2016

Environmental Factors Associated With Body Mass Index Among Long Haul Truck Drivers

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Walden University
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Abstract

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MPH, Walden University, 2010

BA, Thomas Edison State College, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2016

Abstract

In 2009–2010, the prevalence of obesity among U.S. adults was 40%, and the prevalence was 69% among long haul truck drivers. Researchers have not established a clear relationship between working environment and weight among truck drivers. This quantitative cross-sectional study, using an ecological framework, evaluated the relationship between the working environment (sleep performance, food choices, driving environment, and activity level) and weight severity (e.g., body mass index [BMI]) among long haul truck drivers. One hundred and twenty six adults (46 ± 10, years of age), including both genders (male = 97 and females = 29) completed an online questionnaire evaluating their weight and work environment. BMI ranged between 19.7–77.0 (35.4 ± 11.0) kg/m^2among respondents. None of the respondents were underweight, 20 were healthy weight, 28 were overweight, and 78 were obese. Using multiple regression analysis, no statistically significant associations were found between the working environment and weight severity. Statistically significant ($p < 0.05$) mean differences between weight groups were found using a 1-way ANOVA. Regarding physical activity level, there was a statistically significant difference between the overweight and obese Class II groups ($M = 1.034$, $p = .026$). There was also a statistically significant difference between the overweight and obese Class III groups ($M = -.506$, $p < 0.001$) regarding physical activity within the prior month. The findings of this study support the need for further research to advance the knowledge of associations between weight groups and physical activity among this population, which could promote positive social change by guiding public health officials and trucking industry stakeholders toward effective interventions to reduce BMI among long haul truck drivers.

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Dedication

Completing this doctoral study was only possible with the strength and love given to me from God, my heavenly father. I thank my husband for always encouraging me and being my biggest cheerleader. I thank my mother for teaching me the meaning of hard work and determination. Thank you Christopher, Christian, and Amber, for patience and unyielding support throughout this entire journey. Thank you to all of my family and close friends for your understanding and for your prayers.

I dedicate this doctoral study to the memory of Dr. Arthur Wozniak, my mentor and friend.

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Chapter 1: Introduction to the Study

Introduction

Long haul truck drivers venture more than 100 miles from home and often spend weeks at a time traveling over the road to transport cargo, freight, and other goods from points of manufacture or import to various destinations across the United States (Stasko & Neale, 2007). The freight transportation industry has had a tremendous economic impact with industry growth greater than 60% between 1975 and 1997, and expected growth of 70% by the year 2020 (Sedor & Onder, 2006). Federal regulations promote driver safety by imposing restrictions on driving times, with required nondriving times within a 24 hour period (Sedor & Onder, 2006). However, driving for long hours yields a sedentary working environment for drivers and increases their chances of becoming obese and developing other health problems, compared to the general public (Apostolopoulos et al., 2011).

Over the last three decades, the occurrence of global obesity has continuously increased (Dixon, 2010). The prevalence of obesity among American adults more than doubled between the time frames of 1976 to1980 and 2007 to 2008 (Ogden & Carroll, 2010). Between the time periods of 2003 to 2004 and 2011 to 2012, the prevalence of obesity among Americans remained high, but did not change (Ogden, Carroll, Kit, & Flegal, 2014). Obesity negatively impacts health and quality of life and is associated with many other chronic conditions (Ogden, Carroll, Kit, & Flegal, 2014). In the United States, over 80% of truck drivers are either overweight or obese (Apostolopoulos, Sönmez, Shattell, & Belzer, 2012a; Apostolopoulos, Sönmez, Shattell, Gonzales, & Fehrenbacher, 2013).

The negative health impact of obesity among long haul truck drivers is a public health problem (Stasko & Neale, 2007). In this study, I focused on long haul truck drivers and how the sedentary working environment, lack of healthy food choices, physical activity, and sleep performance within the working environment may contribute to high body mass index (BMI). The findings of this study could guide public health officials and trucking industry stakeholders toward interventions to reduce BMI among long haul truck drivers.

Background

BMI is expressed as weight in kilograms divided by height in meters squared (kg/m^2) and is commonly used to categorize obesity. The Centers for Disease Control and Prevention (CDC) classifies overweight as a BMI of 25.0–29.9 kg/m2, and obese as a BMI equal to or greater than 30.0 kg/m2 (CDC, 2012; Ogden & Carroll, 2010). Obesity has a considerable bearing on physical and mental health and quality of life for those affected and the community. Increasing levels of obesity are associated with cardiovascular disease, Type 2 diabetes, osteoarthritis, psychological disorders, and obesity related cancers (Dixon, 2010).

Selected articles relating to the lifestyle, health, and morbidity of long haul truck drivers provided the background for this study. In a 10-year follow-up study, lifestyle-related diseases in long haul truck drivers were compared to other truck drivers (Dahl et al., 2009). A group of 2,175 long haul truck drivers were compared to 15,060 other truck drivers, and long haul drivers were found to have stronger associations with lifestyle-related diseases, including obesity (Dahl et al., 2009).

In a mixed methods study, researchers examined the special health needs of long haul truck drivers, which included obesity and their limited access to health care (Stasko & Neale, 2007). Data from Stasko & Neale's (2007) study indicated 10% of study participants had been diagnosed with heart disease, 59% complained of backaches, and 47% of participants reported falling asleep at the wheel at least once. Suggestions were made for health clinics at truck stops and for adding parking for large truck vehicles at hospitals, pharmacies, and other medical facilities for drivers to more easily access healthcare.

Jacobson, Prawitz, and Lukaszuk (2007) conducted a descriptive cross-sectional study in Illinois to assess healthful food choices of long haul truck drivers. The researchers hypothesized that overweight and obese drivers would not care as much about healthful food choices compared to normal weigh drivers. In this study, no difference in healthy food choices between overweight, obese, and normal weight drivers was found. Additionally, drivers who chose healthy foods also had more favorable attitudes toward restaurants that provided healthy food choices (Jacobson et al., 2007). Since there is no difference in healthy food choices between overweight, obese, and normal weight drivers, assessing the eating habits of drivers in all weight categories was important in order to examine the possible association between eating habits and obesity among this population.

Obstructive sleep apnea (OSA), excessive daytime sleepiness (EDS), and fatigue have been associated with obesity (Anderson et al., 2012). Sleep is a significant regulator of metabolic functions within the body, which alter the body's ability to manage hunger, appetite, and levels of energy (Anderson et al., 2012). Laboratory and epidemiological findings have supported an association between sleep loss and increased risk of obesity (Beccuti & Pannain, 2011). Considering the necessity for drivers to be alert and attentive, sleeping habits were assessed as an environmental factor in this study as they relate to BMI among long haul truck drivers

Problem Statement

There is poor health outcomes associated with the job of long haul truck driving. However, researchers have not yet established a clear relationship between the working environment and BMI among truck drivers. Additionally, no other studies have examined the extent to which the working environment contributes to poor health.

Purpose of Study

In this research study, I evaluated the relationship between the working environment and BMI among long haul truck drivers. In addition, through the study, I examined the extent to which the working environment may contribute to BMI. Findings of this study could lead toward focused interventions that reduce BMI and improve health outcomes among long haul truck drivers.

Research Questions and Hypotheses

The original research questions (RQs) addressed the association between the independent variables (e.g. work environment, eating habits, frequency of physical activity level, and quality of sleep) and the dichotomous dependent variable of obesity. However, because the majority of respondents were obese, the dependent variable was changed to the continuous variable of BMI. The amended RQs were as follows:

RQ1: Is there an association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers?

$H_0 1$: There is an association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers.

$H_1 1$: There is no association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers.

RQ2: Is there an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers?

$H_0 2$: There is an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers.

$H_1$2: There is no association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers.

RQ3: Is there an association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers?

$H_0$3: There is an association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers.

$H_1$3: There is no association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers.

RQ4: Is there an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers?

$H_0$4: There is an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers.

$H_1$4: There is no association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers.

Theoretical Framework for the Study

For this research study, I used the ecological perspective as a component of the framework. The ecological perspective provides an opportunity to explore factors at the personal and environmental level, as it refers to the interaction between a person and his or her environment (Glanz, Rimer, & Viswanath, 2008). The ecological perspective explains that specific health behaviors may have multiple levels of influence, and these factors can interact across different levels (Glanz et al., 2008). Factors on the personal and environmental levels can be bidirectional (Glanz et al., 2008). Therefore, the environment of long haul truck drivers can influence food choice, activity, and sleep behaviors.

Nature of the Study

To answer the research questions, I chose a cross-sectional research design using a quantitative approach for the study. A modified version of the Behavioral Risk Factor Surveillance System (BRFSS) used to collect demographic data of participants ("CDC - BRFSS Questionnaires," n.d.). A previously validated questionnaire, the Health Behaviours Survey, was used to collect data relating to physical activity, sleep, and eating habits (Lee, Lemyre, Turner, Orpana, & Krewski, 2008). I then used the resulting data to examine possible correlations between identified independent variables (e.g., work environment, eating habits, physical activity, and quality of sleep) and the dependent variable, BMI.

Definitions

Body mass index (BMI): A measure expressed as weight in kilograms divided by height in meters squared (kg/m^2); calculated the same for male and female (U.S. Department of Health & Human Services, 2015) commonly used to categorize obesity (Ogden & Carroll, 2010).

*Eating habits***:** The amount and type of food consumed regularly; diet (Templeton et al., 2013); fast food consumption, convenience store food consumption, and eating breakfast.

Ecological perspective: The models of health behavior that considers multiple levels of influence on behavior emphasizing environmental, social, and psychological influences (Glanz et al., 2008).

Long haul truck driver: Truck drivers who travel more than 100 miles from home transporting freight, cargo, and other goods (Stasko & Neale, 2007).

Normal weight: A range of weight that is considered healthy for a given height; BMI between 18.5 and 24.9 is considered normal weight (CDC, 2012).

Obesity: A range of weight that is considered unhealthy for a given height; BMI of 30 or higher is considered obese (CDC, 2012).

Overweight: A range of weight that is considered unhealthy for a given height; BMI between 25 and 29.9 is considered overweight (CDC, 2012).

Physical activity: Movement of the body that results from use of skeletal muscles and uses energy (WHO n.d.). Measured as days per week and minutes per day.

Quality of sleep: A measure of the required resting period of the body and mind (Beccuti & Pannain, 2011); the amount of daily sleep and daytime sleepiness.

Truck stop: A facility providing fuel, parking, and dining with specific accommodations for commercial trucks (Federal Motor Carrier Safety Administration [FMCSA], 2005).

Underweight: A range of weight that is considered unhealthy for a given height; BMI < 18.5 is considered underweight (CDC, 2012).

Work environment: The climate in which job duties are performed (Apostolopoulos et al., 2013). For truck drivers, this would include drive time, drive distance, and driving days per week.

Assumptions and Limitations

Participants reported their height and weight and my assumption was that the information they provided was accurate. Physical measurements were not conducted. Since height and weight are used to calculate the BMI, incorrect reporting of height or weight would generate an inaccurate BMI, which would impact the findings of the study.

The potential for selection bias was a limitation of the study. Participants were recruited and the questionnaire administered using Internet sources. Online surveys do not have to be administered by an interviewer and do not require postage. Therefore, they were much less expensive to use (Szolnoki & Hoffmann, 2013). However, drivers who were not able to access the Internet were unable to participate in the study, and this inability to participate was a limitation of the study.

In this study, I assessed associations between BMI scores and independent variables among one population group. The small sample size was not representative of the whole population of long haul truck drivers. Therefore, the findings of this study cannot be generalized to the whole population. However, the findings can be generalized to long haul truck drivers who used social media to participate.

Scope

I designed this study to focus on a sample of the population of long haul truck drivers in the United States. This population has been associated with poor health outcomes, including obesity. It was my hope that by focusing on this population, the findings may ultimately lead to improvements in health outcomes among long haul truck drivers. In this study, I examined the relationship between their working environment and BMI and the extent to which the working environment may contribute to BMI.

Significance

Obesity has been identified as a public health problem, negatively impacting long haul truck drivers and providing them with poor health outcomes (Stasko & Neale 2007). With this study, I focused on long haul truck drivers and how their sedentary working environment, lack of healthy food choices, and sleep performance (e.g., sleep duration, OSA, etc.) within the working environment may contribute to BMI. The results of this study have the potential to effect positive social change by providing information about the association between working environmental factors of long haul truck drivers and BMI. Additionally, the findings could guide public health officials and trucking industry stakeholders toward interventions that might reduce the risk of obesity among long haul truck drivers.

The results of this study might also generate effective interventions that reduce risks and also provide, promote, and encourage healthier lifestyles for long haul truck drivers. Improvements may include promotion and education about the benefits of improved nutrition and physical activity for long haul truck drivers. Improvements may also include provisions for healthier food choices at truck stops and increased options and opportunities for exercise for drivers at truck stops so that physical activity can be increased and maintained. Healthier diet and increased physical activity among long haul truck drivers might improve overall health and productivity and might reduce the risk for obesity and diseases associated with obesity. Improved sleep behaviors might reduce the risk of associated diseases, such as OSAS and EDS, as well as decrease fatigue and improve productivity.

Summary

In Chapter 1, I introduced the study of environmental factors that may be associated with BMI among long haul truck drivers. I stated the research problem as well as provided a concise statement of the purpose and nature of this study. The theoretical base and framework of the study was provided, as it relates to answering the research questions. I provided definitions for terms that will be used throughout the remaining chapters. Additionally, the limitations and assumptions associated with this study were stated. I also identified the gap in literature, which I will address in this study by attempting to establish a clear relationship between the working environment and obesity among long haul truck drivers. Chapter 2 will consist of an in-depth review of the literature that exists. My review of the literature will also provide a background for this study.

Chapter 2: Literature Review

Introduction

There is poor health outcomes associated with the job of long haul truck driving. However, researchers have not established a definitive relationship between the working environment and obesity among long haul truck drivers. In addition, there is limited research examining the extent to which the working environment contributes to poor health. In Chapter 2, I will discuss my literature search strategy and the theoretical basis of the study. Additionally, I will provide an extensive review of the current literature to explain what is known and unknown about the variables and how in this study, I sought to add to the existing literature and extend knowledge about the working environment of long haul truck drivers and obesity among this population.

Literature Search Strategy

My literature search focused on the association between the work environment of long haul truck drivers and obesity. Predictor variables, such as physical activity, eating habits, and quality of sleep, among long haul truck drivers were researched as well as the impact of these factors on obesity. I found studies noting the connection between physical activity and obesity, eating habits and obesity, and quality of sleep and obesity. A limited amount of literature was found supporting the significant poor health and prevalence of chronic diseases among long haul truck drivers compared to the general population. However, my review of the literature exposed a scientific gap addressing the risk of obesity and level of influence of the work environment, physical activity, eating habits, and quality of sleep on obesity among long haul truck drivers.

The databases I used for my search of the literature search included Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline, Pub Med, Science Direct, BioMed Central, and Google Scholar. Only studies published between January 2004 and the present were included. Keywords reflected the dependent and independent variables related to long haul truck drivers including *obesity, health and lifestyle, working environment, commercial driving regulations and policy, eating habits,* and *quality of sleep*. The application of ecological theories was searched and included as it related to the study. A total of 37 sources met the criteria for inclusion in this literature review.

Theoretical Foundation

Ecology relates to the interaction between organisms and their environments originating from biological science (Glanz et al., 2008). Ecological models have been developed in behavioral sciences and public health and are directed toward the interaction between people and their environments (Lee et al., 2011; Scott & Wilson, 2011; Shimotsu, French, Gerlach, & Hannan, 2007; Whittemore, Melkus, & Grey, 2004). The distinguishing feature of ecological models, compared to behavioral models and theories, is the environmental levels of influence (Glanz et al., 2008). Behavioral models focus on individual factors and the influence of close family and friends (Lee et al., 2011). In behavioral models, the larger community, organizations, and policy are not considered as factors contributing toward health behaviors (Lee et al., 2011; Scott & Wilson, 2011; Shimotsu et al., 2007; Whittemore et al., 2004).

There are some basic principles of ecological models of health behavior. One principle is that there are multiple levels of influence on specific behaviors (Glanz et al., 2008). Those levels include social, cultural, biological, psychological, environmental, and policy (Glanz et al., 2008). Another principle is that the influence on health behaviors can interrelate between the different levels. When ecological models target specific health behaviors, interventions are most effective toward changing the behaviors (Glanz et al., 2008; Shimotsu et al., 2007; Whittemore et al., 2004). The fundamental purpose of ecological models of health behavior is to produce effective interventions that focus on changes at multiple levels of influence (Glanz et al., 2008). In this study, I examined multiple levels of influence of environmental factors associated with BMI among long haul truck drivers, and the ecological theory provided the basis to study those levels.

The social ecological theory was presented as a framework to develop and improve diabetes prevention and management interventions because it combined personal and environmental efforts to change health behaviors and to improve the physical and social surroundings of the community (Whittemore et al., 2004). The ecological framework provided the opportunity to present different perspectives to the planning of interventions. Various perspectives included interpersonal, intrapersonal, institutional factors, community factors, and public policy (Glanz et al., 2008). Interpersonal factors include relationships with family, friends, and coworkers (Whittemore et al., 2004).

Social support has been shown to influence and promote healthy behaviors (Whittemore et al., 2004). Intrapersonal factors include genetic disposition and health behaviors that contribute to diabetes prevention and management (Glanz et al., 2008). Knowledge, beliefs, and attitudes influence behaviors that can help with diabetes self-management (Glanz et al., 2008). Institutional factors include settings such as school, work, and churches (Glanz et al., 2008). These places have the ability to significantly influence health behaviors by providing an environment for health promotion activities and social support for behavior change (Whittemore et al., 2004). Community factors include living conditions within a given geographical area and are associated with health and health behaviors of individuals (Whittemore et al., 2004). Public policy influences health by regulations implemented on the local, state, and national levels (Whittemore et al., 2004). Changes in public policy can be a slow and challenging process and require petitioning and promoting through the legal system (Whittemore et al., 2004). Because of the combination of personal and environmental factors, the social ecological theory was able to provide a foundation that has helped improve diabetes prevention and management interventions.

The ecological theory has been used as a framework to qualitatively study the ecological factors associated with overweight and obesity among a very specific community--African American youth in a rural town in the Georgia (Scott & Wilson, 2011). In Scott and Wilson's (2011) study, in-depth interviews were conducted with African American community leaders who interacted with youth within the home, school, church, and other social settings. Interviews were conducted in the homes of participants and questions addressed the environmental level, such as the built environment and food environment at the structural and super structural levels. At the structural level, topics included city governance and community organizations. At the super structural level, questions related to topics of race and class. Responses were coded and connected to each ecological category. Themes that developed were acknowledged and extended through use of notes and matrices. The researchers combined ideas that emerged. Connections within the home, school, church, and within the community implied the need for community-based interventions that encompassed multiple ecological levels and incorporated super structural factors and concerns related to race, poverty, and the built environment (Scott & Wilson, 2011). The ecological theory was effectively used by Scott and Wilson to examine multiple ecological factors associated with overweight and obesity among a specific population of African American youth in a rural town in Georgia. The ecological theory was used in this study in a similar method--to study multiple environmental factors associated with the specific population of long haul truck drivers.

The interest in ecological models and the application of ecological models in research have increased significantly over the last two decades as a result of the ability of ecological models to guide broad methods to changing behaviors among populations (Apostolopoulos, Sonmez, Shattel, & Belzer, 2010; Jacobson et al., 2007; Lee et al., 2011; Scott & Wilson, 2011; Shimotsu et al., 2007; Whittemore et al., 2004). The major reduction in tobacco use in the United States since the 1960s is credited to the ecological models that combined environmental, policy, social, and individual intervention strategies (CDC, 2013). Healthy People 2010 and the WHO's strategy for diet, physical activity, and obesity are examples of documents that targeted health behavior changes and demonstrated general acceptance of ecological models nationally and internationally (CDC, 2013; Glanz et al., 2008). The ecological perspective provided a comprehensive framework for this study in evaluating the relationship between the working environment and BMI among long haul truck drivers and understanding the multiple levels of influence.

Obesity & Long Haul Truck Drivers

Obesity. Obesity refers to a weight range that is greater than what is considered to be healthy for a given height (WHO, 2015). The CDC classifies overweight as BMI of 25.0–29.9 kg/m2, and obese as BMI equal to or greater than 30.0 kg/m2 (Ogden & Carroll, 2010). A BMI of obesity has been linked with other serious health complications and diseases such as hypertension, Type 2 diabetes, heart disease, stroke, asthma, and sleep apnea (Apostolopoulos et al., 2013; Dahl et al., 2009; Ogden, Carroll, Kit, & Flegal, n.d.; Seipel, 2005). Medical costs connected with individuals who are obese were assessed at $1,429 more than people of normal weight, with roughly $147 billion in medical costs associated with obesity in 2008 (CDC, 2010). Obesity and the associated health consequences cause excessive harm to the health of the workforce with associated disability costs averaging $8,720 per employee every year (Caban et al., 2005).

The prevalence of obesity has increased considerably over the last three decades and is now deemed an epidemic by the WHO (Callahan, 2013; Wiegand, Hanowski, & McDonald, 2009; WHO, 2003). More than 10% (more than 200 million) of the world's population of adults age 20 and older was obese in 2008 (WHO, 2015). The prevalence of obesity reached 40% among U.S. adults from 2009–2010 (Gu et al., 2014). Obesity rates among U.S. workers between 1997–2002 were highest among motor vehicle operators (31.7%; Caban et al., 2005). Between 2004–2011, the prevalence of obesity among motor vehicle operators was found to be 39.2% (Gu et al., 2014). In the United States, more than 72 million adults were obese in 2008 (CDC, 2010). In every state, more than 15% of adults are obese, with over 30% of adults being obese in nine states (CDC, 2010). By 2030, obesity could potentially reach global prevalence of over 1 billion (Callahan, 2013).

Obesity is a complex public health problem requiring interventions on multiple levels (Caban et al., 2005; Callahan, 2013; CDC, 2010; Ogden et al., n.d.; Seipel, 2005). Comprehensive interventions could reduce the cost of this health problem for both employers and employees, and encourage healthier lifestyles. Furthermore, effective interventions could reduce and prevent some of the obesity-related chronic health conditions (Caban et al., 2005; Callahan, 2013; Gregg et al., 2009; Lee et al., 2011; Scott & Wilson, 2011; Seipel, 2005; Sieber et al., 2014).

Long Haul Truck Drivers. Long haul truck drivers operate trucks of at least 26,001 pounds per gross vehicle weight, venture more than 100 miles from home, and often spend weeks at a time traveling over the road to transport cargo, freight, and other goods from points of manufacture or import to various destinations across the United States (Jensen & Dahl, 2009; McCartt, Hellinga, & Solomon, 2008; Stasko & Neale, 2007; U.S. Department of Transportation, 2015). The daily operation of and survival of retail stores, hospitals, gas stations, and a broad array of other industries across the nation rely largely on the goods that are transported and delivered by long haul truck drivers (Stasko & Neale, 2007). Stasko and Neale (2007) reported that 80.4% of intercity freight revenue was carried by trucks. The ability of long haul truck drivers to efficiently transport merchandise across the continental United States has a strong economic impact on the nation (Stasko & Neale, 2007). Between 1975 and 1997, freight transportation grew by 60% and moved 15 billion tons of goods that were valued more than $9 trillion dollars (Stasko & Neale, 2007).

In 2011, 4.4 million workers were employed by the U.S. transportation and warehousing division (Gu et al., 2014; U.S. Department of Labor, 2014). Truck transportation providing road transportation of cargo was the largest of 11 industries within the transportation and warehousing division, representing 31% of the total work force in the U.S. transportation industry (U.S. Department of Labor, 2014). According to the Freight Analysis Framework reported by the Department of Transportation, freight volumes are expected to increase 70% by the year 2020 (Sedor & Onder, 2006).

In the United States, 40% of adults were obese from 2009-2010, and the obesity rate among U.S. workers was 27.7% (Gu et al., 2014; Luckhaupt, Cohen, Li, & Calvert, 2014). The prevalence of obesity among the agriculture industry was found to be 26.4%, obesity among the manufacturing industry was 30.8%, and obesity among the transportation and warehousing industry was found to be 33.1% (Gu et al., 2014). However, the prevalence of obesity among long haul truck drivers in 2010 was 69% (Sieber et al., 2014). The significantly higher prevalence of obesity among this population intensifies the associated increased medical costs and disability within the workforce. Additionally, the increased prevalence magnifies the problem of health conditions and diseases that are associated with obesity.

Work Environment

Protection for the safety of the drivers and regulation of this industry is an important factor in maintaining safety for both truck and car drivers that share the road. Federal regulations have controlled the amount of time commercial truck drivers are allowed on the road and working through hours-of-service rules since 1939 and are enforced through roadside inspections from state to state (U.S. Department of Transportation, 2015). In 1995, Congress instructed the U.S. Department of Transportation to revise regulations in an attempt to reduce driver fatigue and drowsiness that resulted from inadequate rest periods. The new rule, implemented in 2004, presented a major change from previous regulations. Daily and weekly driving limits were increased, as well as daily requirements for resting off-duty periods.

Under the previous rule, drivers were permitted to drive 10 hours after being off duty for 8 hours; allowing up to 16 hours of driving per 24-hour period (McCartt et al., 2008; U.S. Department of Transportation, 2015). The new rule allows 11 hours of driving after being off duty for 10 hours; allowing up to 14 hours of driving per 24-hour period (McCartt et al., 2008; U.S. Department of Transportation, 2015). The new rule requires a longer period of time in the sleeper berth, which is the area inside of the truck where the long haul drivers sleep (McCartt et al., 2008; U.S. Department of Transportation, 2015). At least 8 of the 10 off duty hours must be spent in the sleeper berth (McCartt et al., 2008). Weekly driving limits allowed 60 hours within 7 days, or 70 hours within 8 days, under the previous rule. The new rule still incorporates the same weekly driving limits, but introduces a restart provision. The restart provision allows up to 77 hours of driving in 7 days or 88 hours of driving within 8 days. The new provision allows drivers to restart their work week after 34 consecutive hours off duty (McCartt et al., 2008).

Work Environment and Health of Long Haul Truck Drivers

Driving for long hours most days of the week yields a sedentary working environment for long haul truck drivers. This environment increases the risk of becoming obese and developing other health problems, compared to the general public (Apostolopoulos et al., 2011). Musculoskeletal disease, sleep disorders, and cardiovascular disease are among some of the diseases that are associated with long haul truck drivers (Sieber et al., 2014; Solomon, Doucette, Garland, & McGinn, 2004). The prevalence of obesity, hypertension, high cholesterol, diabetes, and sleep apnea is higher among long haul truck drivers than the U.S. working adult population (Apostolopoulos et al., 2012a; Apostolopoulos et al., 2013; CDC, 2007a, 2007b; Dahl et al., 2009; Sieber et al., 2014; Solomon et al., 2004).

In a 10-year follow-up study, lifestyle related diseases in long haul truck drivers were compared to other truck drivers in Denmark (Dahl et al, 2009). A group of 2,175 long haul truck drivers were compared to 15,060 other truck drivers. In a cohort of long haul truck drivers in Denmark, standardized hospital ratios (SHR) of lifestyle related diseases was analyzed among long haul truck drivers, other truck drivers, and the working population overall. SHR were acquired through connecting data from the Occupational Hospitalization Register to data taken from the Danish Labour Market Supplementary pension Fund registry and Statistics Denmark (Dahl et al, 2009). The SHR was computed as a ratio between observed cases with a specific diagnosis and the expected cases. The 95% confidence intervals assumed a Poisson distribution for the observed cases with a specific diagnosis. Compared to the general working population, long haul truck drivers and other drivers had a statistically significant higher risk for hospitalization due to obesity (SHR: 254, 95% CI: 127–454) and diabetes (SHR: 140, 95% CI:104–185; Dahl et al, 2009). Additionally, compared to the general working population, long haul and other truck drivers had statistically higher risk for acute heart disease (SHR: 122, 95% CI: 113–131), ischaemic heart disease (SHR: 129, 95% CI: 116–144; Dahl et al, 2009). Although there were no statistically significant differences found between long haul truck drivers and other truck drivers, there was a statistically significantly higher risk for hospital treatment of obesity, and other lifestyle related chronic diseases compared to the general working population (Dahl et al., 2009).

To assess the health of truck drivers in the United States, a cross-sectional study was designed and conducted. Three hundred and sixteen truck drivers were randomly selected from truck stops and trucking terminals in North Carolina (Apostolopoulos et al., 2013). Long haul drivers represented 89.6% of the participants. Participants completed a self-administered survey via paper and pencil, which examined the drivers' health and wellness and the associations between trucking environment, and employee health in the workplace. Over 50 % of participants spent more than 11 consecutive days on the road, and 85.8% spent more than 17 days on the road each month, and 60% reported spending over 22 days on the road each month (Apostolopoulos et al., 2013). Chronic sleeping disturbances were reported by 57.9% of participants, and chronic fatigue was reported by 56.3% of participants. Chronic back and neck pain was reported by 42.3% of participants, osteoporosis was reported by 47.8% of participants, and arthritis was reported by 30.4% of participants. Using self-reported height and weight, 83.4% of the participants had a BMI greater than 25 kg/m^2 (Apostolopoulos et al., 2013). A BMI of 25.0–29.9 kg/m2 is classified as overweight, and a BMI equal to or greater than 30.0 kg/m2 is classified as obese (CDC, 2010; Ogden & Carroll, 2010). A BMI of obesity has been linked with increased risk of other serious health complications and diseases such as hypertension, Type 2 diabetes, heart disease, stroke, asthma, and sleep apnea (Apostolopoulos et al., 2013; Dahl et al., 2009; Ogden et al., n.d.; Seipel, 2005). In addition, fitness and exercise facilities were not available for over 70% of truck stops, almost 70% of trucking terminals and 88% of trucking warehouses (Apostolopoulos et al., 2013). Truck drivers work within a harsh environment that does not encourage a healthy lifestyle, and are at a high risk for poor health outcomes. The characteristics of the harsh work environment include poor sleeping accommodations, monotony, and constant demand for mental alertness, irregular eating patterns, and poor nutrition. A connection between the harsh working environments of truck drivers with poor health conditions, as well as a need for access to healthcare for long haul truck drivers has been established (Apostolopoulos, 2010; Apostolopoulos et al., 2012a;, 2012b; Apostolopoulos et al., 2013;CDC, 2007a, 2007b; Dahl et al., 2009; Jensen & Dahl, 2009; McCartt et al., 2008; Shimotsu et al., 2007; Sieber et al., 2014; Solomon et al., 2004; Stasko & Neale, 2007).

In a mixed methods study, researchers examined the special health needs of long haul truck drivers, which included obesity and their limited access to health care. Acknowledging the limited health information about this population, researchers aimed to extablish a foundation for future studies (Stasko & Neale, 2007). Thirty out of 88 truck drivers that were approached, participated in the study and data were collected at truck stops in Michigan. A structured interview with both open- and closed-ended questions was created and administered to examine the health care needs of long haul truck drivers. Because of time restraints and pressure for drivers to meet delivery deadlines, in person interviews were conducted while drivers ate their meals and each participant was offered a beverage of their choice for participating in the study.

Twenty-nine of the 30 respondents were male, and seven of the participants had been on the road for 1 month or longer within the past year (Stasko & Neale, 2007). Twenty-one participants reported having vision problems, and one third were smokers. Eight of the participants drank five or more cups of coffee daily. Ten percent of participants had been diagnosed with heart disease, 59% complained of backaches, and 47% of participants reported falling asleep at the wheel at least once (Stasko & Neale, 2007). Suggestions were made for health clinics at truck stops, and adding parking for large truck vehicles at hospitals, pharmacies, and other medical facilities for drivers to more easily access healthcare. Recommendatons for future research included interviewing a larger sample of long haul truck drivers in multiple states to provide an estimate variance across the nation (Stasko & Neale, 2007). This study addressed the recommendation for futher research on the health of long haul truck drivers by examining environmental factors associated with BMI among this population.

Due to the unpredictable and irregular schedules of long haul truck drivers, they can be a difficult population to study. The National Institute for Occupational Safety and Health (NIOSH) developed the National Survey of Long Haul Truck Driver Health and Injury (LHTDS) (Sieber et al., 2014). The LHTDS is the largest in-depth health survey conducted in the United States specifically for long haul truck drivers. The objective was to generate a nationally representative sample of long haul truck drivers so that estimates of the associated prevalence of health conditions, injuries, and risk factors could be established. Findings were able to identify areas for intervention, and guide the development of health and safety policy (Sieber et al., 2014).

A weighted sampling process was used in order to help produce a sample that could be used as a national representation of the population of long haul truck drivers. Truck stops were chosen within five geographical regions, and along highways with low and high traffic flows (Sieber et al., 2014). The interviews were conducted over a period of 3 days, and between the hours of 7 AM and 10 PM. The LHTDS questionnaire was developed and administered through personal interviews at selected truck stops, and a $25 truck stop gift card was offered to each driver who participated in the personal interview. A nonrespondednt survery was offered to those who did not participate, and a $2 gift card was offered to those who completed it. Differences of variances was the statistical method of analysis, using *t*-Tests of statistical significance. There were 5,514 drivers approached by the interviewers, 3,759 were actual long haul truck drivers. One thousand six hundred and seventy drivers completed the personal interview, had their height and weight measured, or completed the nonrespondent interview only (Sieber et al., 2014).

Of the participants, BMI ranged from 17.2 to 61.7 (Sieber et al., 2014). More than two-thirds were obese, compared to one-third of the U.S. working adults who are obese. Twenty-seven percent of participants averaged less than 6 hours of sleep per 24 hour period, compared to 30% of working adults (Sieber et al., 2014). Sleep has been associated with the risk of obesity in laboratory and epidemiological studies. Sleep is an important regulator of metabolic functions within the body, and can change the body's ability to manage hunger, appetite, and levels of energy (Beccuti and Pannain, 2011). The prevalence of obesity was 69% for long haul truck drivers, compared to 31% in the adult working population in 2010. Only 24% of the participants in the study met the CDC guidelines of moderate to virorous physical activity lasting 30–60 minutes per day for at least 5 days every week.

The Current Population Survey conducts monthly surveys for the Bureau of Labor and Statistics and provides labor force and other demographic data (U.S. Departement of Labor, Bureau of Labor and Statistics, 2015). The population estimate is limited because the current surveillance system does not distinguish between types of drivers. For example, drivers of heavy and tractor trailer trucks are combined with driver-sales workers (Sieber et al., 2014). The inability to distinguish long haul truck drivers from other types of drivers in the estimation of heavy and tractor-trailer truck drivers is a limitation. It is difficult to obtain an estimation of long haul truck drivers specifically. Based on the weighted sample size, the LHTDS represents aproximately 60% of the total number of long haul truck drivers, based on the population estimate from the Bureau of Labor and Statistics in 2010 (Sieber et al., 2014; U.S. Department of Labor, 2014). Researchers pointed to the need to produce a more accurate representation of the population of long haul truck drivers through improved surveillance, which can be achieved by continuing to collect data and evaluating the health needs of this population (Sieber et al., 2014). The proposed study will produce data that may provide additional information about long haul truck drivers across the nation, and may specifically examine the environmental factors associated with BMI among this population. Instead of in-person interviews at various geographical locations across the country, this study collected self-reported data using the internet.

Work Environment and Physical Activity

Driving for long hours most days of the week yields a sedentary working environment for long haul truck drivers (Sieber et al., 2014). This environment increases the risk of becoming obese and developing other health problems, compared to the general public (Apostolopoulos et al., 2011). Apostolopoulos et al. (2012a) observed the physical environment of 25 trucking worksites including terminals, warehouses, rest areas, and truck stops to determine the influence of these sites on eating habits of workers. Built upon ecological models, the trucking work environment was evaluated and a multilevel health promotion program was designed to fit the needs of the trucking work environment. All observations were conducted during daylight hours, with each observation lasting an average of 75 minutes. Data were collected from locations in the southern region of North Carolina, along interstates I-85 and I-40: eight truck stops, eight trucking terminals, seven warehouses, and two highway rest areas (Apostolopoulos et al., 2012a). When drivers are not on the road, they rest, load and unload, shower, socialize, and do their laundry within these areas. The characteristics of transportation work settings were assessed using observation to note the presence of social and built environmental attributes that positively influence food choices, eating habits, physical and recreational activities of truck drivers. Although the truck cab is where long haul truck drivers spend the majority of their day, it was not considered a part of the work environment because it does not offer opportunities for active living. Observations from the worksites were assessed a numerical value based on health promoting components. Health supporting ratings were assigned to each worksite based upon its total score. The resulting low scores indicate the limited opportunities for physical activity and exercise within the work environment, and support the need for interventions to improve the work environment and improve health of truck drivers.

Strength of this study is the ecological model pointing to the need for comprehensive intervention, and observation and assessment of the physical built environment of the trucking industry. A limitation to the study is that the location of the work environment was only in North Carolina. Although the total number of worksites was 25, there were a variety of observed locations, which included truck stops, trucking terminals, warehouses, and rest areas.

Work Environment and Eating Habits

Jacobson et al. (2007) conducted a descriptive cross-sectional study in Illinois to assess healthful food choices of long haul truck drivers. The researchers hypothesized that overweight and obese drivers would not care as much about healthful food choices compared to normal weigh drivers. Additionally, researchers hypothesized that drivers who placed greater importance on healthful food choices would have more positive attitudes about the provisions of healthy foods. At a franchised truck stop in the Midwest, 100 long haul truck drivers were asked to participate in the study. Ninety-two of the 100 long haul truck drivers agreed to participate, providing a 92% response rate. Participants were surveyed during two afternoons, and all participants were offered $20 to participate. Two questionnaires were administered, which were the Food Choices Index and Nutrition Attitude Survey. Registered dietitians collected age, sex, years as a truck driver, exercise habits, and fruit and vegetable consumption. Registered dietitians who were also trained in measuring anthropometrics measured height, weight, and waist circumference. Body fat percentages were also calculated by use of a Tanita Body Composition Analyzer. Body fat percentages that are optimal for health will vary according to age. As an additional assessment to BMI, participants were assessed by age for body fat percentages and categorized as acceptable, overweight, or obese (Jacobson et al., 2007).

Based on BMI, 79 of 92 of the participants were overweight and 52 of the overweight participants were obese. Eleven reported no consumption of fruits and vegetables, and six reported eating more than three servings per day (Jacobson et al., 2007). Regarding the Food Choices Index, the range of possible scores was 15 to 75, with higher scores indicating an understanding of the importance of choosing healthy foods. The mean score was 56.94 $\pm$ 5.68, which indicates that drivers believe that healthy food choices are important. Regarding the Nutrition Attitude Survey, the range of possible scores was 12 to 60. A higher score indicates a more positive attitude toward nutrition. A mean of 44.84 $\pm$ 5.68 represented the drivers' positive attitudes toward healthy foods being provided. There was no statistically significant difference between normal weight drivers and obese drivers regarding the importance of healthy food choices. Therefore, this finding indicated that the importance of healthy food choices is similar among normal weight drivers and obese drivers. The second hypothesis that drivers who placed a greater importance on healthy food choices would have more positive attitudes toward provisions of healthy foods was supported.

The small sample obtained from only one location was a limitation of this study. The truck stop at only one location in the Midwestern part of the country likely introduced sample bias; therefore, findings could not be generalized to all long haul truck drivers. Healthy food options are important to all drivers, normal weight to obese. The health of drivers depends upon the choices that are available to them. Larger studies that can represent the population of long haul truck drivers nationally are suggested (Jacobson et al., 2007). This research study collected data from long haul truck drivers across the country, and recruited a larger sample of the population.

Work Environment and Quality of Sleep

OSA, EDS, and fatigue have been associated with obesity (Anderson et al., 2012). Laboratory and epidemiological findings have supported an association between sleep loss and increased risk of obesity. A review of the literature summarized the association between sleep and obesity. Sleep is a significant regulator of metabolic functions within the body, which alter the body's ability to manage hunger, appetite, and levels of energy (Beccuti and Pannain, 2011). Changes in levels of hormones that regulate appetite can affect consumption of food (Beccuti & Pannain, 2011; CDC, 2011; Spiegel et al., 2004a; Spiegel, Tasali, Penev, & Cauter, 2004b; Van Cauter, Spiegel, Tasali, & Leproult, 2008). Ghrelin is a hormone that promotes hunger and increases with shortened sleep. Leptin is a hormone that regulates perception of satiety, and decreases with shortened sleep. Five hours of sleep, in a routine pattern, has been associated with a 15% reduction in morning leptin levels and comparable increase in ghrelin levels (Beccuti & Pannain, 2011; Brondel, Romer, Nougues, Touyarou, & Davenne, 2010).

In a meta-analysis, which included 18 studies and 604, 509 adults, an odds ratio of 1.55 (1.43–1.68; $p < 0.001$) for less than 5 hours of sleep. For each additional hour of sleep, BMI decreased by 0.35 kg/m^2 (Beccuti & Pannain, 2011). In a cross sectional study of 56, 507 U.S. adults, the probability of obesity increased by 6% for self-reported sleep of less than 7 hours per night (Buxton & Marcelli, 2010). In a prospective six-year study in Italy, 1,597 adults were evaluated. Each hour increase in total sleep time yielded a 30% reduction in obesity (adjusted odds ratio 0.7/hour; CI 0.57-0.86; $p < 0.001$; Bo et al., 2011).

While traveling on the road, long haul truck drivers are required to spend at least 8 hours in the sleeper berth of the truck (U.S. Department of Transportation, 2015). Due to work pressures to meet delivery deadlines, drivers try to maximize their driving hours and will spend no more than the required 8 hours in the sleeper berth (McCartt et al., 2008). Consequently actual sleeping hours and quality of sleep will vary depending on how quickly drivers are able to fall asleep and how restful their sleep is during that time.

Fatigued drivers have reported driving while sleepy, dozing off while driving, and falling asleep at the wheel (McCartt et al., 2008; Philip, 2005). Therefore, the association between the quality of sleep and the amount of sleep that long haul drivers receive while on the road was evaluated in this study.

Summary

Studies were found connecting physical activity and obesity, eating habits and obesity, and quality of sleep and obesity. A limited amount of literature was found supporting the significant poor health and prevalence of chronic diseases among long haul truck drivers compared to the general population. A cross-sectional study gave participants a self-administered survey using paper and pencil in one small study to assess the health of truck drivers (Apostolopoulos et al., 2013). Another cross-sectional study used questionnaires to assess the food choices and eating habits of drivers (Jacobson et al., 2007). A mixed methods study was found using structured interviews with both open- and closed-ended questions (Stasko & Neale, 2007). The mixed methods study examined the special health needs of long haul truck drivers and their limited access to health care. A qualitative observation study of the physical environment of trucking worksites was conducted to determine the influence of these sites on eating habits (Apostolopoulos et al., 2012a). A comprehensive health survey of long haul truck drivers was conducted in 2010 with an objective of generating a nationally representative sample of long haul truck drivers to estimate the prevalence of health conditions, injuries, and risk factors (Sieber et al., 2014). For the health survey, a questionnaire was developed and administered through personal interviews at truck stops throughout the country. Nevertheless, the search of literature exposed a gap addressing the risk of obesity specifically, and the level of influence of the work environment, physical activity, eating habits, and quality of sleep on obesity among long haul truck drivers.

The epidemic of obesity is a public health problem that requires intervention on multiple levels to effectively impact the problem (Caban et al., 2005; Callahan, 2013; CDC, 2010; Ogden et al., n.d.; Seipel, 2005). The link between obesity and increased risk of other serious health conditions and diseases has been well established (Apostolopoulos et al., 2013; Dahl et al., 2009; Ogden et al., n.d.; Seipel, 2005). Increased medical costs and disability has been strongly connected with people who are obese (CDC, 2010).

There is poor health outcomes associated with long haul truck drivers. Long haul truck drivers play a vital role in the daily operation of and survival of retail stores, hospitals, gas stations, and a broad array of other industries across the nation because these industries rely largely on the goods that are transported and delivered by long haul truck drivers. Freight transportation grew by 60% between 1975 and 1997, and moved 15 billion tons of goods that were valued more than $9 trillion dollars (Stasko & Neale, 2007). Truck transportation providing road transportation of cargo was the largest of 11 industries within the transportation and warehousing division, with 31% of the total 4.4 million workers, with an expected increase of another 70% by the year 2020 (Gu et al., 2014; Sedor & Onder, 2006; U.S. Department of Transportation, 2015). However, long haul truck drivers have an increased risk of becoming obese and developing other obesity related health problems, compared to the general public (Sieber et al., 2014; Apostolopoulos et al., 2011; Solomon et al., 2004). Federal regulations control the amount of time long haul truck drivers are allowed on the road and on duty through hour-of-service rules. Drivers are allowed up to 14 hours of driver time per 24 hour period, with requirements of 8 to 10 hours to be spent in the sleeper berth (McCartt et al., 2008; U.S. Department of Transportation, 2015). This sedentary lifestyle increases the risk of adverse health problems. The prevalence of obesity, hypertension, high cholesterol, diabetes, and sleep apnea is higher among long haul truck drivers than the US working adult population (Apostolopoulos, et al., 2012a; Apostolopoulos et al., 2013; CDC, 2007a, 2007b; Dahl et al., 2009; Sieber et al., 2014; Solomon et al., 2004).

The effective use of ecological models in research is demonstrated in the major reduction in tobacco use in the United States since 1960s, as well as in Healthy People 2010. The WHO's strategy for diet, physical activity, and obesity is another demonstration of the effective use of ecological models (CDC, 2013; Glanz et al., 2008; WHO, 2015). The ecological theory was used in this study to examine multiple environmental factors associated with BMI among long haul truck drivers.

Researchers have recommended future research on the health of long haul truck drivers. Previous studies have been conducted using interviewers, through observation methods, and using paper and pencil to record data. Instead of in-person interviews at various geographical locations across the country, the study collected self-reported data using the Internet. The study evaluated the working environment, eating habits, physical activity, quality of sleep, and obesity among long haul truck drivers. The ecological foundation of the study will allow the ability to examine each of these environmental factors and their connection with obesity, as well as the level of influence. Findings will provide the potential to improve health outcomes among long haul truck drivers and effect positive social change. Identifying the factors that have the strongest association with obesity provides a target for stakeholders and health intervention programs. Programs aimed toward reducing the prevalence of obesity and obesity prevention among this population can be designed and implemented effectively with the findings provided by this research. Findings from this research study also identified areas for further studies.

Long haul truck drivers travel hundreds of miles from home and often spend weeks at a time over the road to transport goods to various destinations across the country. Without the transport and delivery of these goods, the daily operation and survival of industries across the nation would be jeopardized. The ability of long haul truck drivers to efficiently perform their duties has a strong economic impact on the nation. Federal regulations provide boundaries that are geared toward the safety of the drivers. However, the health of this population is a public health problem that needs attention.

In Chapter 2, I discussed my literature search strategy, theoretical basis, as well as an extensive review of the current literature. I explained what is known and unknown about the variables. In Chapter 3, I will discuss the research methods of this study in detail.

Chapter 3: Research Method

Introduction

In this chapter, I will provide a detailed description of the cross-sectional study, which was designed to assess possible factors associated with BMI among long haul truck drivers within their working environment. My review of the literature supported the association between each of these factors and the widespread prevalence of obesity and other adverse health conditions related to obesity. The ecological theory provided the framework of this study and allowed for the evaluation of multiple environmental influences on obesity among this population. The purpose of this study was to provide an assessment of the environmental factors associated with BMI and the level of influence of these factors on BMI among long haul truck drivers. In this chapter, I will also provide an overview of the research design and limitation, sampling, data analysis plan, and ethical considerations.

Research Design

In this study, I used a quantitative cross-sectional design to collect and analyze data on long haul truck drivers. BMI was the dependent variable and was calculated by using self-reported height and weight from the participants to determine BMI scores. Work environment was an independent variable that was assessed using measurements of drive time, drive distance, and driving days per week. All independent variables (eating behaviors, physical activity, and sleep quality) were assessed using self-reported data collected using a questionnaire. The measures of fast food consumption, convenience store food consumption, and eating breakfast were used to assess eating habits. The measures of days per week and minutes per day of physical activity were used to assess physical activity frequency, while the measures of the amount of daily sleep and daytime sleepiness were used to assess sleep.

The cross-sectional design is often used in social science research to describe possible associations and patterns between variables (Frankfort-Nachmias, 2008). To examine connections between trucking, disease incidence, and employee health, the cross-sectional design was used to survey a group of truck drivers (Apostolopoulos et al., 2013). A cross-sectional design was also used to assess the association of obesity, diabetes, and other chronic diseases among adults in the United States (Seipel, 2005). The cross-sectional design has been used to establish connections with adverse health conditions and truck drivers, as well as establishing the burden of obesity and related chronic diseases among adults in the United States, and as such, a cross-sectional design was an appropriate choice for this study. It provided an opportunity for me to quantitatively assess, examine, and describe the possible relationship between the long haul truck driver participants' work environment, eating habits, physical activity, and quality of sleep and their BMI.

Sampling

In this study, I used a survey method of data collection, which is essentially used throughout social science research (Frankfort-Nachmias, 2008). Data were collected from long haul truck drivers across the United States, and participants were recruited using social media outlets. To estimate the sample size needed for the study, I conducted a power analysis using G*Power version 3.1 (Buchner, Erdfelder, Faul, & Lang, 2013). The analysis estimated the statistical significance and practical significance of the study. Statistical significance refers to the likelihood of results being caused by chance, but practical significance refers to its meaning in the real world (Cohen, 1992a; Ellis, 2010; Hsieh, Bloch, & Larsen, 1998)

Sample size represents the number of participants in the study or analysis. Statistical significance refers to possibility of the results being caused by chance and the likelihood a Type I error occurring and incorrectly rejecting the null hypothesis (Ellis 2010). The effect is the possible association from environmental factors and obesity among long-haul truckers. The statistical power represents the chance of a Type II error occurring and incorrectly accepting the null hypothesis (Ellis, 2010)). The higher the power, the lower the risk that a Type II error will occur (Cohen, 1992b; Ellis, 2010). With a medium effect size ($d = .5$) and statistical significance of 5% ($a = .05$), a sample size of 125 would have power of .80. Therefore, the probability of making a Type II error would be 20% (Buchner et al., 2013; Ellis, 2010;). Based on the power analysis a minimum of 125 participants was needed for data analysis with the respective research questions.

However, survey research does yield lower response rates than other data collection methods. Response rates on survey research can average between 10–30% (Fan & Yan, 2010; Hardigan, Succar, & Fleisher, 2012; Shih & Fan, 2009; Sinclair, O’Toole, Malawaraarachchi, & Leder, 2012). To address the low response rate of survey research, as well as the potential for missing data and incomplete questionnaires, I recruited multiple groups of long haul truck drivers for the study. Social media was used to recruit participants by posting the recruitment message in several truck driver Facebook groups, with each group having a minimum of 1,500 members. Members of the groups shared the recruitment message using Facebook and Twitter throughout the recruitment time period, which lasted 3 weeks.

Instrumentation and Operationalization

BMI is the dependent variable in the study. The CDC classifies obesity as BMI equal to or greater than 30.0 kg/m2 (Ogden & Carroll, 2010). In addition, individuals with a BMI equal to or greater than 40 kg/2 are considered morbidly obese (Ogden & Carroll, 2010). In this study, I calculated BMI levels by using self-reported weight and height. BMI was calculated by dividing weight in pounds by height in inches squared, and then multiplying by a conversion factor of 703 (CDC, 2015b). The independent variables in the study were work environment, eating habits, physical activity, and quality of sleep.

I used the Health Behaviors Survey and a modified version of the BRFSS questionnaire to collect data for the independent variables (CDC, 2015a; Lee, Lemyre, Turner, Orpana, & Krewski, n.d.). In a previous study that examined the role of health risk perceptions, socioeconomic status, and health behaviors, the Health Behaviors Survey, using a Likert scale, assessed health behaviors (Lee et al., 2008). Developed by the CDC in 1984 for surveillance of health behaviors, the BRFSS is the largest current telephone health survey worldwide (CDC, 2015a). Both surveys were used in this study to measure physical activity, sleep, and eating habits. The BRFSS also provided demographic questions. Additionally, three questions were added to define the driver as a long haul truck driver for participation in the study and to measure the working environment. Those questions were: a). How many miles do you drive each day? b) How many miles do you drive each week? and c). How many days do you drive each week?

The Nutrition Patterns Questionnaire uses Likert-type scales to measure nutritional practices and food selection and was previously validated in a study that evaluated dietary practices between African American and Caucasian girls (McNutt et al., 1997; National Heart, Lung, and Blood Institute Growth and Health Study Research Group, 1992). I used the questionnaire in this study to measure the eating habits of long haul truck drivers. The Epworth Sleepiness Scale (ESS) is a self-administered questionnaire designed to measure an individual's level of daytime sleepiness and is widely used in research (Braeckman, Verpraet, Van Risseghem, Pevernagie, & De Bacquer, 2011; Johns, 1997, 2000). The ESS was used to measure quality of sleep in this study.

Although mail, telephone, and in-person surveys generally have a higher response rate, they are more costly to administer than web-based surveys (Hardigan et al., 2012; Szolnoki & Hoffmann, 2013). Additionally, since long haul truck drivers spend days, weeks, and even months on the road and away from home, traditional mail and telephone surveys would not be the best option for reaching this population. A web-based survey provided the best means for administering the survey. Cellphones and tablets are commonly used to access the web and are widely used by adults (Kuntsche & Labhart, 2013). In 2012, 87% of American adults owned cellphones (Kuntsche & Labhart, 2013). Estimated use of smartphone phones was 46% among adults, and ownership of tablet computers was 31% in the United States (Morris, Mueller, Jones, & Lippencott, 2014). SurveyMonkey is an online survey site that I used to administer the questionnaires, which contained a consent form for all participants. The consent form included background information about the study, procedures, and confidentiality.

Research Questions and Hypotheses

RQ1: Is there an association between work environment (e.g., drive time, drive distance, and driving days per week,) and BMI among long haul truck drivers?

H_01: There is an association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers.

H_11: There is no association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers.

RQ2: Is there an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers?

H_02: There is an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers.

$H_1 2$: There is no association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers.

RQ3: Is there an association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers?

$H_0 3$: There is an association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers.

$H_1 3$: There is no association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers.

RQ4: Is there an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers?

$H_0 4$: There is an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers.

$H_1 4$: There is no association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers.

Data Analysis Plan

I conducted an analysis of demographic data and the resulting descriptive statistics were provided to profile the qualitative information. The results of the demographic analysis can be found in Table 2 of Chapter 4. Initially, Pearson's chi-square test was to be used to establish if there was an association between categorical independent and dependent variables in the study (Field, 2009). However, since the dependent variable was changed from the dichotomous variable of obesity to the continuous variable of BMI, chi-square was not an appropriate test for analysis. Analysis of the data included multiple regression analysis, which is a way of predicting an outcome variable from one or more predictor variables (Field, 2009). After grouping respondents into BMI categories, additional analysis included analysis of variance to determine if there was a difference between the means of the BMI groups and one independent variable at a time. SPSS was the statistical software I used for analysis of data in this study.

Table 1
Variables, Measures, and Coding

Variable	Variable Type	Measure	Field Name	Coding
Age	Independent	What is your age?	Age	(years)
Sex	Independent	Indicate sex of respondent	Male Female	Male=1 Female-2
Race	Independent	Are you Hispanic, Latino/a, or Spanish origin?	Race	Yes=1 No=2 (continue to Race2 variable)
Race2	Independent	Which one or more of the following would you say is your race?	Race2	White=10 Black or African American=20 American Indian or Alaska

(table continues)

Variable	Variable Type	Measure	Field Name	Coding
				Native=(30) Asian=(40) Pacific Islander (50) Other=(60)
BMI	Dependent	About how much do you weigh without shoes? About how tall are you without shoes?	Weight (pounds) Height (ft/inches)	BMI calculated by dividing weight in pounds by height in inches squared, then multiplying by a conversion factor of 703. BMI = (kg/m^2)
BMIgroup	Dependent	BMI	BMIgroup	underweight (BMI < 18.5 kg/m^2), healthy weight (BMI 18.5 – 24.9 kg/m^2), overweight (BMI 25.0 – 29.9 kg/m^2), obese class I (BMI 30.0 – 34.99 kg/m^2), obese class II (BMI 35.00 – 39.99 kg/m^2), obese class III (BMI $\geq$ 40.00 kg/m^2)
Cellphone	Independent	Do you have a cell phone for personal use?	Cellphone	Yes=1 No=2

(table continues)

Variable	Variable Type	Measure	Field Name	Coding
		Please include cell phones used for both business and personal use.		
Internet	Independent	Have you used the internet in the past 30 days?	Internet	Yes=1 No=2
Convenience food consumption	Independent	I buy snack food	ConvFood	Never or almost never=1 Sometimes=2 Usually or always=3
Convenience food consumption	Independent	Number of daily snack occasions	ConvFood2	Never or almost never=1 Sometimes=2 Usually or always=3
Fast food consumption	Independent	Number of times I eat fast food per week	FastFood	Never or almost never=1 Sometimes=2 Usually or always=3
Eat breakfast	Independent	Eat breakfast daily?	Breakfast	Never=1 Rarely=2 Sometimes=3 Most of the time=4 Always=5

(table continues)

Variable	Variable Type	Measure	Field Name	Coding
Physical Activity	Independent	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?	PA	Yes=1 No=2
Days per week/minutes per day	Independent	Participate in 20 minutes of vigorous exercise at least three times a week?	PAfrequency	Never=1 Rarely=2 Sometimes=3 Most of the time=4 Always=5
Amount of daily sleep	Independent	On average, how many hours of sleep do you get in a 24 hour period?	DailySleep	(number of hours)
Daytime drowsiness	Independent	Sitting and reading	SittingReading	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
	Independent	Watching TV	WatchTV	Would never doze=0

(table continues)

Variable	Variable Type	Measure	Field Name	Coding
				Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
	Independent	Sitting, inactive in a public place (e.g. a theatre or a meeting)	SittingInactive	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
	Independent	As a passenger in a car for an hour without a break	Passenger	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
	Independent	Lying down to rest in the afternoon when circumstances permit	LyingDown	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3

(table continues)

Variable	Variable Type	Measure	Field Name	Coding
	Independent	Sitting and talking to someone	SittingTalking	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
	Independent	Sitting quietly after a lunch without alcohol	SittingQuietly	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
	Independent	In a car, while stopped for a few minutes in the traffic	Traffic	Would never doze=0 Slight chance of dozing=1 Moderate chance of dozing=2 High chance of dozing=3
Drive time	Independent	How many hours do you drive each day?	DriveTime	(number of hours)
Drive distance	Independent	How many miles do you drive each day?	DriveDistance	(number of miles)

(table continues)

Variable	Variable Type	Measure	Field Name	Coding
Driving days per week	Independent	How many days do you drive each week?	DrivingDays	(number of days)

Ethical Considerations

Ethical considerations were minimal for the study. The privacy and confidentiality of participants was maintained throughout the study. No personal identifying information, such as name and employer, was required for participation. Participation was voluntary and anonymous, and the survey was limited to long haul truck drivers only. Additionally, SurveyMonkey provided a link from the social media site to the questionnaire. An online informed consent form was on the survey site. Participants were only led to the questionnaire after reading the consent form and agreeing to participate. Incomplete questionnaires were discarded from analysis. All data were exported from SPSS and stored on a secure external hard drive. A separate social media page was created in order to provide the findings of this study.

Summary

This quantitative cross-sectional study was designed to assess possible factors associated with BMI among long haul truck drivers within their working environment by using self-reported data. The ecological theory provided the framework of this study and allowed for the evaluation of multiple environmental influences on BMI among this population. In this chapter, I provided a detailed description of the research design and limitations, sampling, data analysis plan, and ethical considerations of this study.

BMI is the dependent variable in this study. Work environment, eating habits, physical activity, and sleep quality are the independent variables. Since long haul truck drivers spend days, weeks, and even months on the road and away from home, traditional mail and telephone surveys were not the best option for reaching this population. Only long haul truck drivers were asked to participate, and a web-based survey provided the best means for administering the survey. SurveyMonkey is an online survey site that was used to administer the questionnaires and contained a consent form for all participants. A web link to the survey was posted within truck driver groups on social media websites, and participants were asked to participate in the study by following the link and completing the survey. The invitation to participate was addressed to long haul truck drivers only. Once a potential participant followed the link to the survey, the opening web page provided the consent form. The consent form described the study including the background, procedures, voluntary nature, risks, and privacy statement. Although my contact information was provided for participants who may have had questions regarding the study, I was not contacted by anyone regarding the study. Participants who agreed to participate were able to initiate the survey. Participants had the option of printing and saving the consent form.

Analysis of demographic data was conducted and descriptive statistics were provided to profile the qualitative information. The data collected in the study was continuous and ordinal scale data. Analysis of the data included multiple regression analysis, which is a way of predicting an outcome variable from one or more predictor variables. Analysis of variance was also used in further analysis of the data. SPSS is the statistical software used for analysis in this study.

Ethical considerations were minimal for the study. The privacy and confidentiality of participants was maintained throughout the study. Participation was voluntary and anonymous and the survey was limited to long haul truck drivers only. Participants were only led to the questionnaire after reading the consent form and agreeing to participate. Participants were provided with my contact information for any questions they may have had regarding the study before providing consent to participate. Participants had the option of exiting the survey website at any time if they decided not to complete the questionnaire. Data received from incomplete questionnaires were not used in the data analysis., and no incentives were provided for participation in the study.

All data were exported from SPSS and stored on a secure external hard drive. However, a separate social media page was created in order to provide the findings of this study. Findings of the study will be shared with stakeholders within the trucking industry, such as trucking company owners, truck drivers, truck stop owners, and public health organizations. In Chapter 4, I will discuss the data collection and statistical findings.

Chapter 4: Results

Data Collection and Analysis

The purpose of this study was to provide an assessment of the environmental factors associated with obesity and the level of association of these factors with BMI among long haul truck drivers. To answer the RQs in this study, I used a quantitative cross-sectional research design. The data collected in the 26-question survey were used to assess correlations between identified independent variables (e.g., work environment, eating habits, physical activity, and quality of sleep) and the dependent variable of BMI. In this chapter, I will describe the statistical findings organized by RQ.

My recruitment of participants involved the use of social media. I posted a recruitment message in truck driver interest groups on Facebook and links to the message were posted using Twitter. These messages cycled through social media throughout the data collection period of March 25 through April 15, 2015. Data were collected for 3 weeks and downloaded from SurveyMonkey in the form of an Excel file. To address missing data from respondents, only complete questionnaires were used for data analysis. Any questionnaires with missing responses were eliminated from analysis. After removing 23 questionnaires with incomplete responses and making metric conversions using the National Institutes of Health BMI calculator, I transferred the data from Excel to SPSS for analysis.

Of the 149 survey respondents, 126 were complete and met the inclusion criteria of being a long haul truck driver. There were 97 male and 29 female respondents. One hundred fourteen of the sample were Caucasian, six were African American, four were both Caucasian and American Indian or Alaska Native, and two identified themselves as Other. None of the participants identified themselves as Hispanic, Latino/a, or of Spanish origin. Because of the small numbers in all categories other than Caucasian, the racial and ethnic groups that are not Caucasian were grouped together into the category of Other for the purposes of this analysis. One hundred twenty-five respondents had cellphones for personal use and one did not. One hundred twenty-four had used the Internet within the previous 30 days and two had not. The age of respondents ranged from 22 to 72.

Respondents reported their height in feet and inches. Since the formula for BMI is weight in kilograms divided by height in meters squared (kg/m^2), BMI were calculated by dividing weight in pounds by height in inches squared, and then multiplying by a conversion factor of 703. BMI ranged from 19.7–77.0 kg/m^2 among respondents. BMI among male respondents ranged from 19.7 to 77.0 kg/m^2, and among females BMI ranged from 20.5 to 68.0 kg/m^2. None of the respondents were underweight, 20 were a healthy weight, 28 were overweight, and 78 were obese.

Due to the large number of obese respondents, the demographics of the obesity classes were analyzed. Of the 78 obese respondents, 23 were obese Class I, 17 were obese Class II, and 38 were obese Class III. Additionally, since the majority of respondents were obese, the dichotomous dependent variable of obesity was not used. Instead, I used BMI as the continuous dependent variable. All demographic characteristics can be found in Table 2.

Table 2
Demographic Characteristics of Research Participants

Demographic Characteristics	Male	Female	Total
Age Range	22 - 72	31 - 66	22 - 72
Mean (*SD*)	45.2 (10.4)	46.4 (8.8)	45.5 (10.0)
BMI Range (*kg/m*^{2})	19.7 – 77.0	20.5 – 68.0	19.7 – 77.0
Mean (*SD*)	34.5 (10.4)	38.3 (12.5)	35.4 (10.9)
Sex (%)	97 (77%)	29 (23%)	126 (100%)
Race {*N*(%)}:			
White	86 (68.3%)	28 (22.2%)	114 (90.5%)
Black or A.A.	5 (4.0%)	1 (0.8%)	6 (4.8%)
White & A.I. or AK native	4 (3.2%)	0 (0.0%)	4 (3.2%)
Other/Unknown	2 (1.6%)	0 (0.0%)	2 (1.6%)
BMI Weight Classification {*N*(%)}:			
Healthy weight (18.5 – 24.9 kg/m^2)	16 (12.7%)	4 (3.2%)	20 (15.9%)
Overweight (25.0 – 29.9 kg/m^2)	23 (18.3%)	5 (4.0%)	28 (22.2%)
Class I Obesity (30.0 – 34.99 kg/m^2)	19 (24.4%)	4 (5.1%)	23 (29.5%)
Class II Obesity (35.00 – 39.99 kg/m^2)	13 (16.7%)	4 (5.1%)	17 (21.8%)
Class III Obesity($\geq$ 40.00 kg/m^2)	26 (33.3%)	12 (15.4%)	38 (48.7%)
Cellphone for personal use {*N*(%)}:			
Yes	96 (76.2%)	29 (23.0)	125 (99.2%)
No	1 (0.8%)	0 (0.0%)	1 (0.8%)
Internet use within the past 30 days {*N*(%)}:			
Yes	95 (75.4%)	29 (23.0)	124 (98.4%)
No	2 (1.6%)	0 (0.0%)	2 (1.6%)

Note. A.A. = African American; A.I. = American Indian

Research Question 1

RQ1 for this study was: Is there an association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers? The null hypothesis stated that there would be no association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers. Drive time for respondents ranged between 6–15 hours per day. Miles driven per day ranged between 156–1022 miles. Driving days per week ranged between 3–7 days.

I used multiple regression for analysis and no statistically significant association was found between drive time, drive distance, driving days per week and BMI. The null hypothesis that there would not be an association between work environment (e.g., drive time, drive distance, and driving days per week) and BMI among long haul truck drivers was accepted. Table 3 contains the data for work environment.

Table 3
Research Participant Association Between Work Environment and BMI

Variables	Range	Mean (*SD*)	*R*	*p*
Driving Hours Per Day	6 - 15	10.2 (1.5)	.058	.574
Miles Driven Per Day	156 - 1022	560.4 (125.1)	-.038	.717
Driving Days Per Week	3 - 7	6.0 (0.9)	.008	.933

Research Question 2

RQ2 for this study was: Is there an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers? The null hypothesis stated that there would not be an association between eating habits and BMI among long haul truck drivers. The data were analyzed using multiple linear regression to determine whether to accept or reject the null hypothesis.

Ten respondents reported never or almost never buying snack food, 85 reported sometimes buying snack food, and 31 reported usually or always buying snack food. Regarding the frequency of daily snack occasions, 11 reported never or almost never, 77 reported sometimes, and 38 reported usually or always. Regarding the frequency of fast food consumption, 19 reported never or almost never, 60 reported sometimes, and 47 reported usually or always. Twenty-eight reported never eating breakfast, 52 reported that they rarely eat breakfast, and 46 reported that they sometimes eat breakfast. These frequencies are displayed in Table 4.

I used multiple linear regression analysis for analysis, but there were no statistically significant associations between buying snack food, number of snack occasions, fast food consumption, eating breakfast, and BMI among the respondents. The null hypothesis that there would not be an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers was accepted because no statistically significant associations were found among these variables.

Table 4

Research Participant Association Between Eating Behavior and BMI

Variable	Never or Almost Never (%)	Sometimes (%)	Usually or Always (%)	*R*	*p*
Convenience Food (buy snack food)	10 (7.9%)	85 (67.5%)	31 (24.6%)	.101	.431
Convenience Food (daily snack occasions)	11 (8.7%)	77 (61.1%)	38 (30.2%)	.026	.218
Eat Fast Food	19 (15.1%)	60 (47.6%)	47 (37.3%)	.181	.077
	Never (%)	Rarely (%)	Sometimes (%)		
Eat Breakfast	28 (22.2%)	52 (41.3%)	46 (36.5%)	063	490

Research Question 3

RQ3 for the study was: Is there an association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers? The null hypothesis stated that there would be no association between physical activity and BMI among long haul truck drivers. The data were analyzed using multiple linear regression to determine whether to accept or reject the null hypothesis.

Sixty-six (52.4%) respondents reported participation in physical activity within the previous month, and 60 (47.6%) reported no physical activity. Thirty-three (26.2%) of the respondents reported never participating in 20 minutes of exercise at least three times per week, 45 (35.7%) respondents reported rarely participating in 20 minutes of exercise at least three times per week, and 26 (20.6%) respondents reported sometimes participating in 20 minutes of exercise at least three times per week. Fourteen (11.1%) of the respondents reported participating in 20 minutes of exercise at least three times per week most of the time, and eight (6.3%) respondents reported always participating in 20 minutes of exercise at least three times per week. These frequencies are displayed in Table 5.

I used multiple linear regression analysis for analysis, but there were no statistically significant associations between participation in physical activity (*R* = .162, *p* = .116) and BMI, or physical activity days per week and minutes per day (*R* = -.198, *p* = .056) and BMI among the respondents. The null hypothesis that there would be no association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers was accepted because no statistically associations were found among the variables.

Table 5
Research Participant Association Between Physical Activity and BMI.

Variable	Yes (%)	No (%)	*R*	*p*
Participation in physical activity within the last month	66 (52.4%)	60 (47.6%)	.162	.116

Variable	Never (%)	Rarely (%)	Sometimes (%)	Most of the time (%)	Always (%)	*R*	*p*
Participation in 20 minutes of vigorous exercise at least 3 times a week	33 (26.2%)	45 (35.7%)	26 (20.6%)	14 (11.1%)	8 (6.3%)	-.198	.056

Research Question 4

RQ4 for this study was: Is there an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers? The null hypothesis stated that there would not be an association between quality of sleep and BMI among long haul truck drivers. The range of daily sleep was 3–11 hours. Responses to the assessment for daytime sleepiness ranged from zero (would never doze) to 3 (high chance of dozing) on each of eight questions. The scores were totaled for each respondent. Daytime drowsiness scores ranged from 0–21. I used multiple linear regression analysis for analysis, but there were no statistically significant associations between amount of daily sleep, and daytime sleepiness, and BMI among the respondents. The null hypothesis that there would not be an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI was accepted because no statistically significant associations were found among the variables.

Table 6
Research Participant Association Between Quality of Sleep and BMI.

Variable	Range	*M*	*SD*	*R*	*p*
Amount of Daily Sleep (hours)	3 - 11	7.1	1.355	-.089	.322
Daytime Sleepiness Epworth Score	0 - 21	6.8	4.1	-.094	.296

Further Analysis

Since no statistically significant associations were found between the independent and dependent variables, further analysis was conducted to assess if statistically significant differences existed between the BMI classification groups. BMI classification groups were used because of the large number of individuals in the obese category, compared to the normal and overweight category. One-way ANOVA was used to compare the mean difference between healthy weight, overweight, obese Class I, obese Class II, and obese Class III. Regarding eating habits, quality of sleep, and work environment, there were no statistically significant differences between the BMI groups. Regarding physical activity, statistically significant differences were found between the groups. Dunnett's C post hoc test was conducted to determine within which groups the differences existed. The statistically significant differences between the mean values of each group are noted below in Table 7.

Table 7
Statistically Significant Differences Between Weight Groups Regarding Physical Activity

Variable	*M* difference	*p*
Frequency of Physical Activity:		
Overweight and obese class 2	1.034	.026*
Overweight and obese class 3	.883	.016*
Physical Activity Within the Prior Month:		
Overweight and obese class 2	.410	.044*
Overweight and obese class 3	.506	<0.001*

Note. *statistically significant ($P \leq 0.05$)
Statistical tests used: ANOVA; Dunnet's C post hoc

Regarding physical activity within the prior month, there were statistically significant differences between the mean values of the overweight group and the obese Class II group. There were also statistically significant mean differences between the overweight group and the obese Class III group. Of the respondents who participated in physical activity within the prior month, the majority was overweight (34.8%), compared to those who were obese Class II (10.6%) and obese Class III (18.2%). Of the respondents who did not participate in physical activity within the prior month, only 8.3% were overweight; compared to those who were obese Class II (16.7%) and obese Class III (43.3%). These findings are summarized below in Tables 7 and 8.

Regarding frequency of physical activity, there were statistically significant differences between the mean values of the overweight group and obese Class II group. There were also statistically significant differences between the mean values of the overweight group and the obese Class III group. Of the respondents who never participated in 20 minutes of vigorous exercise at least three times a week, 36.4% were obese Class III, 27.3% were obese Class II, and only 15.2% were overweight. None of the respondents in the obese Class II or obese Class III weight groups reported always participating in 20 minutes of vigorous exercise at least three times a week, but 37.5% of the overweight respondents reported always participating in vigorous exercise at least three times a week. Respondents who were overweight, more often achieved 20 minutes of physical activity 3 days per week than respondents who were obese class II or obese class III. See Table 7 and Table 8 below for data distributions related to the ANOVA analysis.

Table 8
Relative Differences Between Weight Groups Regarding Physical Activity

Variable	Healthy Weight	Overweight	Obese Class 1	Obese Class 2	Obese Class 3	Total
Participation in physical activity within the last month, *n* (%)						
Yes	12 (18.2%)	23* (34.8%)	12 (18.2%)	7* (10.6%)	12* (18.2%)	66
No	8 (13.3%)	5* (8.3%)	11 (18.3%)	10* (16.7%)	26* (43.3%)	60
Participation in 20 minutes of vigorous exercise at least 3 times a week, n (%)						
Never	3 (9.1%)	5* (15.2%)	4 (12.1%)	9* (27.3%)	12* (36.4%)	33
Rarely	6 (13.3%)	6* (13.3%)	11 (24.4%)	4* (8.9%)	18* (40.0%)	45
Sometimes	7 (26.9%)	8* (30.8%)	4 (15.4%)	2* (7.7%)	5* (19.2%)	26
Most of the time	2 (14.3%)	6* (42.9)	1 (7.1%)	2* (14.3%)	3* (21.4%)	14
Always	2 (25.0%)	3* (37.5%)	3 (37.5%)	0* (0%)	0* (0%)	8

Note. *statistically significant ($P \leq 0.05$)
Statistical test used: ANOVA

Summary

Data were collected and analyzed for a quantitative cross sectional study that explored-whether-selected-environmental factors were associated with obesity among long haul truck drivers. SPSS was used for analysis of data in this study. Descriptive statistics were provided to profile the qualitative demographic information. With BMI as a continuous dependent variable, multiple linear regression analysis was used to assess whether there was an association between the independent and dependent variables. No statistically significant associations were. BMI scores were then used to classify respondents into healthy weight, overweight, obese Class I, obese Class II, and obese Class III. Further analysis of the variables was conducted to determine if there was a statistically significant difference between the different BMI classifications relative to the independent variables, using a one-way ANOVA.

Regarding eating habits, quality of sleep, and work environment, there were no statistically significant differences between the BMI groups. Regarding frequency of physical activity level, statistically significant differences were found between the groups. Dunnetts C post hoc test showed statistically significant differences between overweight and obese Class II, and overweight and obese Class III. Respondents who were overweight, more often achieved 20 minutes of physical activity 3 days per week than respondents who were obese Class II. In Chapter 5, I will provide a conclusion of this analysis, including recommendations and implications for positive social change.

Chapter 5: Recommendations and Conclusion

Introduction

In this quantitative cross-sectional research study, I examined the environmental factors (e.g., work environment, eating habits, physical activity, and quality of sleep) associated with BMI among long haul truck drivers. One hundred forty-nine long haul truck drivers participated in the survey. Of the participants, 126 completed and met the inclusion criteria of being a long haul truck driver. This achieved the minimum sample size of 125, which was determined by the power analysis described in Chapter 3. About 1,500 participants were recruited through social media and asked to complete a 26-item questionnaire, which I used to collect data. The recruitment message was posted in several truck driver Facebook groups. Each of the truck driver groups had a minimum of 1,500 members. Members of the groups shared the recruitment message using Facebook and Twitter throughout the recruitment time period of 3 weeks. Participation was voluntary and anonymous. SurveyMonkey, an online survey site, administered the survey. Although my contact information was provided for participants who may have had questions, I received no inquiries from any participants.

The purpose of this study was to evaluate the relationship between the working environment and BMI among long haul truck drivers. The following four research questions guided this study:

RQ1: Is there an association between work environment (e.g., drive time, drive distance, and driving days per week,) and BMI among long haul truck drivers?

RQ2: Is there an association between eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast) and BMI among long haul truck drivers?

RQ3: Is there an association between frequency of physical activity level (e.g., days per week and minutes per day) and BMI among long haul truck drivers?

RQ4: Is there an association between quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI among long haul truck drivers?

In the original proposal of this study, obesity was going to be used as a dichotomous dependent variable. However, because the majority of respondents were obese, BMI ended up being used as the continuous dependent variable. The respondents' BMI ranged from 19.7–77.0 kg/m^2(35.4 $\pm$ 11.0 kg/m^2). None of the respondents were underweight (BMI < 18.5 kg/m^2), 20 were a healthy weight (BMI 18.5–24.9 kg/m^2), 28 were overweight (BMI 25.0 – 29.9 kg/m^2), and 78 were obese (BMI $\geq$ 30.0 kg/m^2). The BMI distribution of this study population was similar to the BMI distribution of the Jacobson et al. (2007) study population where 27 of 92 participants were overweight and 52 of 92 participants were obese. Additionally, I examined the demographics of the obesity classes because of the large proportion of obese respondents. Of the 78 obese respondents, 23 were obese Class I (BMI 30.0–34.99 kg/m^2), 17 were obese Class II (BMI 35.00–39.99 kg/m^2), and 38 were obese Class III (BMI > 40.00 kg/m^2; WHO, 2006).

Using BMI as a continuous dependent variable in multiple linear regression analysis, I found no statistically significant associations between any of the independent and dependent variables. Therefore, BMI scores were used to classify respondents into healthy weight (BMI 18.5–24.9 kg/m^2), overweight (BMI 25.0–29.9 kg/m^2), obese Class I (BMI 30.0–34.99 kg/m^2), obese Class II (BMI 35.00–39.99 kg/m^2), and obese Class III (BMI > 40.00 kg/m^2; WHO, 2006). Further analysis with one-way ANOVA showed statistically significant differences regarding frequency of physical activity level between the groups. Dunnett's C post hoc test showed statistically significant differences between overweight and obese Class II and overweight and obese Class III. There was a difference in BMI of the overweight and obese Class II groups, as well as between the overweight and obese Class III groups, that was most likely to be the result of the level of physical activity within the prior month and not just by chance. Regarding physical activity within the prior month, there were statistically significant differences between overweight and obese Class II and overweight and obese Class III. Respondents who were overweight more often achieved 20 minutes of physical activity 3 days per week than respondents who were obese Class II.

Interpretation of Findings

In this study, I used multiple linear regression analysis to assess association between work environment (e.g., drive time, drive distance, and driving days per week); eating habits (e.g., fast food consumption, convenience store food consumption, and eating breakfast); physical activity level (e.g., days per week and minutes per day); and quality of sleep (e.g., amount of daily sleep and daytime sleepiness) and BMI. No statistically significant associations were found between work environment, eating habits, physical activity level, or quality of sleep and BMI. Therefore, any changes in BMI were most likely the result of factors other than the independent variables in this study.

For multiple linear regression analysis, the assumption of normal distribution must be met. Upon visual inspection, the BMI distribution was skewed to the right and kurtosis was wider than a normal distribution (Field, 2009). Non-normal distributions can distort relationships between variables and findings may be unreliable (Field, 2009). The lack of statistically significant associations among the independent and dependent variables suggests that the associations are likely due to chance. However, the findings may have practical significance. The findings among this study population could be due to the large number of obese respondents. Of the respondents, 61.9% were obese. This is similar to the higher prevalence of obesity among long haul truck drivers (69%) compared to other occupational groups and U.S. working adults reported in recent literature (Gu et al., 2014; Luckhaupt et al., 2014; Sieber et al., 2014). .

Due to no statistically significant associations being found between the variables, I conducted further analysis to assess if statistically significant differences existed between the BMI classification groups. The assumptions of one-way ANOVA state that each sample is an independent random sample, distribution of the response variable follows a normal distribution, and population variances are equal across responses for the group levels (Field, 2009). Results may be unreliable if the data don’t meet these assumptions. One-way ANOVA was used to compare the population mean difference between healthy weight, overweight, obese Class I, obese Class II, and obese Class III. Regarding eating habits, quality of sleep, and work environment, no statistically significant ($p < 0.05$) differences were found between the BMI groups. However, regarding frequency of physical activity and physical activity within the prior month, there were statistically significant differences between the mean values of the groups. Follow-up tests were conducted to examine pairwise differences among the means. The Levene's test for homogeneity of variance was significant. Therefore, Dunnett's C test was used for post hoc comparisons because it does not assume equal variance among groups.

Regarding frequency of physical activity, there were statistically significant differences between the means of the overweight group and the obese Class II group ($M = 1.034$, $p = .026$). There were also statistically significant differences between the means of the overweight group and the obese Class III group ($M = .883$, $p = .016$). The majority of respondents who never or rarely participated in 20 minutes of vigorous exercise at least three times a week were obese Class III (36.4% and 40.0% respectively). Alternatively, the majority of respondents who sometimes or most of the time participated in 20 minutes of vigorous exercise at least three times a week were overweight respondents (30.8% and 42.9% respectively). None of the obese Class II or obese Class III respondents always participated in 20 minutes of vigorous exercise at least three times a week, but 37.5% of overweight respondents always participated in physical activity at this level. The differences between the weight groups of overweight respondents and those who were obese Class II and obese Class III were likely due to the frequency of physical activity and not due to chance, since the differences were statistically significant.

Regarding physical activity within the prior month, there were statistically significant differences between the means of the overweight group and obese Class II group ($M = .410$, $p = .044$) and means of the overweight group and obese Class III group ($M = .506$, $p = < 0.001$). The majority of the respondents who had participated in physical activity in the prior month were overweight (34.8%), compared to those who were obese Class II (10.6%) and obese Class III (18.2%). Of the respondents who had not participated in physical activity in the prior month, 43.3% were obese Class III and 16.7% were obese Class II. However, only 8.3% of the respondents who had not participated in physical activity in the prior month were overweight. The difference between the overweight group of respondents and the obese Class II group of respondents is likely due to participation in physical activity, since the differences were statistically significant. Additionally, the difference between the overweight group and the obese Class III group is likely due to participation in physical activity, since the differences were statistically significant.

These results of this study of long haul truck drivers support that participation in physical activity and frequency of physical activity may have a positive association with lower BMI, since obese class levels are determined by BMI. Driving for long hours most days of the week yields a sedentary working environment for long haul truck drivers. Therefore, participation in physical activity may present a challenge for drivers.

A BMI of obesity has been associated with elevated risk of other serious health complications and diseases such as hypertension, Type 2 diabetes, heart disease, stroke, asthma, and sleep apnea (Apostolopoulos et al., 2013; Dahl et al., 2009; Ogden et al., n.d.; Seipel, 2005). An observational study conducted by Apostolopoulos et al. (2012a) demonstrated that there are limited opportunities for physical activity and exercise within the work environment of long haul truck drivers and pointed to the need for interventions to improve such opportunities. In another study, Apostolopoulos et al. (2013) found that fitness and exercise facilities were very limited for long haul truck drivers and not available for over 70% of truck stops, almost 70% of trucking terminals, and 88% of trucking warehouses. These conditions within the working environment of long haul truck drivers increases the risk of becoming obese and developing other health problems compared to the general public (Apostolopoulos et al., 2011).

Limitations

One limitation of this study was self-reported height and weight. Since height and weight were used to calculate the BMI, incorrect reporting of height or weight could have generated inaccurate BMI and impacted the findings of the study. Height is sometimes significantly overestimated and weight is sometimes significantly underestimated (Pursey, Burrows, Stanwell, & Collins, 2014). Consequently, BMI can be inaccurately calculated and categories can be misclassified. Although this study had a high prevalence of obesity, it still may have been an underestimation of the burden of obesity among this population (Pursey et al., 2014).

Another limitation of this study was that it was only available in English. In the original proposal, the questionnaire was going to be available in Spanish. However, because of the inability to accurately translate the questionnaire into Spanish, the questionnaire was only available in English.

The potential for selection bias was another limitation of the study. Participants were recruited through social media and asked to complete a 26-item questionnaire, which was used to collect data. In order to recruit participants, I used social media. Recruitment messages were posted in multiple truck driver Facebook groups, with each group having at least 1,500 members. The online survey was a good choice for this study because it did not require an interviewer to be present, and with no associated postage expense, it was very cost effective (Szolnoki & Hoffmann, 2013). However, drivers who did not have access to the Internet were not able to participate in the study. Users of social media may or may not be more likely to participate, which may be an additional limitation this study. Long haul truck drivers spend large amounts of time on the road and away from home, making traditional mail and telephone surveys a less than optimal option for reaching this population. In this study, web-based survey provided the best means for administering the survey.

Some bias is associated with self-reported data, especially regarding BMI (Shields, Connor Gorber, Janssen, & Tremblay, 2011; Shiely, Hayes, Perry, & Kelleher, 2013; Stommel & Osier, 2013). Height is often overestimated and weight is often underestimated, yielding distorted and miscalculated BMI and underestimation of obesity (Shields et al., 2011). The use of anthropometric measures of height and weight are the most accurate ways of calculating BMI, but associated costs and logistics did not allow for this option in the study. Although bias with self-reported data has been well noted, there is no clear estimation of the extent of underestimation of obesity. Self-reported height and weight continues to be widely used in obesity research (Shields et al., 2011; Shiely et al., 2013; Stommel & Osier, 2013). Self-reported data regarding sleep could result in an overestimation of sleep, which could lead to an underestimation of the association between sleep and obesity (Silva et al., 2007; Zeitlhofer et al., 2010). However, self-reported data regarding sleep has been widely used and was used in this study. Overestimation of self-reported healthy eating habits and exercise can be a result of social desirability bias (Crowley, Grubber, Olsen, & Bosworth, 2013; Yoong, Carey, Sanson-Fisher, & D'Este, 2012). Privacy reduces this type of bias (Crowley et al., 2013). Since the survey was administered online instead of in person, privacy for participants was increased and the chance of this type of bias was reduced.

There are limitations of data analysis due to the under representation of participants. Without having a nationally representative sample of long haul truck drivers, the reliability of the findings are reduced. Longer recruitement period, and broader recruitment in order to reach a more representative sample are recommended for the future and are further discussed in the next section.

Recommendations

A recommendation for future research would be to recruit a more representative sample so that findings can be generalized to a larger population of long haul truck drivers. This might be accomplished by having a longer recruitment period, and expanding recruitment to include more internet and social media groups. Additionally, extending the recruitment to more drivers through the involvement of long haul truck driver employers and unions may reach more participants. Purposive sampling could help ensure a broader representation across all BMI groups before analyzing for associations between the independent and BMI.

Twenty-three percent of respondents in this study were female. However, females represent 6% of the population of long haul truck drivers in the United States (Jacobson et al. 2007; Sieber et al. 2014; Stasko & Neale 2007). Studies focused on the specific health needs of female drivers are recommended, and online recruitment may be a proactive way of reaching this population. A longer recruitment period, using social media is likely to yield a larger sample and provide the opportunity to generalize findings to a larger population of long haul truck drivers. Additionally, extending recruitment to include employers and union groups could also increase the chance of providing a more accurate representation of the female population of long haul truck drivers as well.

Considering the large proportion of obese drivers, using categorical obesity measures are highly recommended over the BMI continuous variable. Given the statistically significant difference between obese class groups regarding physical activity, future studies that explore physical activity and obesity among long haul truck drivers would be warranted. Perhaps an extensive assessment of the physical environment of truck stops to determine what opportunities for exercise exist and what potential for such opportunities exist for future development should be explored.

Although there was a statistically significant difference between physical activity and weight class groups, the results might not be clinically relevant. The reason for this is due to the choices from the survey, where the statistical difference was between never and rarely. Rarely would mean that respondents are not likely active versus never active. Future research might quantify physical activity minutes per week to determine if a true clinical difference exist.

Implications for Social Change

The public health problem of obesity has had a negative impact on the population of long haul truck drivers (Stasko & Neale, 2007). The findings of this study support the need for further research among this population. An implication for positive social change is the use of social media to reach this highly mobile population in future studies. The use of social media to reach a larger sample of this population should be pursued, as this population is often traveling and difficult to reach otherwise. Health promotion interventions that focus on awareness of this problem of obesity among long haul truck drivers could be beneficial. It may encourage larger stakeholders to engage continued research of this population to explore the working environment and obesity, ultimately leading to effective health promotions programs.

The results of this s The results of this study have the potential to effect positive social change by providing information about the possible association between working environmental factors of long haul truck drivers and BMI.

tudy have the potential to effect positive social change by providing information about the possible association between working environmental factors of long haul truck drivers and BMI. Findings of this study support the need for additional research to advance the knowledge of these associations. Additionally, the findings could guide public health officials and trucking industry stakeholders toward interventions to reduce BMI among long haul truck drivers.

Conclusion

In the United States, over 80% of truck drivers are either overweight or obese (Apostolopoulos et al., 2012b; Apostolopoulos et al., 2013). Obesity has a negative impact among long haul truck drivers and is a health problem that requires attention (Stasko & Neale, 2007). This was a quantitative cross-sectional research study that examined selected environmental factors (e.g., work environment, eating habits, physical activity, and quality of sleep) hypothesized to be associated with BMI among long haul truck drivers. Since no statistically significant associations were found between any of the independent and dependent variables using multiple regression analysis, BMI scores were used to classify respondents into weigh class groups of healthy weight, overweight, obese Class I, obese Class II, and obese Class III. One-way ANOVA was used to examine BMI mean differences between the weight groups. Further analysis indicated statistically significant differences between overweight and obese Class II, and overweight and obese Class III regarding physical activity level.

The small sample size was not representative of the whole population of long haul truck drivers. Therefore, findings cannot be generalized to the whole population. A recommendation for future research would be to recruit a more representative sample by having a longer recruitment period and expanding recruitment to include more internet and social media groups so that findings can be generalized to the whole population of long haul truck drivers. Another way to recruit a more representative sample might be to collaborate with community partners who work with long haul truck drivers and have a vested interest in supporting a healthy work environment. Health promotion interventions that focus on obesity awareness among long haul truck drivers might be beneficial, and further research of the working environment and obesity among long haul truck drivers is recommended.

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Appendix A: Questionnaire

Questionnaire

1. What is your age?

2. Indicate sex of the respondent. *Male or Female*

3. Are you Hispanic, Latino/a, or Spanish origin? *Yes or No*

4. Which one or more of the following would you say is your race? *White, Black or African American, American Indian or Alaska Native, Asian, Pacific Islander, Other*

5. About how much do you weigh without shoes?

6. About how tall are you without shoes?

7. Do you have a cell phone for personal use? Please include cell phones used for both business and personal use.

8. Have you used the internet in the past 30 days? *Yes or No*

9. How many hours do you drive each day?

10. How many miles do you drive each day?

11. How many days do you drive each week?

12. I buy snack food: *Never or almost never, Sometimes, Usually, or Always*

13. Number of daily snack occasions: *Never or almost never, Sometimes, Usually, or Always*

14. Number of times I eat fast food per week: *Never or almost never, Sometimes, Usually, or Always*

15. Eat breakfast daily? *Never or almost never, Sometimes, Usually, or Always*

16. During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise? *Yes or No*

17. Participate in 20 minutes of vigorous exercise at least three times a week?

Never, Rarely, Sometimes, Most of the time, Always

18. On average, how many hours of sleep do you get in a 24 hour period?

Use the following scale to choose the most appropriate number for each situation

0 = Would never doze

1 = Slight chance of dozing

2 = Moderate chance of dozing

3 = High chance of dozing

___Sitting and reading

___Watching TV

___Sitting, inactive in a public place (e.g. a theatre or a meeting)

___As a passenger in a car for an hour without a break

___Lying down to rest in the afternoon when circumstances permit

___Sitting and talking to someone

___Sitting quietly after a lunch without alcohol

___In a car, while stopped for a few minutes in the traffic

Appendix B: Recruitment Message

Your input is requested in a cross-sectional study of obesity among long haul truck drivers.

As part of a doctoral dissertation at Walden University, the study will evaluate the connection with obesity and quality of sleep, healthy food choices, and physical activity of long haul truck drivers while working on the road. Your participation is anonymous and should take about 10 minutes to complete.

Your contribution is greatly appreciated.

Survey may be accessed directly at

(Provide link to the Survey Monkey website here.)

Once complete, findings of the study will be made available at

(Provide facebook page link here.)