicker understanding of the lived experiences and conditions on the towboat. Within this qualitative design, I used multiple methods to triangulate and validate the data. The objective was to better identify what type of intervention would be most appropriate and beneficial to towboat crew to assist them in meeting USCG BMI standards, and leading healthier lives. A qualitative approach is especially useful when exploring newly researched phenomena such as this (Marshall & Rossman, 2011).

The study included four components to examine how life on the river affects perceived health status, and perceived benefits and barriers to good health, as well as motivation to meet physical standards. (Figure 1) The first component consisted of interviews with key informants in upper management with barge transportation companies, towboat cooks, pilots, and captains. The second component consisted of a tour of two towboats and observation. The third component of the study was a focus group with towboat captains and pilots. The fourth component was a review of USCG documents and regulations regarding body weight, nutrition, and physical activity. The study was conducted in Paducah, Kentucky, the hub of river barge industry in the U.S., and was completed during Fall 2010. All research received Human Subjects Approval through the Office of Research Development and Administration at Southern Illinois University Carbondale.

To discover the essence of life on the boat, 11 key informants: a port captain, human capital manager, crew manager, two cooks, two captains, and two pilots were interviewed. Although interview questions were pre-planned, the interviews were unstructured (Maxwell, 2005). These were conducted during training events, and during the towboat tour.

The second component of the study consisted of two towboat tours and observation of the crew. Using Spradley's "grand tour" model of observation, field notes addressing space (towboat), actors (crew), activity (work on the barge), object (barges), act (job duties), event (working), time (shift work), goal (deliver barges on schedule), and feelings (of crew) were recorded (Shank, 2002). Additionally, unstructured interviews during the tour also occured.

The third component of the study, the focus group, was conducted with 20 captains and pilots with the Merchant Mariners credential. A focus group was chosen to extract perceptions in an open-ended way and to facilitate discussion that occurs when participants respond or react on one another's statements (Creswell, 2007). The PRECEDE-PROCEED planning model, which provides a comprehensive structure for assessing health-related behaviors and environmental forces for designing, implementing, and evaluating health promotion interventions, was used to guide the focus group scripts (Green & Kreuter, 1999) (Figure 2). All participants were male, which is typical of this industry. The session was incorporated into an existing day-long training for wheelhouse officers. The focus group was recorded with consent of participants and field notes were taken. Participants provided demographic information.

The fourth component of the study included analyzing USCG documents and regulations to triangulate data gathered through other study components to provide further validation of the research (Creswell, 2007). Crew Endurance Management (CEMS) Practices guides, Navigation and Vessel Inspection (NVIC) Circulars, and National Maritime Center (NMC) Homeport and USCG websites were analyzed for information relating to BMI requirements, and nutrition and physical activity on the boat.

Analytic Strategy

Using thematic analysis, field notes from interviews and towboat tours were examined and coded into key themes. The focus group recording was analyzed and key themes were identified and coded (Figure 3). Through theoretical comparison, categories of key themes were identified. To ensure accuracy of this report, feedback was obtained from two knowledgeable informants (Shank, 2002). Microsoft Excel was used to calculate mean number of years on the river, and means and standard deviations of BMI (National Heart Lung and Blood Institute, 2011).

Participants

All 20 wheelhouse officers who participated in the focus group were male. Mean years working on the river was 24.6 $\pm$ 7.3 years. Mean BMI was 30.05 $\pm$ 2.85. Ten (50%) were between the ages of 45 and 54; 6 (30%) were between the ages of 35 and 44; 3 (15%) were between the ages of 55 and 64; and only one was between the ages of 25 and 34. All but one officer were Caucasian.

Categories of Key Themes

In each of the four study components, the same five categories of key themes emerged: commitment to healthy practices, southern-style cooking tradition is a barrier to healthy eating, the built environment is a barrier to physical activity, shift work is a barrier to both healthy eating and physical activity, and the industry is anticipating change.

Commitment to Healthy Practices

Although few participants reported healthy eating practices and regular physical activity while on the tow, those who did, consistently indicated “you must make the activity routine and you must be dedicated”. Strategies to stay active included bringing equipment such as mini-stair steppers, mini-trampolines, and exercise bands. Some boats had a treadmill, and several informants would use them daily. Two cooks used portion control and exercise to achieve major weight losses (40 pounds and 140 pounds). Finally, a captain decided to lose weight so he “will be around longer for [his] kids” and reported he had become obsessive about physical activity and healthy eating to maintain an 80 pound weight loss.

Southern Cooking Tradition Barrier to Healthy Eating

The men who work on the tow spend 14-30+ days together, work grueling schedules, are in limited company, and have very limited amenities. One thing the men look forward to is the “great southern-style” food. Breakfast may include biscuits and sausage gravy, bacon and/or sausage, pancakes or French toast, and hot and cold cereals. Lunch is traditionally a big, hot meal such as meatloaf, mashed potatoes and gravy, corn, and green beans. Supper is lighter and might consist of sloppy joes, tacos, or chicken strips. There are typically two desserts at

each meal. Furthermore, it is custom to serve certain foods on certain days. For example, Friday is fried fish, Saturday steak, and Sunday is fried chicken. Southern-style cooking is a hard and fast tradition in the towboat industry, and one that will not easily be changed. Furthermore, the cooks and the crew emphasized repeatedly, that the cook's job depends on satisfying their captain and crew.

When focus group participants were asked what makes it easy to eat healthily on the boat, one chuckled, "you won't have much down for that one." Conversely, when asked what makes it harder to eat healthily on the boat, there were numerous responses. Participants said it is hard to turn away from good food, and they always want seconds. Others indicated easy access to snack foods and desserts made it hard to watch what they eat, while some indicated that the crew "does not want to adopt healthy eating practices". Limited refrigerator and freezer storage was also cited as a constraint for eating healthily, as well as having to "re-train" the cooks. The observation revealed towboat galleys are similar in size and equipment to home kitchens, confirming the notion of limited space.

Built Environment Barrier to Physical Activity

Throughout the interviews and focus group, the crew verbalized that physical activity gives them more energy, aids in weight loss, decreases stress levels, decreases blood pressure and cholesterol levels, and inspires those around them to exercise. Even so, the barriers tend to prevail over the benefits. The towboat itself is not conducive to promoting physical activity due to limited

space as well as obstructions, wires, deck fittings, and hatches. Outside walkways are narrow and are too dangerous to run on, and the weather often prevents walking on the tow. Interior space is also limited with both bedrooms and common rooms being too small for exercise, and walkways and stairs are narrow. Noise of engines and lack of privacy and equipment were also cited as deterrents to physical activity.

Shift Work Barrier to Healthy Eating and Physical Activity

Crew members, with the exception of the cook and engineer, work 6 hours on, 6 hours off, working 12 hours per day. Working a swing shift makes it difficult to incorporate physical activity, according to the captains and pilots. The “front watch” is usually from 6am-12pm and 6pm-12am; the “back watch” is from 12pm-6pm and 12am-6am. During their 6 hours off, the crew finds time to sleep, eat, socialize, exercise, and fit in “down time.” According to two captains, the most exercise they get is “when they walk from the wheelhouse down to the galley to eat and back.” The galley is available 24/7. Traditional meal schedules are not conducive to shift work and promote eating prior to sleeping.

Wheelhouse officers’ jobs are mentally challenging, but require very little physical activity. The wheelhouse officer must stand or sit in a very small space during the 6 hour shift, and is only able to leave the helm long enough to visit the bathroom. Furthermore, captains and pilots often begin their career on the river as deckhands, which is a physically demanding job requiring a great amount of energy. As they transition through the ranks, though, they tend to not decrease

the number of calories they are taking in to account for the decrease in physical activity, which leads to significant weight gain..

Industry is Anticipating Change

The prospect of the USCG implementing more restrictive BMI standards was a frequently expressed concern, and towboat companies are anticipating change. The industry as a whole would like crews to be healthier to be able to work longer disability-free. This will reduce sky-rocketing health care costs, time and cost of training, and employee turnover at a time when there is an industry-wide shortage of qualified mariners (Cohen, 2008). Wheelhouse officers indicated they would be motivated to incorporate more healthy practices if it would enable them to keep their Merchant Mariner license and allow them to work longer.

Discussion

As with all qualitative research, caution must be taken when generalizing the findings to the population of towboat crew. In addition, deckhands and engineers are not well represented. Lastly, perceptions represent management and crew from just two barge companies.

Having used the PRECEDE-PROCEED model as my framework, enabled me to identify both the facilitating factors and barriers surrounding healthy practices on the towboat (Figure 4). Identification of barriers by the crew, though, is an important predictor of behavior change and is an important consideration for interventions (Wilson, et al., 1997). In the focus group, only 5 of the 20 captains and pilots viewed themselves as healthy. This is corroborated by the fact that the

mean BMI was 30.05, obese by the CDC standards (Centers for Disease Control, 2009a). Towboat crew were knowledgeable about benefits of healthy eating practices and physical activity, however barriers appear to prevail. This is unfortunate since physical inactivity, poor diet, and obesity are three of the major modifiable risk factors for heart disease (American Heart Association, 2009). Diet and nutrition can also positively affect other controllable risk factors for heart disease including cholesterol levels, blood pressure, diabetes, and overweight/obesity (American Heart Association, 2011b).

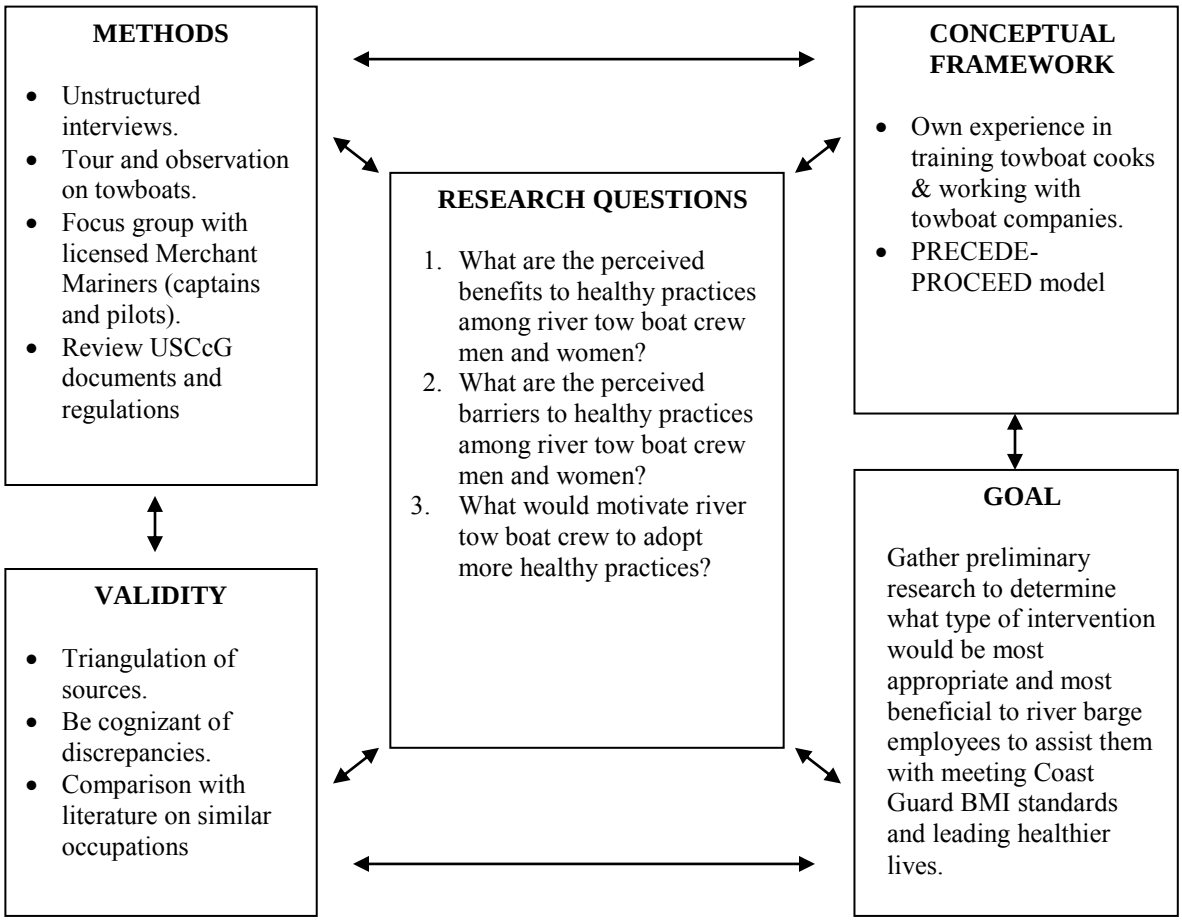
Towboats were not designed to promote physical activity among the crew outside of their job duties. Towboats were designed to push upwards of 40,000 tons of cargo up and down the river. Additionally, the industry is well known for its tradition of “great southern-style” cooking on the boat, which often translates to high-fat, high-sodium, calorie-dense meals. The combination of living on a towboat for extended lengths of time, having a buffet of homemade and snack foods widely available, and an environment that provides limited opportunities for physical activity, can wreak havoc on one’s health. The CDC refers to environments such as this as “obesogenic”, meaning the environment promotes increased eating, unhealthful eating, and physical inactivity (Centers for Disease Control, 2011b).

Conclusion

Barge work is a unique occupation with unique challenges when it comes to designing an effective health education intervention. Although the barriers are tremendous, the crew is aware of the benefits of physical activity and healthy

eating. An ecological approach is essential in designing an intervention, recognizing individual-level, socio-cultural and environmental-level influences (Crawford, et al., 2010; Green & Kreuter, 1999). For a successful intervention, it must be tailored to current worksite behaviors and the culture of the tow, namely, the family-like atmosphere, cook setting the tone of the day, and captain being in charge of daily operations (Gottlieb, et al., 1992). The captain and cook are critical as decision-makers and role models. Lastly, interventions must be geared toward all crew, even those with normal BMI and who engage in regular physical activity, to encourage them to maintain low risk of obesity and co-morbidities (Prior, et al., 2004).

These findings should be replicated through more comprehensive studies examining all occupations on the towboat, and focusing on perceptions regarding healthy behaviors within the built environment as well as motivation to adopt healthy eating practices and exercise on the tow. Findings from this study can be applied to similar occupations with restrictive working environments.


METHODS
Unstructured interviews.
Tour and observation on towboats.
Focus group with licensed Merchant Mariners (captains and pilots).
Review USCcG documents and regulations
CONCEPTUAL FRAMEWORK
Own experience in training towboat cooks & working with towboat companies.
PRECEDE-PROCEED model
RESEARCH QUESTIONS
1. What are the perceived benefits to healthy practices among river tow boat crew men and women?
2. What are the perceived barriers to healthy practices among river tow boat crew men and women?
3. What would motivate river tow boat crew to adopt more healthy practices?
VALIDITY
Triangulation of sources.
Be cognizant of discrepancies.
Comparison with literature on similar occupations
GOAL
Gather preliminary research to determine what type of intervention would be most appropriate and most beneficial to river barge employees to assist them with meeting Coast Guard BMI standards and leading healthier lives.

Factor	Question
Predisposing	1) Is it easy or hard to stay healthy on the boat?
Enabling	2) What makes it easier or harder to eat healthy on the boat?
Enabling	3) What makes it easier or harder to be physically active on the boat?
Behavioral	4) What might motivate you to eat healthier or be more physically active on the boat?
Reinforcing	5) What kind of messages do you get from your family and employer?

Code	Description
Healthy eating - Benefits	Perceptions about benefits of healthy eating, and how living and working on the towboat makes it easier to eat healthy.
Healthy eating - Barriers	Perceptions about barriers to healthy eating, and how living and working on the towboat makes it harder to eat healthy.
Physical activity - Benefits	Perceptions about benefits of physical activity, and how living and working on the towboat makes it easier to exercise.
Physical activity – Barriers	Perceptions about how living and working on the towboat makes it harder to be physically active.
Motivation to adopt healthy practices	What would motivate towboat crew to adopt more healthy practices?
Messages from company in regards to healthy practices	What messages does the crew receive from their employer in regards to health?

Phase 5:

Administration & Policy Diagnosis

Policy regulation organization

- United States Coast Guard (U.S.C.G.) BMI requirements and physical ability guidelines
- U.S.C.G. Crew Endurance Management Practices guidelines
- Individual barge company policies

Phase 4:

Educational & Organizational Diagnosis

Predisposing factors

- Perceptions: healthy foods don't taste good
- Knowledge: physical activity is good for my health, i.e., helps with weight loss, increases energy, decreases stress, decreases blood pressure, and decreases cholesterol
- Attitudes: eating healthy helps you live longer and feel better

Reinforcing factors

- Crew not wanting to adopt healthy eating practices
- Company encouraging healthier cooking on vessel and physical activity
- Exercise equipment available on some vessels

Enabling factors

- Tradition of southern-style cooking
- Limited access to healthy foods
- Unlimited access to unhealthy foods & snacks

Phase 3:

Behavioral & Environmental Diagnosis

Behavior & lifestyle

- Physical inactivity
- Eating practices
- Shift work

Environment

- Built environment not conducive to physical activity, i.e., small spaces, narrow walkways and stairs
- Only large vessels have a treadmill

Phase 1 & 2:

Social & Epidemiological Diagnosis

- Prevalence of Obesity = early mortality, decreased number of years working disability-free, decreased quality of life

SIUC HSC FORM A

REQUEST FOR APPROVAL TO CONDUCT RESEARCH ACTIVITIES INVOLVING HUMAN SUBJECTS

CERTIFICATION STATEMENT

By making this application, I certify that I have read and understand the University's policies and procedures governing research activities involving human subjects. I agree to comply with the letter and spirit of those policies. I acknowledge my obligation to:

1. Accept responsibility for the research described, including work by students under my direction.
2. Obtain written approval from the Human Subjects Committee of any changes from the originally approved protocol **BEFORE** implementing those changes.
3. Retain signed consent forms in a secure location separate from the data for at least **three** years after the completion of the research.
4. Immediately report any adverse effects of the study on the subjects to the Chairperson of the Human Subjects Committee, SIUC, Carbondale, Illinois - 618-453-4533 and to the Director of the Office of Research Development and Administration, SIUC.
   Phone 618-453-4531. E-mail: **siuhsc@siu.edu**

Project Title
Life on the river: How does living on a barge affect perceived health and wellness of employees?

RESEARCH ADVISOR'S ASSURANCE: My signature on this application certifies that the student is knowledgeable about the regulations and policies governing research with human subjects. I am aware of my obligations stated on Form A and will be available to supervise the research. When on sabbatical leave or vacation, I will arrange for an alternate faculty sponsor to assume responsibility during my absence. I will advise the Human Subjects Committee by letter of such arrangements.

Dawn Null 10/6/10

Researcher(s) or Project Director(s) Dawn Null, MS, RD Date
Please print or type name below signature.

Kathleen J Welshimer 10/7/10

Researcher's Advisor (required for all student projects) Dr. Kathleen Welshimer Date
Please print or type name below signature.

The request submitted by the above-named researcher(s) was approved by the SIUC Human Subjects Committee.

This approval is valid for one year from the approval date. Researchers must request an extension to continue the research after that date. This approval form must be included in all Master's theses/research papers and Doctoral dissertations involving human subjects that are submitted to the Graduate School.

Janet Swanson 10-11-10

Chairperson, Southern Illinois University Human Subjects Committee Date

APPENDIX B

Qualitative Observation

November 2, 2010 Marquette Tug Tour

Spradley's Model – Grand Tour

1. ***Space***. The Miss Kris tug boat itself is a large vessel, however, the living quarters are limited. The deckhands share a bedroom with just enough room to have two twin beds and a night stand. The captain and the pilot each have their own bedroom as does the cook and the engineer. All rooms are very small, accommodating a twin bed, a night stand, and a dresser. There is also a crew lounge on the vessel. The lounge fits a small couch, and a chair, and has a small television nestled in a built-in corner cabinet. Most tugs have a treadmill, which might be located in the guest bedroom or in the engine room. The kitchen is very much like a home eat-in kitchen. The appliances and cabinets are typical to what you might find in a home kitchen, with the exception of the stove, which is commercial grade. There are two to three home-model refrigerators and a small ice maker. The kitchen is open to the crew at all times. Additionally, there is a table in the kitchen which seats 8 to 10. The kitchen is located on the main floor of the tug, while the living quarters are on the second floor, and the wheelhouse is on the third floor. The kitchen, as well as the rest of the boat, is very clean. To get to the wheelhouse, you must walk up a narrow steep set of scissor stairs, turning half-way up each floor. It is almost like a straight spiral if that makes any sense. The stairs are too narrow to allow for two people to walk side by side. There is a walkway on the outside of the main floor, however, it is narrow and has only a chain fence between you and the river. Because of the pull of the propellers, the likelihood of

surviving after falling off a moving tug boat is slim. That being said, deckhands mostly work on the outside of the tug and on the barges. The small living space and limited space available for movement, is not conducive to encouraging physical activity among the crew, with the exception of the deckhands whose job in and of itself is physically demanding.

2. ***Actors***. On each tug, there is a captain, a pilot, an engineer, deckhands, and a cook. The captain and the pilot are your wheelhouse officers, and, in addition to steering the tug, they are in command of the tug and its crew. The engineer takes care of all vessel maintenance and repair. The deckhands take care of the rigging, securing barges, painting and cleaning the vessel, and helping guide the vessel from the front of the barges. The cook maintains the kitchen, cooks three hearty meals per day, and orders the food. With the exception of the cook and the engineer, all crew members work six hours on, six hours off, for a total of twelve hours working per day. There were nine crew members on the Miss Kris. Most will work 28 days on the tug, 15 off. However, one of the captains was on his 49th day straight on the tug. Often times the same crew will be together on a tug where they develop a familial relationship. Often times the cook is the only female on the tug so she becomes the “mother figure” for the crew to talk to.
3. ***Activity***. My observation is during the “back watch” (11am-5pm; and 11pm-5am), therefore, the pilot is steering the tug. While steering, the pilot

is focused on the river ahead and the instruments he uses to guide him. The space he works in is approximately 4’ x 4’. He has the option to stand or use a chair. The longest the pilot is able to be away from the helm is for a quick trip to the bathroom. By the end of the 6 hour shift, the pilot is more mentally than physically exhausted, as the pilots move very little during the entire shift. Since this is mid-afternoon, the cook is busy in the kitchen preparing for the next meal. Crew members go in and out of the kitchen picking up a snack or a drink, and talking to the cook. Deckhands are busy on the front of the barges helping to guide the pilot and the other tow boat, the Limestone Lady, to move the barges to where they want them. Once stopped, the Limestone Lady, picks us up. When we board the Limestone Lady, as well as the Miss Kris, we are greeted by the Deckhands, who make sure we make it safely onto the boat. The engineer on the Limestone Lady had just finished a 22 hour shift because of a mechanical malfunction that needed immediate attention. In the wheelhouse, the pilot was at the helm. He was retired, but still fills in when Marquette needs help. He started working on the river in 1962. The captain of the vessel was up and drinking coffee gearing up for his next shift. Most of the other crew members who are on their “off” time, are sleeping.

4. ***Object***. The tow boat and the barges themselves are the props.
5. ***Act***. All crew members work 6 hours on, 6 hours off, working a total of 12 hours per day, with the exception of the engineer and the cook, who work

as needed. The “front watch” is from 5am-11am and 5pm-11pm; the “back watch” as mentioned earlier is from 11am-5pm and 11pm-5am. While on duty, the wheelhouse officer (the captain or the pilot) is in charge of all employees on the boat as well as steering the boat. The cook is preparing for the next meal, and the deckhands are guiding the vessel from the front of the barges. The crew who are off may be sleeping, eating, watching television, playing video games, or on the cell phone. All positions are dependent upon one another. The deckhands may be doing similar jobs, but everyone else works independently.

6. ***Event***. As mentioned previously, all positions on the boat work collaboratively. The captain or pilot coordinates events that occur on the boat.
7. ***Time***. Sequences on the boat are cyclical. Similar acts occur during each 6 hour shift on the boat.
8. ***Goal***. The captain or pilot’s goal is to safely arrive with his shipment to the desired location within the given time frame.
9. ***Feelings***. While observing, the pilot appeared to be intensely watching the barges ahead and the instruments, as we navigated down a curvy narrow section of the Cumberland River. Additionally, there was a bridge ahead that the pilot had to navigate through and a personal watercraft passing the tow boat on the right. The crew gave off a family-like heir, like they all worked well together and enjoyed being together on the boat.

APPENDIX C

Pictures from Observation

November 2, 2010 Marquette Tug Tour

Figure 1. The Miss Kris Tow Boat, Marquette Transportation.

Figure 2. Riding the skiff boat from land to the Miss Kris tow boat. *From left to right*: Dr. Kathleen Welshimer, HED, SIUC; Mr. Steve Bryan, Port Captain, Marquette Transportation; and Mr. Paul Dutton, Human Capital Manager, Marquette Transportation.

Figure 3. From left to right: Ms. Jennifer Edwards, Crew Manager, Marquette Transportation; a Deckhand, Marquette Transportation; Dr. Dhitinut Ratnapradipa, HED, SIUC; and Dawn Null, HED doctoral candidate, SIUC.

Figure 4. The cook standing next to the stove in the kitchen of the Miss Kris tow boat.

Figure 5. Refrigerators, a freezer, and an ice machine in the kitchen of the Miss Kris. Due to the size of the kitchen, home refrigerator/freezer storage is typical on a tow boat.

Figure 6. The pilot (or captain) steers the tow boat up the narrow curves and under a bridge of the Cumberland River. As you can see in this picture, the pilot and captain have limited space to move while steering the vessel.

Figure 7. This picture is represents what the pilot is seeing as he is navigating the vessel under the bridge. There are 5 rows of 3 barges each in front of the Miss Kris.

Figure 8. This picture depicts the narrow walkways around the tow boat.

Figure 9. The tow boat has 3 to 4 levels above water. A narrow, steep set of stairs connects the main floor to the wheelhouse with a landing halfway up each flight. There is enough room for one person to pass while another waits on the landing.

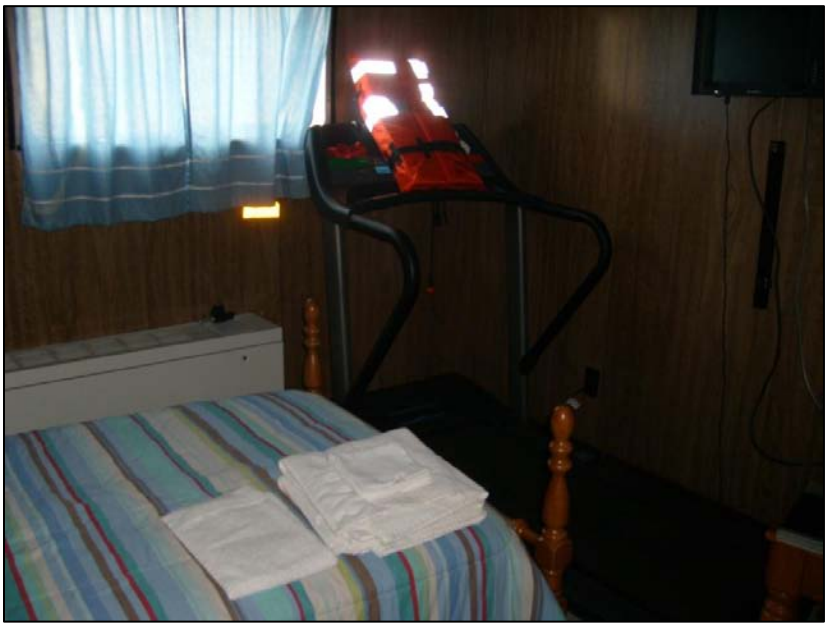


Figure 10. This is a guest room with a treadmill in it. The space is very small with very little walking space between the bed and the treadmill.

Figure 11. This is the crew lounge. The picture is taken from the doorway. There is room for about 3 people to watch television.

Figure 12. Dawn Null with Sheila and Jennifer Edwards. Sheila is one of the Marquette cooks that has been to the Nutrition trainings. We are holding up more nutritious items that Sheila has started buying as a result of the training.

Figure 13. The gentleman on the far left is the captain of this vessel, the Limestone Lady. The two other men are deckhands.

APPENDIX D

SIUC HUMAN SUBJECTS APPROVAL

FOR THE PILOT STUDY AND DISSERTATION STUDY

AND

BARGE COMPANY PERMISSION TO REQUEST EMPLOYEE PARTICIPATION

IN RESEARCH STUDY

SIUC HSC FORM A

REQUEST FOR APPROVAL TO CONDUCT RESEARCH ACTIVITIES INVOLVING HUMAN SUBJECTS

CERTIFICATION STATEMENT

By making this application, I certify that I have read and understand the University's policies and procedures governing research activities involving human subjects. I agree to comply with the letter and spirit of those policies. I acknowledge my obligation to:

1. Accept responsibility for the research described, including work by students under my direction.
2. Obtain written approval from the Human Subjects Committee of any changes from the originally approved protocol **BEFORE** implementing those changes.
3. Retain signed consent forms in a secure location separate from the data for at least **three** years after the completion of the research.
4. Immediately report any adverse effects of the study on the subjects to the Chairperson of the Human Subjects Committee, SIUC, Carbondale, Illinois - 618-453-4533 and to the Director of the Office of Research Development and Administration, SIUC.
   Phone 618-453-4531. E-mail: **siuhsc@siu.edu**

Project Title

A Study of Living and Working on the Towboat: What are the Health and Nutrition Implications?

RESEARCH ADVISOR'S ASSURANCE: My signature on this application certifies that the student is knowledgeable about the regulations and policies governing research with human subjects. I am aware of my obligations stated on Form A and will be available to supervise the research. When on sabbatical leave or vacation, I will arrange for an alternate faculty sponsor to assume responsibility during my absence. I will advise the Human Subjects Committee by letter of such arrangements.

Kathleen J Welshimer Dawn Null 3-8-2011

Researcher(s) or Project Director(s) **Dawn Null, MS, RD** Date

Please print or type name below signature.

Kathleen J Welshimer

Researcher's Advisor (required for all student projects) **Dr. Kathleen Welshimer** Date

Please print or type name below signature.

The request submitted by the above-named researcher(s) was approved by the SIUC Human Subjects Committee.

This approval is valid for one year from the approval date. Researchers must request an extension to continue the research after that date. This approval form must be included in all Master's theses/research papers and Doctoral dissertations involving human subjects that are submitted to the Graduate School.

Janet Swanson 3-18-11

Chairperson, Southern Illinois University Human Subjects Committee Date

CROUNSE CORPORATION

River Transportation

400 MARINE WAY
PADUCAH, KENTUCKY 42003
PHONE 270-444-9611
FAX 270-444-9615

March 17, 2011

Ms. Dawn Bloyd Null, MS, RD, LDN
Instructor
Coordinator, Dietetic Internship Program
Department of Animal Science, Food and Nutrition
Mailcode 4317
Southern Illinois University Carbondale
Carbondale, IL 62901

Dear Ms. Null:

We support your research proposal - **A Study of Living and Working on the Towboat: What are the Health and Nutrition Implications?**

Your project will benefit our industry by being the first of its kind to look at the health and nutrition status of towboat crew. Moreover, the identification of perceived barriers to healthy eating and physical activity on the towboat, will allow us to explore ways to minimize the barriers and promote healthier living on the boat.

This is a worthwhile research project. We grant you permission to contact and offer our employees the opportunity to participate in the research.

Please accept my support for this project.

Sincerely,

Jack Buri

Jack Buri
Manager-Safety & Training

Hunter Marine

P. O. Box 3490 • Paducah, Kentucky 42002-3490
• Telephone: (270) 444-7011 • Fax: (270) 444-7079
www.HunterMarine.net

dhall@huntermarine.net

April 28, 2011

Subject: Research Project

Dear Ms. Null:

Please allow this letter to serve as Hunter Marine's show of support and endorsement of your research proposal - **A Study of Living and Working on the Towboat: What are the Health and Nutrition Implications?**

We believe your project will benefit our industry by being the first of its kind to look at the health and nutrition status of towboat crews. Moreover, the identification of perceived barriers to healthy eating and physical activity on the towboat will allow us to explore ways to minimize the barriers and promote healthier living while underway.

This truly is a worthwhile research project. We grant you permission to contact and offer our employees the opportunity to participate in the research.

Again, please accept my personal support and that of Hunter Marine as you continue this project.

Sincerely,

Donnie Hall
Director, Safety & Risk Management
Hunter Marine

RESPONSIBLE CARRIER PROGRAM

HUNTER

APPENDIX E

PERMISSION TO ADAPT KRISTAL'S FOOD HABITS QUESTIONNAIRE

Kristal Food Habits Questionnaire

6 messages

Dawn Null <dawnnull@siu.edu> **Mon, Nov 29, 2010 at 2:16 PM**
To: akristal@fhcrc.org

Hello Dr. Kristal,

My name is Dawn Null, and I am a student at Southern Illinois University Carbondale working on my PhD in Health Education. My research is focusing on nutrition and physical activity of river barge crew. I have been reviewing different measures to assess diet quality, and I am interested in using your Food Habits Questionnaire for my dissertation research. Could I please adopt this tool for use in my dissertation research? Also, is the 1997 21-item Kristal Food Habits Questionnaire the most recent? Lastly, For your perusal, I have included my study purpose below.

Study Purpose:

Living and working on a river barge for 21-30 days continuously has potential health and wellness implications. The Coast Guard, who regulates the river barge industry, is set to impose Body Mass Index (BMI) requirements on licensed barge personnel including captains and pilots, within the next two to three years. To date, there is no published research describing the perceived health status of river barge employees, perceived benefits and barriers to good health, and motivation to meet impending BMI requirements.

I very much look forward to hearing from you. Thank you in advance for your assistance.

Sincerely,
Dawn Null

--
Dawn Bloyd Null, MS, RD, LDN
Instructor
Coordinator, Dietetic Internship Program
Department of Animal Science, Food and Nutrition
Mailcode 4317
Southern Illinois University Carbondale
Carbondale, IL 62901
Phone 618.453.5192
Fax 618.453.7517

Find us on Facebook!!
Southern Illinois University Dietetic Internship Program

Dawn Null <dawnnull@siu.edu> **Mon, Nov 29, 2010 at 3:01 PM**
To: mwelling@fhcrc.org

Hello Ms. Welling,

I had emailed Dr. Kristal to obtain his permission to use his Food Habits Questionnaire. I see that he is unavailable until the 13th of December, and that you are his contact person. I was hoping to adopt his instrument and pilot test it within the next couple of weeks. Do you know if this is possible? If not, I'm happy to wait until his return for an answer.

Thanks so much! Happy Holidays!

Sincerely,
Dawn Null

Welling, M J <mwelling@fhcrc.org> **Mon, Nov 29, 2010 at 3:15 PM**
To: Dawn Null <dawnnull@siu.edu>

Hi Dawn,

Is this the instrument you want to use? It is free for you to to use as you wish.

I am not sure about the validity of modifications to the form... Dr. Kristal may reply, as he has been on email today.

MJ Welling
FHCRC
206/667-7208

From: Dawn Null [mailto:dawnnull@siu.edu]
Sent: Monday, November 29, 2010 1:02 PM
To: Welling, M J

Fat related diet habits - eating patterns.pdf
169K

Dawn Null <dawnnull@siu.edu> **Mon, Nov 29, 2010 at 3:33 PM**
To: "Welling, M J" <mwelling@fhcrc.org>

Yes, that is it! Thanks so much!

Dawn

Kristal, Alan R <akristal@fhcrc.org> **Wed, Dec 8, 2010 at 5:16 AM**

To: Dawn Null <dawnnull@siu.edu>
Cc: "Welling, M J" <mwelling@fhcrc.org>

Hello Dawn Null

The latest version I have, which is quite old, will be sent to you later today. You may and indeed should revise this questionnaire for your purposes. It's more of a method than a product fixed in stone. Others have used and revised the instrument, not all as I would but no matter, and a quick look at google scholar for papers referencing the original will make these easy to find

(MJ-would you please send the documentation?)

Best of luck with your project

Alan Kristal

Dawn Null <dawnnull@siu.edu> **Wed, Dec 8, 2010 at 9:30 AM**
To: "Kristal, Alan R" <akristal@fhcrc.org>

Hi Dr. Kristal,

Thanks so much! Have a nice holiday!

Dawn

APPENDIX F

LETTERS REQUESTING PARTICIPATION

NUTRITION, HEALTH & PHYSICAL ACTIVITY INSTRUMENT

AND

THE SPSS CODED INSTRUMENT

Dear Employee,

My name is Dawn Null, and I am a graduate student at Southern Illinois University Carbondale. For my dissertation research, I am studying towboat cooks, deck hands, engineers, pilots, and captains' perceptions of how life on the towboat affects health. I am using the attached survey to assess perceived benefits and barriers to physical activity and healthy eating practices, as well as motivation to meet USCG physical and BMI guidelines. In addition, I am collecting physical measurements including height, weight, and waist circumference.

Return of the questionnaire and participation in the physical measurements constitutes willingness to participate in the study. Your responses will be kept confidential, and I will take all reasonable steps to protect your identity. The data will be stored in a secure location and will be destroyed upon completion of the study. Only myself and the faculty advisor mentioned below will have access to the survey data.

If you have any questions about this project, please come talk to me!
Thank you in advance!

Dawn Null, MS, RD
Southern Illinois University
Carbondale, IL 62901
618-453-5193
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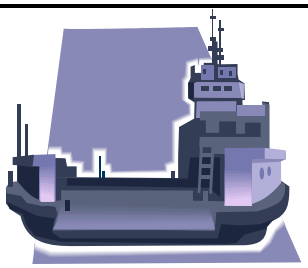

Participant's Agreement:

I am aware that my participation in this study is voluntary. I understand the intent and purpose of this research. If, for any reason, at any time, I decide not to participate, I may do so without having to give an explanation.

I have been offered a copy of this consent form that I may keep for my own reference.

I have read the above form and, with the understanding that I can withdraw at any time and for whatever reason, I consent to participate in today's study.

_____ _____

Participant's signature Researcher or Data Collector's signature

Questions concerning your rights as participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone (618) 453-4533. Email: siuhsc@siu.edu.

Nutrition, Health & Physical Activity Assessment

I am trying to learn a little about how living on a tow boat affects your health. Please take a few minutes to complete this anonymous survey. Please check (✔) those items that apply.

Some people exercise a lot, some not at all. Please think about how many times per week you typically exercise **on the boat** and respond accordingly.

	0 days	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**	**6 days**	**7 days**
1. In a typical **week on the boat**, how many times do you exercise for at least 20 minutes that makes you sweat and breathe hard, like jogging on a treadmill, stationary bicycle, jumping on a mini trampoline or similar aerobic activity?								
2. In a typical **week on the boat**, how many times do you do stretching exercises, such as toe touching, knee bending, or leg stretches?								
3. In a typical **week on the boat**, how many times do you do muscle-strengthening activities such as push-ups, sit-ups, or weight lifting?								
4. In a typical **week on the boat**, how many times do you walk for at least 30 minutes at a time?								

Whether you are exercising or not, think about how living and working on the boat affects your physical activity. Also, think about how exercising might benefit you.

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
5. Exercising is good for my blood pressure.	❍	❍	❍	❍	❍
6. Exercising will decrease my cholesterol.	❍	❍	❍	❍	❍

7. Exercising will inspire crew working with me.	❍	❍	❍	❍	❍
8. Exercise will increase my energy level.	❍	❍	❍	❍	❍
9. Exercise will help me feel better.	❍	❍	❍	❍	❍
10. Exercise will reduce my stress level.	❍	❍	❍	❍	❍
11. Exercise will help me lose weight.	❍	❍	❍	❍	❍
12. I worry that I will get injured if I exercise.	❍	❍	❍	❍	❍
13. Exercise will help me be more fit.	❍	❍	❍	❍	❍
14. Exercise will help me live longer.	❍	❍	❍	❍	❍
15. It is hard to make time to exercise.	❍	❍	❍	❍	❍

Whether you are eating healthy or not, think about how living and working on the boat affects how you eat. Also, think about how eating healthy might benefit you.

ON THE BOAT . . .	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
16. Healthy food doesn't taste good.	❍	❍	❍	❍	❍
17. Healthy food costs too much.	❍	❍	❍	❍	❍
18. The cooks would have to be re-trained to cook healthy foods.	❍	❍	❍	❍	❍
19. Good southern cooking is a tradition, and a benefit to working on the boat, that the crew looks forward to.	❍	❍	❍	❍	❍
20. It's easy to eat healthy on the boat by taking smaller servings.	❍	❍	❍	❍	❍
21. It's hard not to take seconds when there is such good food available.	❍	❍	❍	❍	❍
22. Food is accessible all of the time, so it is easy to over eat.	❍	❍	❍	❍	❍
23. All of the good desserts available make it hard to eat healthy.	❍	❍	❍	❍	❍

24. The crew doesn't want a healthy diet.	❍	❍	❍	❍	❍
25. There is limited space to store fresh fruits and vegetables.	❍	❍	❍	❍	❍
26. Preparing fresh veggies as a snack would be a waste of time and money since they wouldn't get eaten.	❍	❍	❍	❍	❍
27. I would eat healthier if the cook would make healthier meals.	❍	❍	❍	❍	❍
28. Eating healthy will make me feel better.	❍	❍	❍	❍	❍
29. Eating healthy will help me live longer.	❍	❍	❍	❍	❍
30. Eating healthy will make me more alert.	❍	❍	❍	❍	❍
31. Eating healthy will help lower my cholesterol.	❍	❍	❍	❍	❍
32. Eating healthy will help me control my weight.	❍	❍	❍	❍	❍
33. Eating healthy will help me lower my blood pressure.	❍	❍	❍	❍	❍

MOTIVATION TO MEET U.S.C.G. PHYSICAL ABILITY GUIDELINES	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
34. I would eat healthier if my family would encourage me to.	❍	❍	❍	❍	❍
35. I would eat healthier more if my crew would encourage me to.	❍	❍	❍	❍	❍
36. I would exercise more if my family would encourage me to.	❍	❍	❍	❍	❍
37. I would exercise more if my crew would encourage me to.	❍	❍	❍	❍	❍
38. I would reduce fat in my diet to reduce my cholesterol, if I had to, to keep my job.	❍	❍	❍	❍	❍

39. I would lose weight if I had to, to keep my job.	❍	❍	❍	❍	❍
40. If there were company incentives, I would eat healthier and exercise more.	❍	❍	❍	❍	❍
41. If there was a friendly competition among tow boats on who has the healthiest crew, myself and my crew would eat healthier and exercise more so we could win.	❍	❍	❍	❍	❍
42. I would be more likely to exercise if other crew members on the boat would exercise.	❍	❍	❍	❍	❍

ON THE BOAT . . .	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
43. There is limited space on the boat to exercise.	❍	❍	❍	❍	❍
44. I can usually walk on the tow to get exercise.	❍	❍	❍	❍	❍
45. The weather often prevents me from walking on the tow.	❍	❍	❍	❍	❍
46. The most exercise I get is going from the wheelhouse down the stairs to the kitchen to eat and back up.	❍	❍	❍	❍	❍
47. It's hard to exercise on the boat because of my shifts.	❍	❍	❍	❍	❍
48. It's harder to exercise if there is no equipment (treadmill, a stationary bicycle, and/or weights, etc.) on the boat.	❍	❍	❍	❍	❍
49. The noise on the boat makes it hard for me to exercise.	❍	❍	❍	❍	❍
50. Bringing my own exercise equipment makes it easier to exercise on the boat.	❍	❍	❍	❍	❍

51. The lack of privacy on the boat makes it hard for me to exercise.	❍	❍	❍	❍	❍
52. The good southern cooking on the boat makes it easy for me to over eat.	❍	❍	❍	❍	❍
53. There are healthy snacks like fresh fruit and vegetables available most times.	❍	❍	❍	❍	❍
54. Snack foods like Little Debbie snack cakes are hard to resist.	❍	❍	❍	❍	❍

Please think about the food choices in the past MONTH. Important Note: If the question does not apply to the way you eat, please choose “Not Applicable”. For example, if you do not eat chicken, choose “Not Applicable” to “remove the skin from chicken”.

IN THE PAST MONTH WHILE ON THE BOAT . . .	Usually or Always	Often	Sometimes	Rarely or Never	Not Applicable
55. When you ate breakfast, how often did you eat biscuits and sausage gravy?	❍	❍	❍	❍	❍
56. When you ate breakfast, how often did you eat biscuits with no gravy?	❍	❍	❍	❍	❍
57. When you ate breakfast, how often did you eat bacon?	❍	❍	❍	❍	❍
58. When you ate breakfast, how often did you eat eggs?	❍	❍	❍	❍	❍
59. When you ate breakfast, how often did you eat cereal, such as Cheerios or oatmeal?	❍	❍	❍	❍	❍
60. When you ate bread, how often did you eat white bread or toast?	❍	❍	❍	❍	❍
61. When you ate bread, how often did you eat 100% wheat or whole grain bread or toast?	❍	❍	❍	❍	❍
62. When you ate chicken, how often was it fried?	❍	❍	❍	❍	❍
63. How often did you remove the skin from chicken?	❍	❍	❍	❍	❍

64. When you eat steak, how often do you trim all the visible fat?	❍	❍	❍	❍	❍
65. When you eat fish, how often is it fried?	❍	❍	❍	❍	❍
66. How often did you have a vegetarian dinner (main meal without meat, fish, eggs, or cheese)?	❍	❍	❍	❍	❍
67. When you ate spaghetti or noodles, how often were they plain, or with a red or tomato sauce without meat?	❍	❍	❍	❍	❍
68. When you ate a meal, how often did you include a starchy vegetable such as corn, potatoes (not fried), peas?	❍	❍	❍	❍	❍
69. When you ate a meal, how often did you include a non-starchy vegetable such as green beans, broccoli, cauliflower, tomatoes, or carrots?	❍	❍	❍	❍	❍
70. When you ate cooked vegetables, how often did you add butter, margarine, or other fat?	❍	❍	❍	❍	❍
71. When you ate cooked vegetables, how often did you add salt?	❍	❍	❍	❍	❍
72. How often were the vegetables fried?	❍	❍	❍	❍	❍
73. When you ate potatoes, how often were they fried, like French fries, hash browns, or tator tots?	❍	❍	❍	❍	❍
74. When you ate baked or boiled potatoes, how often did you eat them **without** any butter, margarine, sour cream, or gravy?	❍	❍	❍	❍	❍
75. When you ate baked or boiled potatoes, how often did you eat them **without** any added salt?	❍	❍	❍	❍	❍

76. When you ate salad, how often did you use low-fat or non-fat dressing?	❍	❍	❍	❍	❍
77. When you ate bread, rolls, or muffins, how often did you eat them **without** butter or margarine?	❍	❍	❍	❍	❍
78. When you ate a meal, how often did you include a fruit?	❍	❍	❍	❍	❍
79. When you ate hamburgers, how often do you have cheese on it?	❍	❍	❍	❍	❍
80. When you ate dessert, how often did you eat only fruit (not fruit pie)?	❍	❍	❍	❍	❍
81. How often did you eat home-baked cookies, cakes, or pies?	❍	❍	❍	❍	❍
82. When you ate frozen desserts, how often did you choose frozen yogurt, sherbet, or low-fat ice cream?	❍	❍	❍	❍	❍
83. When you ate snacks between meals, how often did you eat raw vegetables or fresh fruit?	❍	❍	❍	❍	❍
84. When you ate snacks between meals, how often did you eat snack cakes such as Swiss cake rolls or oatmeal pies?	❍	❍	❍	❍	❍
85. When you used mayonnaise or mayonnaise-type spread, how often did you choose low-fat or nonfat types?	❍	❍	❍	❍	❍
86. I add salt to my meals.	❍	❍	❍	❍	❍
87. When you drank milk, how often was it whole milk?	❍	❍	❍	❍	❍
88. When you drank milk, how often was it 2% milk?	❍	❍	❍	❍	❍
89. When you drank milk, how often was it 1% or skim	❍	❍	❍	❍	❍

milk?					
90. When you drank soda, how often was it regular soda (not diet)?	❍	❍	❍	❍	❍
91. When you drank tea, how often was it sweetened?	❍	❍	❍	❍	❍

Tell me about yourself! **TOWBOAT COMPANY:_____**

92. Which category describes you? ***Please check only one!*** ❍ I'm not interested in making any changes to my lifestyle. ❍ I have been thinking about changing some of my health behaviors. ❍ I am planning on making a health behavior change within the next 30 days. ❍ I have made some health behavior changes but I still have trouble following through. ❍ I have had a healthy lifestyle for years.	93. I would describe my overall health as . . . ❍ Excellent ❍ Good ❍ Fair ❍ Poor
94. Have you been diagnosed by a healthcare provider as having any of these conditions? ***Check all that apply.*** ❍ High Cholesterol ❍ High Blood Pressure ❍ Heart Disease ❍ Diabetes	95. How old are you? ❍ 18-24 ❍ 25-34 ❍ 35-44 ❍ 45-54 ❍ 55-64 ❍ 65+
96. Do you smoke? ❍Yes ❍No ❍Yes, but trying to quit	97. How do you describe yourself? *(please mark all that apply)* ❍ White, non Hispanic (includes Middle Eastern) ❍ Black, non Hispanic ❍ Hispanic or Latino/a ❍ Asian or Pacfic Islander ❍ American Indian, Alaskan Native, or Native Hawaiian ❍ Biracial or Multiracial ❍ Other
98. Have you smoked at least 100 cigarettes in your lifetime? **1**❍Yes **2**❍No	
99. What is your job title? ❍ Wheelhouse Officer ❍ Engineer ❍ Deckhand ❍ Cook ❍ Other	100. **Weight: _____ pounds** 101. **Height: _____ ft _____inches**

106. What is your gender? ❍Female ❍Male	102. **Waist circumference: _____ inches** **Or pant waist size: _____** 103. **Body Fat: _____ %** 104. **BMI: _____** 105. ***Self-Report___ Researcher Initials___***
107. What is the highest level of education you have completed? ❍ Less than high school ❍ High school/GED ❍ Some college ❍ College degree (Associates, Bachelors, Masters)	108. How many years have you been working on the river? (please write in) _____years ***THANK YOU!!***

VITA

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Dissertation Title:

A Study of Living and Working on the Towboat:

What are the Health & Nutrition Implications?

Major Professor: Kathleen Welshimer