5-2014

IMPACT OF PHYSICAL AND PSYCHOSOCIAL WORKPLACE HAZARDS ON EMPLOYEE HEALTH: AN IRISH TALE OF CIVIL SERVANT WORKERS

Kyle R. Stanyar
Clemson University

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IMPACT OF PHYSICAL AND PSYCHOSOCIAL WORKPLACE HAZARDS ON EMPLOYEE HEALTH: AN IRISH TALE OF CIVIL SERVANT WORKERS

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
Industrial-Organizational Psychology

by
Kyle R. Stanyar
May 2014

Accepted by:
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Dr. Patrick Rosopa
Dr. Paul Merritt
Dr. James McCubbin
ABSTRACT

Obesity, mental health problems, and absenteeism are both economic and health burdens for employers and employees. Research suggests that physical and psychosocial hazards in the workplace contribute to health risks and health problems among employees. There is a need for researchers to examine how exercise, diet, and age interact with the negative effects of workplace hazards upon health. Hypotheses 1a through 3b predicted that physical and psychosocial workplace hazards would negatively impact body mass index (BMI), general mental health, and sickness absences. Further, hypotheses 4a through 9b predicted that exercise and diet would buffer stress from occupational hazards upon BMI, mental health, and sickness absences. Finally, hypotheses 10a through 11b predicted that age would act as a moderator between occupational hazards and employee health outcomes. A sample of 16,651 civil servant workers from the Northern Ireland Civil Service Workforce were examined. The data was split into two groups based on salary-senior level pay grade and lower level pay grade. The results confirmed hypotheses 1a, 1b, 3a, 3b, 11a, and 11b for the lower level pay grade, but failed to support hypotheses 2 and 4a through 10b. Additionally, the results confirmed hypotheses 1b for the senior level pay grade; however the results failed to confirm hypotheses 1a and hypotheses 2 through 11b. Importantly, physical activity was related to a lower BMI, improved mental health, and less sickness absences, while a healthy diet was related to a lower BMI for both pay grades. Promoting physical activity and a healthy diet are viable methods for improving employee health.
ACKNOWLEDGEMENTS

Several people have played a vital role in helping to complete this dissertation. I am extremely grateful and indebted to each and every one of them. Without their support and guidance I would not have been able to complete this paper.

First, I would like to thank my advisor and mentor Dr. Robert Sinclair. Without his support and guidance, my dissertation would not be what it is today. His expertise in Occupational Health Psychology and his high standards for work quality have helped improve my own work. Without his help I would not have made it into graduate school, and I am greatly appreciative of that.

In addition to my advisor and mentor, I also have committee members who I deeply respect. Dr. James McCubbin has helped expand my expertise in health psychology and allowed me to apply my knowledge of health psychology to workplace settings. Further, Dr. Paul Merritt has allowed me to gain valuable experience in designing and implementing research studies related to physical fitness. Finally, Dr. Patrick Rosopa has been a great mentor for teaching me statistics and research design.

I must also thank Dr. Jonathan Houdmont, who allowed me to use his data for my dissertation. Without the generosity of Dr. Houdmont, I would not have a dissertation at all. I greatly appreciate his generosity.

Finally, I want to thank my family and friends for giving me support throughout the years, allowing me to get to this point in my life. I want to especially thank my parents Dave and Susan Stanyar, as well as my sister, who have always supported me in my choice to pursue a Ph.D. in Industrial-Organizational Psychology. Thank you!
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CHAPTER 1
INTRODUCTION

People are spending increased amounts of time at work, as organizations compete to stay profitable in a globalized economy. Mexico tops the list, with Mexicans spending 2,250 average annual hours of work per person, recently surpassing South Korea at 2,193 average annual hours of work per person (OECD, 2012). In comparison, U.S. employees average 1,787 annual hours and the Dutch logged the least amount of working hours per person, averaging 1,379 hours of annual work. The United Kingdom averaged 1,625 hours of annual work per person, ranking 23rd among 32 nations surveyed by the Organization for Economic Co-operation and Development (OECD, 2012).

In light of the fact that people are spending increased amounts of time at work, health promotion in the workplace is becoming recognized as an important area of research. Psychologists have argued that psychology needs to take a more active role in applying research to practice, in order to prevent occupational stress, illness, and injury (NIOSH, 2013). Occupational health psychology can help bridge the gap between research and practice. According to NIOSH (2013) Occupational Health Psychology concerns the application of psychology to improving the quality of work life, and to protecting and promoting the safety, health, and well-being of workers. Considering the fact that people are spending increased amounts of their daily lives at work, Occupational Health Psychology (OHP) has become recognized as a critical area of study for investigating the causes and consequences of employee health and well-being.
One of the challenges of workplace health promotion is that it involves encouraging behaviors outside of work, which may be perceived as an action beyond an employer’s authority or responsibility (Eakin, 1992). Further, some researchers fear that placing an emphasis on individual employee behaviors outside of work may create an environment conducive to employers discriminating against their employees who suffer from health problems (Khatri, Brown, & Hicks, 2009). For example, discrimination against obese employees and employees with mental health problems is quite common (Roehling, Roehling, & Pichler, 2007; Stuart, 2006). However, many researchers and practitioners now acknowledge that it is necessary to promote employee health both within and outside the organization, while at the same time protecting the privacy and rights of employees (NIOSH, 2013).

NIOSH (2013) has coined the term “total worker health” as a strategy to integrate occupational safety and health protection with health promotion. The goal of total worker health promotion is to simultaneously prevent worker injury and illness and to advance health and well-being. Recent research demonstrates that both work-related factors and health factors outside of the workplace contribute to the health and well-being of employees (NIOSH, 2013). In the past, workplace health and safety programs have been segmented. For example, health protection programs have been solely targeted towards reducing employee exposure to risk factors arising in the workplace. In contrast, most workplace health promotion programs have focused on health behaviors outside of the workplace (NIOSH, 2013). Many health promotion programs tend to omit organizational factors from consideration when creating programs and many health protection programs
from an organizational framework tend to omit employee health behaviors outside of the workplace (Griffiths, 1999). According to NIOSH (2013), the most effective health and safety promotion programs combine both work-related factors and health factors beyond the workplace.

When taking total worker health into account, it is necessary to understand the prevalence and impact of health issues among the workforce in order to illustrate how important the topic of employee health is. First and foremost, obesity is a major health concern among the working population. The CDC defines being overweight as a body mass index (BMI) of 25 or higher and obesity is defined as a BMI of 30 or higher. According to the OECD (2013), as of 2009, the United States leads the world in obesity, with 33.8% of adults being categorized as obese. Not far behind the U.S. in obesity rates were Mexico (30%), New Zealand (26.5%), Chile (25.1%), Australia (24.6%), Canada (24.2%), and the United Kingdom (23%). In contrast, the least obese countries were Korea (3.8%) and Japan (3.9%). Shockingly, at least 1 in 2 people are now overweight or obese in half of the 32 countries surveyed by the OECD.

The high rates of obesity worldwide are cause for concern because obesity is linked to many unfavorable health outcomes. According to the CDC (2012), overweight and obese individuals are at an increased risk for several health problems such as heart disease, type 2 diabetes, cancer, hypertension, stroke, and sleep disturbances. Obesity can be caused by a person’s environment, genetics, diseases, drugs, or a combination of all four.
There are also occupational safety concerns for obese workers. Obese employees suffer from increased occupational injuries compared to non-obese employees. Ostbye, Dement, and Krause (2007) report that obese workers suffer from increased rates of lower extremity pain and back pain, falls or slips, and injuries caused by exertion and/or lifting. Polack et al. (2007) also found that employees who were classified as obese by the body mass index scale were almost twice as likely to sustain traumatic workplace injuries. Importantly, the combination of obesity and high-risk occupations that require heavy lifting were found to be particularly detrimental to employee injuries (Ostbye, Dement, & Krause, 2007).

Obesity is also a large financial burden for individuals, organizations, and countries. Healthcare expenditures for obese people are 25% higher than for a person of normal weight (OECD, 2013). Further, obesity is responsible for 1-3% of total healthcare expenditure among OECD countries surveyed and 5-10% for the U.S. Interestingly, obese people also earn up to 18% less in wages compared to people of normal bodyweight (OECD, 2013). The reduced earning potential of obese employees is likely linked to increased absences. For example, obese employees miss more work days due to short-term absences, long-term disability, and premature death compared to non-obese employees (Harvard School of Public Health, 2011). Obese employees suffer from increased occupational injuries compared to non-obese employees as well. Finkelstein et al. (2010) estimate that the average annual cost of obesity related productivity losses and medical expenditure for employers is 73.1 billion dollars annually. Employers must also
pay higher life insurance premiums and pay out more worker compensation for employees who are obese (Harvard School of Public Health, 2011).

Specifically, obesity is expected to have a huge economic impact on the U.S. and the U.K. Wang, McPherson, Marsh, Gortmaker, and Brown (2011) project that by 2030 there will be 65 million more obese adults in the U.S. and 11 million more obese adults in the U.K. Obesity is predicted to cost 48-66 billion dollars annually for the U.S. and 1.9-2 billion dollars annually for the U.K. in medical costs associated with obesity. Given the projected increase in obese individuals in the workplace, organizations will need to turn to occupational health psychology for answers about how to improve employee health and how to keep healthcare and insurance costs of employees to a minimum.

Another important factor to consider when promoting “total worker health” is the mental health of the working population. The World Health Organization (2001) estimates that approximately 450 million people worldwide suffer from a mental health problem. Mental health disorders vary by country, but are a particular problem for the U.S. According to the World Mental Health Consortium Survey (2004), the U.S. suffers from the highest rates of anxiety and mood disorders among 14 countries surveyed. The U.S. rates of anxiety disorders are 18.2% and 9.6% for mood disorders. Not far behind the U.S. in anxiety and mood disorders are France (12%; 8.5%) and Lebanon (11.2%; 6.6%). In contrast, the countries with the lowest rates of anxiety and mood disorders are China (2.4%) and Japan (5.3%). Although the United Kingdom was not included in the Mental Health Consortium Survey, a study by Wiles et al (2006) found that 4.4% of the U.K. population suffers from mental health problems.
Importantly, poor mental health is associated with several negative outcomes, which can impact an individual’s well-being. Complications associated with poor mental health can include unhappiness, decreased enjoyment of life, social conflicts, self-harm or harm to others, weakened immune system, heart disease, and other medical conditions (Mayo Clinic, 2012). Risk factors for mental illness can include having a biological relative with a mental illness, experiences in the womb, experiencing stressful life events, use of drugs, and having a lack of social support (Mayo Clinic, 2012).

There are also occupational safety concerns for employees who have mental health problems. Employees who suffer from poor mental health may not be able to cope with job stress as well as mentally healthy people (Gabriel, 2000). Further, when employees are unable to cope with job stress, they are at an increased risk for workplace accidents and illnesses (Gabriel, 2000). Suzuki et al. (2004) report that occupational errors are more prevalent among employees with poor general mental health compared to employees who reported good general mental health. In addition, employees who take medication for mental health problems do not anticipate that the side-effects of the medication may make them feel worse initially. Consequently, the negative side-effects of medication have been cited as a contributing factor to lowered work performance and accidents (Haslam, Atkinson, Brown, & Haslam, 2005). However, Gabriel (2000) notes that workers with mental disorders vary in their response to stress. In addition, a good match between the employees’ needs and working conditions can be considered more important to employee health, more so than mental health conditions (Gabriel, 2000).
The negative effects of mental health problems extend beyond the individual who may suffer from a mental health disorder. Although the financial cost of mental disorders can be difficult to precisely calculate, the estimated annual cost of mental illness is approximately 2.5 trillion dollars worldwide (Bloom et al., 2011). The Agency for Healthcare Research and Quality estimates mental healthcare costs approximately 57.5 billion dollars annually in the U.S (Soni, 2009). In comparison, the adverse effects of poor mental health in the U.K. cost approximately 77 billion in terms of welfare benefits and lost productivity at work (National Mental Health, 2011). The main economic burden of mental illness for most countries does not stem from healthcare costs, but from a loss of income due to unemployment and indirect costs due to chronic disability (National Institute of Mental Health, 2013).

When examining the health of the working population it is also important to review factors in the workplace that can impact employee health. Since employees spend many hours at their job, an individuals’ work environment can potentially play a significant role in their physical and mental health. In light of the fact that a growing proportion of people are working indoors, in the post-industrial era, new workplace hazards have shifted from an outdoor environment to indoor environments such as office buildings (Jaakkola & Jaakkola, 2007). These work environments present employees with new workplace hazards.

NIOSH (2013) states that several elements contribute to a healthy office environment for employees. Attention to chemical hazards, office equipment, workstation design, task design, and physical environment is needed. Physical environment
factors can include, but are not limited to temperature, lighting, noise, and ventilation. In addition, psychological factors can contribute to a healthy office environment. These factors can include personal interactions with peers and supervisors, work pace, and job control. Employees may develop stress and be prone to injury and illness if the demands of the job exceed their psychological or physical abilities and resources (NIOSH, 2013).

NIOSH (2013) also describes several situations which can lead to injury or illness in the workplace. For example, physical hazards such as leaving extension cords across walkways or unsecure objects falling from an overhead shelf can compromise worker health. Job-task related injuries can also occur, if the speed, repetition, or duration of an activity exceeds one’s physical or psychological capabilities. Environmental hazards such as exposure to chemicals or biological sources can also lead to acute or long term health problems. Finally, design-related hazards can contribute to employee ill-health. For example, non-adjustable furniture or equipment can be hazardous for employees who have physical health problems such as chronic or acute lower back pain (NIOSH, 2013).

Workplace injuries are a serious and prevalent occurrence, which can be highlighted by examining the rates of workplace accidents worldwide.

Worldwide accident rates are difficult to estimate because countries vary in their workplace safety standards and accident reporting. According to Hämäläinen, Saarela, and Takala (2009), the worldwide total of occupational accidents has increased; however fatality rates per 100,000 workers has decreased. Worldwide, there were approximately 360,000 fatal occupational accidents in 2003 and almost 2 million fatal work-related diseases in 2002. Each day, more than 960,000 people are injured on the job and each
day 5, 330 people die due to work-related disease (Hämäläinen, Saarela, & Takala, 2009).

On average, the African countries suffer from higher rates of workplace accidents and injuries leading to fatalities whereas Western Europe tends to show lower rates of workplace accidents and fatalities.

Although less developed countries tend to suffer from high levels of occupational accidents, workplace accidents are a serious problem in developed countries as well. According to the Bureau of Labor Statistics (2011), fatal workplace injuries in the U.S. are on the decline, but the rates of fatalities in the workplace are still alarmingly high. In 2011, 4,609 workers were killed on the job in the U.S. The private sector industry accounted for 4,188 fatalities in the workplace while the government sector accounted for 421 fatalities. Within the private sector, 738 fatalities were in construction (Bureau of Labor Statistics, 2011). In addition, non-fatal workplace injuries in the U.S. among private industry, state government, and local government lead to 1,181,290 days away from work due to injury. Twenty percent of the days away from work due to injury were concentrated among laborers, nursing aids, janitors/cleaners, truck drivers, and police officers (Bureau of Labor Statistics, 2011). The incidence rate of non-fatal accidents among private sector employees was 190 cases per 10,000 workers compared to 105 for non-private sector employees (Bureau of Labor Statistics, 2011).

The United States is not the only economically developed nation that is plagued by high rates of occupational accidents. Fatal workplace injuries account for 590 deaths in the United Kingdom annually. In contrast to the U.S, a smaller number of fatal workplace injuries were concentrated among construction workers, causing 49 deaths, at
an incidence rate of 2.3 per 100,000 workers (Health and Safety Executive, 2011). Further, the agriculture sector in the United Kingdom accounted for the highest incidence of fatalities (33), at a rate of 9.7 per 100,000 (Health and Safety Executive, 2011). In addition, an estimated 591,000 employees in the United Kingdom had a non-fatal accident at work, leading to 368,000 separate cases of absences lasting longer than 3 days. Service industries accounted for the largest number of non-fatal major injuries, accounting for 18,466 injuries (Health and Safety Executive, 2011).

Occupational accident rates are commonly used as an indicator of how safe a work environment is for employees across industries and countries (WHO, 2001); however caution should be taken when interpreting accident rate statistics. For example, the reporting of accidents may vary by country (Hämäläinen, Saarela, & Takala, 2009), making it difficult to distinguish whether a region has low accident rates due to safe work environments or an underreporting of accidents. For example, Hämäläinen, Saarela, and Takala (2009) note that the accident rates in China and India appear to be too low. Considering both China and India have a high concentration of workers in agriculture and construction, which are industries known to have higher accident rates, it is very plausible that accident reporting is low in both countries.

In addition to the problem of underreported accidents, accident rate statistics also fail to describe the underlying factors in the workplace that create an unhealthy or unsafe work environment. For example, a workplace may have a high accident rate, but this statistic does not explain why accidents are occurring. In order to fully understand how to
increase employee well-being and safety it is necessary to appreciate how workplace hazards affect the work environment and impact employee health.

Although definitions and groupings can vary, workplace hazards can be broadly grouped into two categories; psychosocial and environmental hazards (Cox, 1993). Psychosocial hazards can include job content, work pace, interpersonal relationships, and job control. Environmental hazards can include a lack of working space, poor lighting, heat exposure, and excessive noise (Leka & Jain, 2010). Psychosocial and environmental hazards have been linked to increased accident rates and absences from work due to injury (Clarke, 2006; Oliver, Cheyne, Tomás, & Cox, 2002); however the occupational stress produced by workplace hazards can also have mental and physical consequences beyond accidents. For example, psychosocial hazards have been found to be negatively related to mental health (Standsfeld & Candy, 2006). Further, environmental hazards such as excessive noise levels have been linked to increased stress levels among employees (Topf, 2000). A growing body of research also suggests that high levels of environmental workplace hazards are linked to negative physical health outcomes such as obesity and poor physical health (Schulte, Wagner, Downs, & Miller, 2008).

Although occupational stress is related to negative health outcomes such as poor mental health, obesity, and absences (Burton et al., 1999; Stansfeld & Candy, 2006; Torres & Nowson, 2007), there is research to suggest that physical activity can buffer the negative effects of stress on health outcomes (Sonnentag & Fritz, 2007). Importantly, occupational stress may result in negative health outcomes due to a lack of recovering or psychological detachment from work (Craig & Cooper, 1992). Virtanen et al. (2009)
suggest that occupational stress can be amplified if there is a lack of recovery after work, which could take the form of physical activity during leisure time. Sonnentag (2001) explains that leisure activities can play a factor in a person’s psychological recovery after work. Leisure activities can include recreational activities that involve physical activity, or simply doing physically demanding household chores. It is believed that physical activities provide a temporary relief from job related demands, and allow the body’s functional systems to recover (Sonnentag, 2001). Additionally, Yeung (1996) explains that physical activity provides a cognitive distraction from job related activities. Importantly, physical activity may buffer the negative effects that stress has on employee health.

Physical activity alone may not be as effective in buffering the negative effects of stress if an individual has a poor diet. High stress levels have been linked to unhealthy eating habits, such as eating foods high in saturated fat (Ng & Jeffery, 2003). Payne, Jones, and Harris (2005) argue that stress has a direct effect on eating behaviors, even more so than the link between stress and exercise behaviors. People who feel stressed are more likely to eat unhealthy foods, which can contribute to poor health. However, people who maintain a healthy diet can prevent weight gain and chronic disease (Harvard School of Public Health, 2013). Individuals who eat a healthy diet low in saturated fats and high in lean meats, fruits, and vegetables tend to maintain a healthy body weight compared to people who eat unhealthy diets (Harvard School of Public Health, 2013). Research also suggests that individuals who maintain a healthy diet have stronger immune systems, allowing a person’s body to better cope with stress and illnesses associated with stress.
Further, Jackson, Knight, and Rafferty (2010) believe that positive health behaviors, such as eating a healthy diet can buffer the negative effects that stress has on developing mental health problems.

It is evident that obesity, poor mental health, occupational accidents and illnesses have both financial and health implications for the individual employee and the organizations that employ them (Marmot, Friel, Bell, Houweling, & Taylor, 2008). Clearly, several factors come into play, which can contribute to an employees’ health. Personal health problems such as suffering from poor mental health or being overweight can contribute to decreased health and well-being. In addition, hazards in the workplace such as psychosocial and environmental hazards can have a negative impact on employee health and well-being. Using the framework set out by NIOSH (2013) it is essential that both health behaviors and health hazards that occur within and outside the workplace be considered when promoting total worker health.

Based on the total worker health framework proposed by NIOSH the purpose of the current study is twofold. The first goal of this study is to extend past literature on the antecedents of occupational stress, obesity, poor mental health, and absences due to sickness. Specifically, the current study will examine how workplace hazards impact employee stress, obesity, mental health, and workplace absences due to illness. The second goal of this study is to determine whether physical activity and a healthy diet can buffer the negative effects of workplace hazards upon the health outcomes stated above. Importantly, it is vital for organizations to understand how employee well-being can be influenced by health behaviors both within and outside the workplace in order to
recognize how health can be promoted. Finally, the current paper will consider the changing demographics of the workforce, in order to properly promote total worker health. Given the aging workforce it is essential that employers develop strategies to promote the health of older workers, who are at a higher risk for health problems and injury (Houx & Jolles, 1993).

Currently, there is a gap in the literature with regards to how environmental hazards affect psychological health outcomes. Numerous studies have examined how environmental hazards can affect physical health outcomes such as muscular skeletal problems (Magnavita et al., 1999); however less attention has been paid to how environmental hazards can impact psychological outcomes such as general mental health or acute psychological distress. In addition, few studies have examined both psychosocial and environmental hazards as an antecedent to health outcomes. Finally, few studies have given proper attention to the aging workforce, and how to best promote the health of older workers (University of Iowa, 2009).

Another gap in the literature is that many studies have examined how exercise can buffer the negative effects of occupational stress without recognizing other important health behaviors (Steptoe, Wardle, Pollard, Canaan, & Davies, 1996). For example, there is a need for studies to examine how a healthy diet can potentially buffer the negative effects of occupational stress. In addition, the combination of a healthy diet and exercise is known to improve health (Center for Disease Control, 2011), however, few studies have examined how the combination of a healthy diet and exercise can affect a more distal outcome in the workplace, such as absences due to illness.
Finally, it appears that there is an overabundance of studies that have used U.S. samples of participants when examining health outcomes such as obesity, mental health, and illnesses. It is also important to examine the health behaviors and health outcomes of different country populations to ensure that the information uncovered by health promotion research is generalizable worldwide.

The current study will bridge the gap in the literature in several important ways. First, the current study will go beyond examining the effects of environmental hazards on physical health outcomes, and include an investigation of how environmental and psychosocial hazards affect both physical and psychological health outcomes. Secondly, the current study will improve upon past research by investigating how both exercise and diet can buffer the negative effects of stress. Additionally, the current study will bridge the gap in the literature by examining the antecedents of physical and mental health outcomes among a non U.S. sample. A study based on a non U.S. sample is much needed in the health research field, allowing researchers to understand how health behaviors differ across cultures. Finally, the current study will take into consideration the changing needs of an aging workforce for health and safety promotion.

**Obesity**

Before the antecedents and influences on specific health outcomes are examined, it is necessary to understand the physiological underpinnings of the human body. Since obesity is a major health risk among the workforce, a discussion of what obesity is and how obesity affects the body is important. In addition, a review of the human body’s
physiological processes is essential in understanding how obesity affects the body, and how the environment and individual factors can affect obesity.

Overweight and obesity are defined as excessive fat accumulation which can impair health (WHO, 2013). Both the Center for Disease Control and the World Health Organization define someone as being overweight if they have a body mass index (BMI) greater than or equal to 25. Further, anyone with a BMI equal to or greater than 30 is considered obese. BMI is a common index of weight to height that is used to classify adults as obese or overweight (WHO, 2013). BMI is calculated by dividing a person’s weight in kilograms by the square of his/her height in meters (CDC, 2012). The WHO (2013) states that BMI is useful because it is a population-level measure of overweight and obesity, as it is the same for both sexes and for all adult ages. However, BMI should be used with caution because the BMI numbers do not always correspond to the same level of body fat for different people.

According to the WHO (2013) the main cause of being overweight or obese is due to an energy imbalance between calories consumed and calories expended. When an individual consumes more calories than they expend weight gain will result. Body weight will decrease when an individual consumes less calories, increases energy expenditure through physical activity, or a combination of both. The Harvard School of Public Health (2013) explains that the body will store excess calories as body fat, which can accumulate over time, resulting in weight gain.

There are several factors that can cause or contribute to obesity. The WHO (2013) cites increased consumption of energy-dense foods, which are high in fat as a major
contributor to weight gain. In addition, decreased physical activity due to the sedentary nature of many forms of work and changing modes of transportation have contributed to obesity. Further, the negative health behaviors people practice can interact with their genetics, increasing the likelihood of being overweight or obese (WHO, 2013). For example, someone who has a genetic predisposition to fat accumulation and eats an unhealthy diet is at a greater risk for developing obesity compared to a person who does not have a genetic predisposition to store fat but also eats an unhealthy diet.

There are several health consequences to being overweight or obese. Obesity is the second leading cause of death in the U.S. after tobacco use (Harvard School of Public Health, 2013). Obesity is linked to a long list of health conditions such as heart disease, stroke, diabetes, high blood pressure, unhealthy cholesterol, asthma, sleep apnea, gallstones, kidney stones, infertility, and 11 types of cancer. Further, obesity is linked to social and emotional problems such as discrimination, lower wages, lower quality of life and depression. Additionally, obese individuals are at an increased risk for developing mental health disorders (Harvard School of Public Health, 2013).

**Mental Health**

Although obesity is linked to mental health problems such as depression (Harvard School of Public Health, 2013), poor mental health is a serious health risk on its own. In order to fully understand the severity of poor mental health as a health risk for the working population, it is critical to review what mental health is and how it affects the human body.
According to the Center for Disease Control (2011) mental health is defined as a state of well-being in which individuals realize their own abilities, can cope with the normal stresses of life, can work productively, and are able to make a contribution to their communities. Surprisingly, it is estimated that only 17% of the working population are considered to be in a state of optimal mental health (CDC, 2011). Since approximately 83% of the population is not considered to be in “optimal mental health” it is important for researchers and organizations to determine how to increase mental health to promote total worker health (NIOSH, 2013).

The CDC (2011) states that there are 3 main indicators of mental health. The first indicator of mental health is emotional well-being. Emotional well-being includes perceived life satisfaction, happiness, cheerfulness, and peacefulness. The second indicator of mental health is psychological well-being. Psychological well-being includes factors such as self-acceptance, personal growth, openness to new experiences, optimism, hopefulness, purpose in life, control of one’s environment, spirituality, self-direction, and positive relationships. The third indicator of mental health is social well-being, which includes social acceptance, beliefs in the potential of people, personal self-worth and a sense of community.

Closely related to mental health is mental illness. Although both terms are often used interchangeably, mental health and mental illness represent different psychological states (CDC, 2011). Mental illness is defined collectively as all diagnosable mental disorders or health conditions that are characterized by alterations in thinking, mood, behavior, or a combination of all three conditions, associated with distress, and/or
impaired functioning (CDC, 2011). The most common type of mental illness is depression, which affects 26% of the U.S adult population.

Mental health disorders can be triggered by many factors. The Mayo Clinic (2013) states that genetics can play a role in the likelihood of developing a mental health disorder. People with biological relatives who have had a mental disorder are at an increased risk for developing a disorder themselves. Certain genes can also increase an individuals’ risk of developing a disorder, and stressful life situations can trigger these genes, leading to a disorder. In addition, environmental exposures during birth can cause mental disorders. For example, exposure to viruses, toxins, and drugs while in the womb have been linked to mental illness.

The Mayo Clinic (2013) also cites negative life experiences as a risk factor for developing a mental health disorder. Stressful life events such as the death of a loved one, financial problems, and high stress can trigger mental illnesses. In addition, a poor childhood upbringing resulting in decreased self-esteem or a history of sexual and physical abuse can contribute to the development of a mental disorder. Specifically, negative life experiences can lead to unhealthy patterns of thinking related to mental illness, such as pessimism.

Mental disorders have been shown to be related to many chronic health problems such as immune suppression, diabetes, cancer, cardiovascular disease, asthma, and obesity. In addition, mental health disorders are strongly related to risk behaviors of chronic disease, including physical inactivity, smoking, excessive drinking, and insufficient sleep (CDC, 2011). Importantly, mental health problems and stress resulting
from feeling lonely or depressed can suppress an individual’s immune system, which can increase susceptibility to other health problems (American Psychological Association, 2006).

**Immune System**

Before the antecedents and influences on specific health outcomes are examined it is necessary to understand the physiological underpinnings of the human body. The main system in the human body that fights infection and disease is the immune system. The National Institute of Allergy and Infectious Disease (2011) describes the immune system as a network of cells, tissues, and organs that work together to defend the body against microbes, bacteria, parasites, fungi, and viruses. The immune systems seeks out these “invaders” and destroys them. The immune system is comprised of millions of cells that communicate information back and forth when an infection is detected. Specifically, the immune system contains certain types of white blood cells named B lymphocytes and T lymphocytes (National Institutes of Health, 2013). B lymphocytes become cells that produce antibodies, making it easier for the immune system to destroy harmful antigens. T lymphocytes attack antigens directly and help control the immune response. Once the immune system is alerted of an infection, powerful chemicals are produced and released to attack the “invaders”. The substances produced by the immune cells allow the cells to regulate their own growth and behavior, enlist other immune cells, and direct the newly recruited immune cells to the spot of the infection (National Institute of Allergy and Infectious Disease, 2011).
Importantly, one major factor that can harm the immune system is stress. It is believed that the mediating factor between stress and immune system suppression is the stress hormone cortisol (Randall, 2011). Cortisol’s main function is to restore homeostasis to the body following exposure to stress. Unfortunately, long term cortisol secretion can block T lymphocytes from multiplying by preventing some T cells from recognizing signals from other immune cells and can reduce the bodies’ inflammation response. Cortisol’s ability to suppress the immune response can leave individuals suffering from chronic stress and very vulnerable to infection (Randall, 2011).

Notably, people who are older or are already sick are more prone to stress-related immune changes (APA, 2006). For example, individuals who suffer from mild depression show signs of a suppressed immune system such as a weaker T lymphocyte immune response, which is the bodies’ major defence mechanism against viruses and bacteria (Glaser, McGuire, & Glaser, 2002). In addition, immune response significantly decreases as the age of the individual increases. It appears that both sickness and age contribute to a suppressed immune system (APA, 2006). Further, people who are both sick and older suffer the greatest health problems with a suppressed immune system (Segerstrom & Miller, 2004).

**Physiological Processes of Stress**

In light of the fact that stress can lead to immune suppression and can negatively impact health, it is important to understand the underlying mechanisms behind stress in order to determine how stress can be reduced. O’Leary (1992) explains that acute stress results when an immediate situation or event is perceived as a stressor. Acute stress
causes the activation of the autonomic nervous system (ANS). The ANS consists of two branches; the sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system is responsible for physiological processes which increase arousal and attention, including increased heart rate, dilated pupils, respiration, and the release of adrenalin. These physiological changes were adaptive in the past when humans had to survive in the wilderness. These processes helped humans survive by preparing the body to “fight or flee” a potential threat or predator. The parasympathetic system is designed to bring back homeostasis to the ANS, by returning physiological processes back to a normal rate; decreased heart rate, slower rates of respiration, and reduced levels of adrenalin (O’Leary, 1992).

Long-term stress results when the amount or frequency of experienced stressors are too great for the parasympathetic system to stabilize. Long-term stress can cause excessive secretion of epinephrine, norepinephrine, and can suppress the immune system (O’Leary, 1992). Stress activates the sympathetic nervous system and the HPA activation-adrenomedullary system. Cortisol levels also take longer to return to normal among stressed individuals (O’Leary, 1992). Long-term stress can lead to reduced well-being, insomnia, nightmares, and disturbing dreams (The American Institute of Stress, 2011).

So far, I have discussed the effects of stress on various health outcomes, including obesity, mental health, and illnesses. Although there are many different antecedents to stress; the main precursor to experienced stress is the individuals’ perception that an event or situation (whether acute or chronic) is perceived as a threat (O’leary, 1992).
There are many different factors in a person’s environment that may be perceived as a threat and lead to stress. Therefore, it is important to identify specific threats and stressors in an individual’s environment in order to help reduce and/or remove a potential stressor from the workplace.

It is necessary to go beyond a general framework for stress and investigate how the environment that a person spends most of their waking life in (work) can affect health and well-being. Specifically, the investigation of how hazards in the workplace affect employee stress levels is important for several reasons. First, the ability for organizations to identify and remove workplace hazards can have a large impact on employee health and well-being. Further, healthy employees tend to incur less health care costs for employers and healthy employees also tend to be more productive (CDC, 2011).

**Workplace Hazards**

Before presenting an in-depth analysis about how workplace hazards affect individual and organizational outcomes it is important to clearly define the meaning of workplace hazards. Researchers have given differing interpretations about what workplace hazards are and how to group them. Cox (1993) explains that work hazards can be broadly grouped into two categories; physical and psychosocial hazards. Physical hazards can include biological, biochemical, chemical, and radiological hazards. Physical hazards have also been labelled as environmental/ambient factors in some instances. For example, the International Labor Office (ILO, 2001) defines a hazard as an ambient factor that has the potential to cause harm, illness, or injury as a result of exposure. Hazardous ambient factors include excessive noise, heat, or exposure to harmful
chemicals or toxins (ILO, 2001). In addition, Taylor, Baldry, Bain, and Ellis (2003) group physical hazards into proximate environment (work technology, work station design) and ambient environment (work building, lighting, temperature, air quality, and acoustics). Further, the World Health Organization (WHO, 2010) labels environment and equipment hazards as inadequate equipment availability, suitability or maintenance, poor environmental conditions such as lack of space, poor lighting, and excessive noise. It is important to note that the WHO (2010) groups environment and equipment hazards into the category of psychosocial hazards. Rugulies et al. (2007) advocate that physical aspects of the work environment (e.g. noise, exposure to heat) do not constitute psychosocial work hazards and should be treated separately, even if these exposures have psychological effects. It is also important to point out that the WHO’s environmental hazards are very similar to other researchers’ definition of physical and/or environmental hazards, which are often labelled as distinct from psychosocial hazards.

In contrast psychosocial hazards may be considered a broader domain than physical/environmental hazards. For example, the International Labor Office (ILO) (1986) defines psychosocial work hazards as the interactions among job content, work organization and management, environmental, organizational conditions, employee competencies, and needs. Cox (1993) offers a slightly different definition of psychosocial hazards, which are described as aspects of job content, work organizational management, environmental, social, and organizational conditions which can cause psychological or physical harm. The WHO argues that there is reasonable consensus in the literature about the nature of psychosocial hazards. The WHO (2010) groups psychosocial hazards into
10 categories; job content, workload and work pace, work schedule, control, environment and equipment, organizational culture and function, interpersonal relationships at work, role in organization, career development, and home-work interface.

**Workplace Hazards and Stress**

Workplace hazards can affect both psychological and physical health (WHO, 2001). Given that both psychosocial and physical workplace hazards can affect an individual’s health it is important to point out that most studies examining the hazards-stress-health relationship have omitted physical work hazards (Cox, 1993). Importantly, the psychological effects of physical hazards can be as harmful as the direct physical harm that a hazardous chemical can have on the human body. An employee may be aware, suspect, or fear that they are being exposed to a harmful hazard, which can induce psychological stress (Cox, 1993). For example, exposure to harmful fumes may have a psychological effect on a worker through the direct effects on the brain, as a result of the unpleasant smell of fumes and through the workers fear that such exposure may be harmful (Cox, 1993). Therefore, occupational stress and health outcomes can be focused on 2 main areas; stress and health outcomes associated with physical workplace hazards and the stress and health outcomes associated with exposure to psychosocial workplace hazards.

**Physical Hazards and Health**

According to the Fifth European Working Conditions survey, employees are exposed to physical work hazards at a similar rate as 20 years prior. It is alarming that there has not been a decrease in physical hazards exposure among workers over the past
20 years, despite advances in technology and increased awareness of workplace hazards. According to the Fifth European Working Conditions survey (Eurofound, 2010), 16% of employees are subject to tiring and uncomfortable positions during their entire work day, 33% carry heavy loads at least a quarter of their working day, and 23% of employees are exposed to vibrations. Although many employees still do work that involves physical labor, physical workplace hazards are not limited to manual laborers and blue-collared workers. Employees in the rapidly expanding service industry also carry out physical work. For example, cashiers carry out repetitive movements during most of their working time. Further, high work intensity in all work occupations can reduce the likelihood that employees will use protective equipment as well as ergonomic devices that can alleviate some physically demanding aspects of work (Eurofound, 2010).

Overall, research suggests that poor physical working conditions can affect both an employee’s experience of stress and their psychological and physical health (WHO, 2010). Results from the Fourth and Fifth European Working Conditions survey (Eurofound, 2007; Eurofound, 2010) indicate that employees with high levels of exposure to physical hazards are more likely to report that their health is at risk as a result of their work. An important study conducted by Lu (2008) discovered that the top five physical hazards among employees were ergonomic hazards (72.2%), heat (66.6%), overwork (66.6%), poor ventilation (54.8%), and chemical exposure (50.8%). The most common illnesses reported were gastrointestinal problems (57.4%), backache (56%), headache (53.2%), and fatigue/weakness (53.2%). Most physical work hazards can be objectively measured, fairly reliably and validly and are therefore easily monitored in the workplace.
(Cox, 1993). Further, in some cases standards exist for a minimum level of exposure to physical hazards such as noise levels in the workplace (Canadian Center for Occupational Health and Safety, 2011).

Physical workplace hazards have been shown to affect rates of employee sickness and injury. Lund et al. (2006) examined the effects of physical work environment on sickness absences among employees in Denmark. For both male and female employees, sickness absences were increased by bending or twisting of the neck and back, working standing and/or squatting during most of the work day, lifting or carrying heavy loads, and pushing or pulling heavy loads. Physically strenuous work environments can lead to musculoskeletal disorders, especially among employees who work in the construction and agriculture sector (Lee, Yeh, Chen, & Wang, 2005). Among the most prevalent musculoskeletal injuries are neck, shoulder, hand, upper back and elbow injuries. Further, physical working conditions are a strong predictor of upper extremity disorders in manufacturing and service industries (Lee et al. 2005).

Taylor, Baldry, Bain, and Ellis (2003) also argue that ambient environmental factors such as the work building, lighting, temperature, air quality, and acoustics can have a negative impact on employee health (Stolwijk, 1991). Among employees surveyed by Taylor et al. (2003), physical hazards thought to be responsible for increased sickness absences included variable temperature conditions and poor ventilation. Ambient factors were also stronger predictors of sickness absences compared to proximate factors, e.g. cardiovascular health. Importantly, for some physical hazards it is the extremes of physical work conditions which are associated with the experience of stress and negative
health outcomes (Cox, 1993). For example, employees can often adapt to mid-range conditions without effort or attention; however extremely cold or hot conditions may induce discomfort and stress (Cox, 1993). In the case of other hazards, the simple presence of the hazard or perceived threat of its presence can induce stress. For example, doctors and nurses report anxiety when dealing with patients who might be affected with HIV (Dworkin, Albrecht, & Cooksey, 1991).

The physical layout of a physical work environment can also affect employee health. Croon, Sluiter, Kuijer, and Frings-Dresen (2005) conducted a literature review about the effects of office layout on worker health and performance. Croon et al. (2005) found that working in open-concept workplaces reduced privacy and job satisfaction. In addition, Pejtersen et al. (2006) examined the effects of the indoor physical climate on employee health. The sample consisted of office employees distributed among naturally ventilated and mechanically ventilated office buildings. Five of the office buildings had open-plan offices and eight of the office buildings had a mixture of cellular, multi-person, and open plan offices. The results indicated that employees who worked in the open-office environments were more likely to perceive thermal discomfort, poor air quality and noise. Employees who worked in the multi-person offices and cellular offices reported more complaints about central nervous system health issues and mucus membrane symptoms.

Physical hazards are not the only kinds of workplace hazards that can impact employee health. Not only can psychosocial hazards affect the level of response that an individual may have to physical hazards (Stolwijk, 1991), psychosocial hazards can
impact employee health directly (Eurofound, 2011). Subsequently, it is necessary to review psychosocial hazards in the workplace in order for researchers and employers to understand how to improve employee health and reduce employee exposure to workplace hazards.

**Psychosocial Hazards and Health**

According to Eurofound (2011) psychosocial stressors in the workplace are on the rise. The most prominent psychosocial workplace hazards are stress (62%), bullying and harassment (37%) and overwork (29%). The rise in psychosocial hazards can be attributed to the arrival of bullying and harassment as the second most common hazard. According to Eurofound (2011) reports of bullying and harassment have almost doubled since 2008, with a rise from 20% to 37% in 2010. Psychosocial work hazards are also more common in larger workplaces. For example, stress and bullying/harassment have shown dramatic increases among organizations with over 200 employees and even steeper increases among organizations with over 1,000 employees. Stress and bullying/harassment are also more common in the public sector compared to the private sector. However, the incidence of overwork is similar for both sectors (Eurofound, 2011).

According to Leka and Jain (2010) there is reasonable consensus among researchers that psychosocial hazards in the workplace which are experienced as stressful have the potential to cause significant harm to employees. Leka and Jain (2010) argue that several different forms of psychosocial workplace hazards can cause significant damage to employee health and well-being. According to Leka and Jain (2010) there are several psychosocial factors that can lead to poor health; job content, workload and work
pace, work schedule, control, interpersonal relationships, organizational function and
culture, workplace harassment, lack of career development opportunities, and home-work
interface.

Psychosocial hazards may affect both physical and psychological health directly
or indirectly through the experience of stress. Most attention has been given to the
possible indirect, stress mediated effects of psychosocial hazards on health (Cox, 1993).
Work situations are experienced as stressful when they are perceived as involving
important work demands which are not well matched to the knowledge and skills of
employees (WHO, 2010). Research has shown a link between occupational stress and
increased risk of health problems such as heart disease, depression and musculoskeletal
disorders (WHO, 2010). Job strain has also been linked to negative outcomes such as
migraines, psychological distress and work injury (Wilkins & Beaudet, 1998).

Studies that have examined the relationship between physical hazards and health
tend to be grouped by the specific physical hazard. In contrast, research that focuses on
psychosocial hazards in the workplace appear to be grouped by the health outcome,
GROUPING several psychosocial hazards together. For example, some studies have
examined how psychosocial hazards can affect mental health and functioning (Stenfors et
al., 2013) while other studies have chosen to focus on sickness absences (Lund et al.,
2005) or somatic health complaints (Wilkins & Beaudet, 1998) as an outcome.

The current literature provides support that psychosocial hazards and occupational
stress resulting from exposure to workplace hazards can lead to poor health (WHO,
2010). Subsequently, it is not surprising that researchers have investigated the link
between psychosocial hazards in the workplace and sickness absence among employees. According to Lund et al. (2005) psychosocial factors in the workplace are predictive of sickness absences among women and men. Nielsen et al. (2006) has also found a link between psychosocial hazards in the workplace and sickness absence. In addition, Niedhammer, Chastang, and David (2008) recently examined the contribution of psychosocial work hazards to poor health using data from the National French SUMER survey. The study revealed that low levels of decision latitude and social support and high psychological demands were predictive of poor self-reported health and reported sickness. Sickness absence has been used as an indicator of health in many studies (Kivimäki et al., 2003); however sickness absences can be considered a distal indicator of health. Health complaints and symptoms are a more proximal indicator of health since health complaints stem directly from a health problem.

Psychosocial hazards have also been linked to various health complaints, including migraines, sleeping problems, and stomach symptoms (Asa, Brulin, Angquist, & Barnekow-Bergkvist, 2005). Further, psychosocial hazards such as low co-worker support have been found to be related to general health complaints among men and work injury and psychological distress among women (Wilkins & Beaudet, 1998). Workplace bullying and harassment are also strong predictors of psychological and somatic health complaints (Mikkelsen & Einarsen, 2002). Some studies have also found that psychosocial hazards in the workplace can lead to health problems such as reported musculoskeletal pain (Sembajwe et al., 2013). Lack of supervisor support was the strongest predictor of musculoskeletal pain among the healthcare workers surveyed by
Sembajwe et al. (2013). Psychosocial hazards, including low job control, high job demands, and low work-related social support also predict quality of life (Cheung, Kawachi, Coakley, Schwartz, & Colditz, 2000).

Psychosocial hazards in the workplace can also lead to mental and cognitive health problems. Boschman et al. (2013) examined the relationship between psychosocial work environment and mental health complaints among blue-collar workers. Psychosocial hazards such as a lack of job control, few learning opportunities and low future perspectives were related to a need for recovering after work, distress, depression, and post-traumatic stress disorder. Stenfors et al. (2013) also found evidence that psychosocial hazards in the workplace lead to higher rates of cognitive complaints such as problems with concentration, memory, decision-making, psychiatric problems and sleeping problems. It is evident from the current literature review that psychosocial hazards in the workplace can affect both psychological and physical health.

The Current Study

The current study will examine the effects of both physical workplace hazards and psychosocial workplace hazards on health outcomes among a sample of civil servant workers from Northern Ireland. Specifically, the effects of physical and psychosocial workplace hazards on absences due to sickness, BMI, and general mental health will be examined. Refer to Figure 1, below for a visual representations of the study’s model.
For the current study, workplace hazards were grouped into two distinct categories based on the recommendations of Cox (1993); physical workplace hazards and psychosocial workplace hazards. For the present study, the definition of physical hazards will be based on descriptions set forth by Cox (1993); biological, biochemical, chemical, and radiological hazards which can cause injury, illness, or death. In addition, characteristics of office building design and layout, which can potentially impact employee health will be included in the definition of physical work hazards, as described by the WHO (2010). Examples of physical workplace hazards can include a lack of space, poor lighting, poor ventilation and excessive noise. For the current study psychosocial hazards will be based on the definition stated by Cox (1993); aspects of job
content, work organization and management and of social and organizational conditions which have the potential for physical and psychological harm. Specifically, psychosocial hazards include organizational function and culture, role in organization, career development, decision latitude/control, interpersonal relationships at work, home-work interface, task design, workload/work pace and work schedule (Cox, 1993).

Much of the current discussions about the hazard-stress-health relationships have primarily focused on psychosocial hazards in the workplace while giving less attention to physical hazards in the workplace (Cox, 1993). Further, there is a need for researchers to explore and compare the differential negative health consequences between physical and psychosocial hazards in the workplace. For example, physical hazards may directly impact the human body by exposure to harmful substances. In addition, physical hazards may also indirectly affect the body by means of psychological stress induced by an individual worrying about the potential health consequences of exposure to a harmful substance (Cox, Griffiths, & Rial-Gonzalez, 2000). In contrast, psychosocial hazards may not cause a direct physical health problem, but may lead to health problems due to symptoms related to psychological distress. Since both physical and psychosocial hazards can negatively affect health via multiple processes, it is necessary to examine whether physical and psychosocial hazards are equally troublesome for employee health. Identifying which types of workplace hazards are most detrimental to employee health is necessary for organizations and policy makers to promote strategies to best protect and promote total worker health.
Further, there is a lack of research examining how physical hazards can impact psychological outcomes such as mental health and how psychosocial hazards can impact physical health outcomes. Importantly, the present study will advance the current literature and investigate how physical hazards impact mental health, after controlling for psychosocial hazards. Further, the relationship between psychosocial hazards and physical health outcomes will be examined, while controlling for psychosocial hazards. The strength of this study is that controlling for physical or psychological hazards allows for incremental validity; examining whether psychosocial hazards predicts health outcomes above and beyond physical hazards, and whether physical hazards predicts health outcomes above and beyond psychosocial hazards.

There is also a need for occupational health psychology researchers to integrate the use of self-report data and more objective measures of health, such as BMI or employee sickness absence records. Some researchers argue that self-report measures, which are a common measurement technique within the field of organizational psychology are plagued by biases of the participant (Spector, 1994). To counteract the potential effects of respondent bias many researchers prefer to use non-self-report measures of health, arguing that many of the biases can be controlled (Spector, 2006). However, in some instances self-report data is much less labor intensive, and can be a valuable tool. For example, it could be argued that absences due to sickness or BMI are more accurate measures of health because the information is based on objective measures. It is important to note that if the data used to calculate BMI or absences is...
based on self-report data, it can still be a nice addition to a study that only uses psychological measures of health such as self-reported well-being.

Spector (1994) explains that the benefit to using objective measures is that “facts” can be checked for accuracy. Further, self-report data that is based on a physical measurement can also be checked for accuracy. For example, an employee may report what their height and weight are (indicators of BMI); therefore, measures of body fat can be checked to confirm the accuracy of the statements if needed. Self-report measures are also very useful when the intent of the research is to capture a construct which is expected to be comprised of perceptions, such as employee perceptions of safety climate (Cooper & Phillips, 2004). Further, relying on one form of measurement can lead to method variance biases (Spector, 1994). For example, self-reports of physical health may be subject to social desirability, with people not wanting to admit they are unhealthy (Spector, 2006). If, however body fat percentage is measured, the effects of social desirability are removed from the equation. The current study will incorporate both self-report measures of psychological health and self-report measures of physical health.

Thus far, the current paper has reviewed the effects of physical and psychosocial hazards on the general health of individuals. It is important to understand the many ways in which physical and psychosocial hazards can impact the general health of the working population. Knowledge about workplace hazards can allow employers to identify hazards and improve employee health. To further help organizations and employees understand how workplace hazards can impact employee health it is also necessary to narrow the scope of investigation to specific health outcomes. Focusing on specific health outcomes
can allow for an understanding about how both physical and psychosocial hazards directly affect different aspects of health. In addition, understanding the specific health consequences associated with workplace hazards aids organizations and policy makers in the development of workplace hazard regulations to protect and promote total worker health.

**Workplace Hazards and Obesity**

One area of research that needs to be expanded is the investigation of how workplace hazards can affect employee body fat percentage and obesity. Little research has specifically examined the effects of work conditions on BMI (Schulte et al., 2007). Further, few studies have explored obesity and work hazards together, in order to develop public health strategies targeted at reducing obesity. Schulte et al. (2008) argue that there is a need for researchers to investigate the relationship between workplace hazards and obesity; while seemingly independent, occupational hazards and obesity can be, and often are interrelated, although most studies related to occupational hazards and obesity were not designed to test the presence of effect modification. Schulte et al. (2008) also point out that workplace exposures can lead to obesity and obesity can modify important outcomes such as morbidity and mortality.

Within the literature, studies tend to examine the effects of physical workplace hazards on the health of obese individuals, who are at an increased risk of injury. For example, Maeda, Kaneko and Ohta (2006) found that obesity is a risk factor for heat stress among employees, with obese individuals more likely to suffer from heat stress compared to non-obese individuals. Exposure to respirable workplace contaminants such
as dust, solvents and irritants may also increase the prevalence of obesity among men with certain blood types or long-term occupational exposure (Suadicani, Hein, & Gyntelberg, 2005). Individuals with high fat diets have also been found to accelerate the development of plaque in the circulatory system following exposure to harmful substances such as carbon nanotubes (Li et al., 2007). Vibration from work equipment is another physical workplace hazard for obese employees. Wieslander, Norbäck, Göthe and Juhlin (1989) reported that damage to the body resulting from obesity may compromise muscular, neural and vascular tissues, making the body more susceptible to vibration-induced injuries.

Studies that have examined the association between physical hazards and obesity have mostly been limited to obese employees being at a greater risk for suffering injuries due to physical workplace hazards. In contrast, studies that have examined the link between psychosocial hazards and obesity have focused on how psychosocial hazards and associated stress can lead to obesity. A recent study by Lallukka et al. (2008) revealed that psychosocial hazards and job strain were positively related to BMI among a sample of civil servant workers from the WhiteHall II study. In addition, Ostry, Radi, Louie and LaMontagne (2006) found an association between psychosocial work conditions and BMI among a sample of Australian blue-collar and white-collar workers. High exposure to psychosocial demands were related to increased BMI across both men and women. Moreover, Kivimaki et al. (2003) found that employees who face psychosocial hazards such as workplace bullying have an average of 1 unit higher BMI compared to employees who do not suffer from workplace bullying. A 1 unit increase in BMI is a serious health
concern because even a small increase in BMI can lead to health complications such as coronary heart disease (Kivimaki et al., 2006).

Many studies have also used the job-demand-control model as a framework for examining the relationship among psychosocial hazards and obesity. Hellerstedt and Jeffery (1997) showed a positive relationship among high work demands, low job control and BMI. In addition, Martikainen and Marmot (1999) found that psychosocial hazards based on the job-demand-control framework were related to increased incidence of obesity among employees. Another study conducted by Netterstrom et al. (1991) surveyed a sample of Danish employees and found that job strain resulting from psychosocial hazards such as high demands and low control over work was related to increased incidence of weight gain.

Yamada et al. (2007) hypothesized that work could facilitate weight gain and obesity in 3 major ways. First, jobs stress could impact health behaviors such as alcohol consumption and sedentary leisure activities that are related to weight gain. Secondly, psychological strain could lead to modification of endocrine factors related to weight gain. Thirdly, overwork could result in fatigue and inhibit behaviors that prevent weight gain and fat accumulation. Importantly, all three risk factors for obesity described by Yamada et al. (2007) involve some form of occupational stress, which then leads to poor health habits or negative physiological changes to the body, which in turn can lead to negative health outcomes such as weight gain.

Researchers argue that the occupational stress resulting from employee exposure to physical and psychosocial hazards may help explain why workplace hazards can lead
to increased obesity levels (Ostry, Radi, Louie, & LaMontagne, 2006). Cox (1993) explains that workplace hazards can lead to occupational stress; the psychological effects of physical hazards can be as harmful as the direct physical harm that a hazardous chemical can have on the human body. An employee may be aware, suspicious, or fear that they are being exposed to a harmful hazard, which can induce psychological stress. In addition, it is well documented that physical workplace hazards increase occupational stress (WHO, 2010).

The current study will investigate how physical and psychosocial hazards in the workplace are related to BMI. There is research linking stress and eating habits to BMI (Harvard School of Public Health, 2013), however few studies have specifically examined the link between workplace hazards and BMI. Additionally, most studies that have looked at physical hazards and obesity have focused on obese employees being at an increased risk for injury. There is a need for more research on the link between physical hazards and the development of obesity. Further, researchers need to examine how not only stress, but psychosocial hazards can contribute to BMI. Examining the effects that workplace hazards have on BMI is important because employees who are exposed to workplace hazards will likely suffer from greater rates of obesity. For example, employees who face many physical and psychosocial hazards in the workplace will perceive greater levels of stress, likely resulting in unhealthy behaviors and increased BMI. The current study will bridge the gap in the literature and examine the association between workplace hazards and BMI. This leads into the first hypotheses of the present study.
**Hypothesis 1a.** Physical workplace hazards will be positively related to BMI.

**Hypothesis 1b.** Psychosocial workplace hazards will be positively related to BMI.

As previously discussed, focusing on specific health outcomes is a powerful tool for determining how both physical and psychosocial hazards affect different aspects of health. Thus far the effects of physical and psychosocial hazards upon the general well-being of employees have been examined. The specific effects of physical and psychosocial hazards upon obesity have also been reviewed in this paper. Additionally, another important health outcome to focus on is the mental health of employees. Mental health can impact an individuals’ physical and mental well-being (WHO, 2010). Further, workplace hazards can negatively impact employee mental health (Cox, Griffiths, & Leka, 2005).

**Psychosocial Hazards and Mental Health**

Psychosocial hazards can greatly affect an individuals’ mental health and well-being. Occupational stress, depression, and anxiety can be directly linked to the exposure of psychosocial hazards in the workplace (Cox, Griffiths, & Leka, 2005). As previously discussed in the current paper, researchers have defined and grouped psychosocial hazards in different ways. Across research findings work characteristics such as lack of job control, low decision latitude, low skill discretion, and job strain have been associated with the risk of depression, poor health functioning, anxiety, distress, and fatigue (WHO, 2010).
Stansfeld and Candy (2006) conducted a comprehensive meta-analysis on the psychosocial work environment and mental health. Eleven articles met the inclusion criteria. Stansfeld and Candy (2006) included several psychosocial categories in their analyses; decision authority, decision latitude, psychological demands and work social support, in addition to components of the job-strain model and effort-reward imbalance model. The results of the meta-analysis revealed that job strain, low decision latitude, low social support, high psychological demands, effort-reward imbalance and high job insecurity predicted common mental disorders.

Further, a longitudinal study conducted by Stansfeld, Fuherer, Shipley, and Marmot (1999) surveyed a sample of UK men which set out to understand the causal relationship between work characteristics and psychiatric disorders. The results of the study indicated that demands at work increased the risk of psychiatric disorders while social support and high decision authority decreased the risk of psychiatric disorders. In addition, high efforts and low rewards were associated with an increased risk of developing psychiatric disorders.

Studies have also examined the effects of psychosocial hazards on general mental health, using the well validated General Mental Health Questionnaire (GHQ12). Recently, Laaksonen, Rahkonen, Martikainen, and Lahelma (2006) investigated the effects of psychosocial work hazards on general mental health, using the GHQ12 questionnaire as a measure of mental health. Psychosocial work hazards such as job demands, lack of job control, unfair organizational practices and workload were examined. The results confirmed that all psychosocial hazards, excluding unfair
organizational practices independently predicted general mental health. Niedhammer et al. (2006) also examined the effects of psychosocial hazards upon general mental health and depressive symptoms. Psychosocial hazards examined in the study included job strain, low decision latitude, lack of social support, and over-commitment. The GHQ12 was used to assess general mental health. The results demonstrated that each psychosocial hazard predicted general mental health and depressive symptoms.

Another important study by Rugulies, Bultmann, Aust, and Burr (2006) examined the effects of psychosocial work characteristics on depressive symptoms among a sample of the Danish workforce between 1995 and 2000. The result revealed that women with low levels of influence at work and low social support were at the greatest risk for experiencing depressive symptoms. Among men, job insecurity predicted severe depression symptoms. It is important to point out that many of the studies reviewed thus far use the term “psychosocial characteristics” or “psychological demands”, even though the psychosocial factors examined would fall under the category of psychosocial hazards according to Cox (1993).

Given the abundant amount of literature linking psychosocial hazards to mental health, it is clear that investigating this relationship may not add much new and valuable information to the scientific literature. Although it is important to review which kinds of workplace hazards impact mental health, it is also important to focus on relationships that have been investigated less often and can make the greatest contribution to the literature; the link between physical hazards and mental health.
Physical Hazards and Mental Health

Research suggests that physical hazards in the workplace can have a negative impact on mental and cognitive outcomes such as anxiety, depression, distress, decision making, and attention (Cox, Griffiths, & Rial-González, 2000). Although there is a plethora of research concerning the effects of psychosocial hazards on mental health (WHO, 2010), there is much less research investigating the effects of physical workplace hazards upon mental health. Cox (1993) argues that physical workplace hazards can directly and indirectly affect psychological health. For example, exposure to harmful substances such as metals, pesticides and solvents can change brain chemistry, and actually induce temporary or long-term mental health problems (Canadian Environmental Law Association, 2011). In contrast, worrying about exposure to physical hazards can induce stress (Cox, 1993).

Many studies that investigate the link between physical workplace hazards and mental functioning have focused on the physiological effects of hazards on psychological health. For example, physical hazards such as heat exposure have been linked to reduced cognitive functioning as a result of dehydration directly affecting the brain (Cian et al., 2000). As previously discussed, exposure to harmful chemicals and substances can directly affect brain chemistry, resulting in symptoms such as anxiety, irritability and depression (Canadian Environmental Law Association, 2011). Less attention has been given to psychological effects that chemicals and toxins can have on behavior (Evans, 2003). For example, over-exposure to lead can impede self-regulatory behavior in children, which is then related to behavioral conduct disorders such as fighting and
aggression (Sciarillo, Alexander, & Farrell, 1992). Further, some behavioral reactions to chemicals/toxins are caused by the psychological trauma associated with threats to personal health (Evans, 2003). Individuals who have discovered that they have been exposed to hazardous materials can suffer from psychological distress and post-traumatic stress disorders in some instances (Edelstein, 2002).

There have been some important advances in the research area concerning the effects of environmental characteristics upon mental health. Research has examined how the built environment (e.g. housing, office buildings) can affect mental health. According to Evans (2003) environmental characteristics that can directly affect mental health include housing, crowding, noise, indoor air quality and lighting. The built environment can also indirectly affect mental health by altering psychosocial conditions which are known to alter mental health. For example, higher residential density can interfere with the development of socially supportive relationships within a household, reducing social support and increasing psychological distress (Evans, 2003).

Studies have examined how high-rise buildings and floor level can affect mental health. Evans, Wells, and Moch (2003) found that high-rise housing can lead to elevated psychological distress. It is believed that high-rise buildings can lead to social isolation if the building does not have sufficient space to aid in the development of interaction with neighbors, such as patios or backyards (Evans, 2003). Further building quality such as the structural quality of the building, maintenance, upkeep and physical hazards have been linked to mental health (Halpern, 1995). Although many of the studies mentioned above
were conducted on the home environment, it is appropriate to predict that the building a person works in everyday would also affect mental health.

Research has also investigated how noise can impact mental health, although most studies concerning noise and mental health have been limited to airport noise exposure or non-occupational settings (Evans, 2003). Early studies have supported that there is a positive relationship between aircraft noise exposure and an increased incidence of psychiatric admissions (Evans, 2003). Further, a study conducted by Lercher, Evans, Meis, and Kofler (2002) revealed that noise pollution in neighborhoods can increase psychological distress. Exposure to excessive noise has also been linked to an increase in psychotropic drug use among adults (Knipschild & Oudshoorn, 1977).

Lack of sufficient light is a physical workplace hazard which can impact mental health. Levels of illumination, specifically the amount of daylight an individual is exposed to can impact psychological wellbeing (Evans, 2003). Importantly, seasonal affective disorder (SAD) is a form of depression that is linked to the amount of daylight exposure a person is exposed to (Mayo Clinic, 2013). Individuals who are chronically exposed to shorter hours of daylight suffer more sadness, fatigue, and clinical depression in some instances. Although there is less research investigating illumination levels in occupational settings, studies examining the link between daylight exposure and mental health among the general population have been fruitful. Research has shown that hospital patients recover more quickly when in a brightly lit room (Beauchemin & Hayes, 1996) and school children with insufficient exposure to daylight suffer from more behavioral problems (McColl & Veitch, 2001). Importantly, employees who suffer from SAD can be
aided by properly lit work areas. Mills, Tompkins, and Schlangen (2007) report that employees suffering from SAD can increase mental health, productivity, and alertness by working in a well-lit office area.

The research reviewed thus far has indicated that physical hazards both within and outside of the workplace can negatively impact mental health and well-being (Evans, 2003). Physical hazards such as chemicals or fumes can physiologically affect the brain and mental health (Canadian Environmental Law Association, 2011). Further, an individuals’ appraisal that they have been exposed to a physical hazard can lead to stress and changes in mental health (Edelstein, 2002).

The current study will specifically examine how physical workplace hazards are related to general mental health. There is abundant literature on the relationship between psychosocial hazards and mental health (Rugulies et al., 2006), however more research is needed to explore the relationship between physical workplace hazards and mental health. Despite the fact that certain chemicals and physical hazards can directly and indirectly affect mental health (Cox, 1993), occupational health psychology has not given appropriate attention to the link between physical hazards and mental health. Examining the association between physical hazards and mental health is important because employees who are exposed to many physical hazards will likely be at risk for mental health problems. The current study will bridge the gap in the literature and test the association between physical workplace hazards and mental health, while controlling for psychosocial hazards. The literature suggests that psychosocial hazards are a strong predictor of mental health; therefore controlling for psychosocial hazards will
demonstrate whether physical hazards predict mental health beyond psychosocial hazards. This leads into the second hypothesis of the current study.

**Hypothesis 2.** Physical workplace hazards will be negatively related to general mental health.

The current paper has examined how physical and psychosocial factors in the workplace can affect general health, obesity, and mental health. In addition, absences due to sickness, illness, and injury can be used as an accurate proxy for employee health (Kivimäki, Head, Ferrie, Shipley, Vahtera, & Marmot, 2003). Absences due to sickness, illness, and injury are considered by many researchers to be an accurate measure of health, especially if the data can be fact checked (Spector, 1994), allowing for a comparison between self-report data and employee records. Therefore a review of the effects of workplace hazards on health would not be complete without examining the relationship between workplace hazards and employee absences. Examining workplace absences due to sickness can allow researchers to compare absence rates with self-reported health problems. If self-reported health problems are indeed serious or accurately reported then employee health should also be accurately portrayed by means of sickness absences.

**Physical Workplace Hazards and Employee Absences**

Physical workplace hazards are cause for concern for both employers and employees. Based on a review of the GAZAL data (France’s national gas and electricity company), Melchoir et al. (2005) state that physical work conditions account for 42% of absences due to sickness and injury for men and 13% for women. The association
between physical hazards and sickness absences applies to both white collar and blue collar jobs. Niedhammer, Chastang, David, and Kellecher (2008) analyzed data on both blue-collar and white-collar workers and found that the workplace physical hazards most strongly associated with sickness absences were ergonomic hazards, physical and chemical exposures, and biological exposures for women. Ergonomic hazards included postural constraints and vibrations. Among physical exposures, noise and extreme temperatures were most commonly reported while chemical and biological exposure were defined by frequency of exposure. Haukenes, Mykletun, Knudsen, Hansen, and Maeland (2011) also conclude that physical hazards are a real threat to employees’ health both among skilled and unskilled occupations.

In most cases, studies that have investigated the link between physical hazards and absences have examined ergonomic factors such as working posture, physical demands such as carrying heavy loads, and ambient factors such as noise (Allebeck & Mastekaasa, 2004). A well designed study by Boedekker (2001) examined several physical hazards to determine the relationship between workplace physical hazards and absences due to sickness. The physical hazards index included physical demands such as heavy lifting, forced body postures, vibrations, noise, and unfavorable climate. The Boedekker study revealed that vibrations and physical demands such as heavy lifting were significantly related to sickness absences. Further, sick leave from work due to accidents was strongly related to physical demands, vibrations, and work restraints, including unadaptable workplace design and unhandy tools. Taking a broad approach, D’Errico and Costa (2011) also investigated the association between several kinds of
workplace hazards (both physical and organizational factors) and sickness absence. Among the most serious physical workplace hazards, exposure to risk of injury was significantly related to sickness absences among men and women. Noise and vibration were also related to an increased risk of sickness absences among male employees.

In contrast, some studies have chosen to focus on specific workplace physical hazards instead of examining a general index of workplace hazards. One area of investigation that has received attention by researchers are the effects of physical demands and physical loads on employee sickness absences. Hoogendoorn et al. (2002) conducted a study examining how high physical workload and low job satisfaction can increase the risk of sickness absences due to lower back pain. The results of the Hoogendoorn study found that flexion and rotation of the trunk and lifting were risk factors for sickness absences due to low back pain. More recently, Lund, Labriola, Christensen, Bultmann, and Villadsen (2006) investigated the relationship between physical workplace hazards such as uncomfortable work positions, physical workload and sickness absences. A sample from the Danish workforce was used, with data from the Danish work environment cohort study and a national register. For both males and females, extreme bending or twisting of the neck or back, working mainly standing or squatting, lifting or carrying heavy loads, and pushing or pulling loads were significant risk factors for sickness absence. Labriola, Lund, and Burr (2006) also took a similar approach by examining the effects of physical demands on absences due to sickness. The Labriola et al. (2006) study confirmed the findings from previous studies that extreme
bending and twisting of the body and repetitive monotonous work are associated with increased sickness absences.

Excessive noise in the workplace is another physical hazard which has been linked to increased sickness absences among employees. Evidence suggests that noise is one of the most common stressors in the physical work environment among the industrialized workforce in North America and Europe (Kjelberg, 1990; Tempest, 1985). Fried (2002) specifically examined the effects of excessive noise levels on sickness absences among a sample of industrial Israeli workers. Sound levels were measured using a recording device, with samples taken twice per day. Upon analysis, the study found that higher noise levels were correlated with increased sickness absence rates. Women also reported more sickness absences compared to men. Employees may also develop health problems and be less able to cope with stress resulting from excessive noise levels in the workplace when they are not fairly compensated with an adequate salary (Ose, 2004).

Based on the comprehensive literature review in the current study, physical hazards in the workplace are a grave risk factor for employee health, injury, and absences due to sickness. Both clusters of physical hazards and individual physical hazards can negatively impact employee health and lead to increased rates of sickness absences (Allebeck & Mastekaasa, 2004). The association between physical hazards in the workplace and employee absences due to sickness are also well documented across different countries and occupations (Melchoir et al., 2005; Haukenes, Mykletun, Knudsen, Hansen, and Maeland, 2011).
The current study will investigate the relationship between physical workplace hazards and sickness absences. Within the literature there is a tendency for studies to focus on the effects of psychosocial hazards or physical hazards upon sickness absences separately. It is important to examine how workplace hazards can affect sickness absences because sickness absence is an accurate predictor of employee health (Kivimaki et al., 2006), the main focus of total worker health. The present study is unique because the effects of physical hazards upon sickness absences will be examined, while controlling for psychosocial hazards. Controlling for psychosocial hazards allows for an examination of whether physical hazards impact sickness absences beyond the effects of psychosocial hazards. It is likely that employees who face many physical hazards will suffer from more illness resulting in missed work days compared to employees who face few physical hazards. This leads into the third hypothesis.

**Hypothesis 3a.** Physical workplace hazards will be positively related to absences due to sickness.

It is evident from the current literature review that physical hazards in the workplace are a significant risk factor for sickness absences among employees (Melchoir et al., 2005). When identifying hazards in the workplace it is necessary to conduct a comprehensive analysis of which hazards exists to accurately evaluate the real health and safety threats that employees face. Therefore, in order to fully identify the full array of possible workplace hazards it is also necessary to consider psychosocial hazards, in addition to physical hazards. Psychosocial hazards may be more difficult for organizations to identify compared to physical hazards because psychosocial hazards may
not stem from a tangible factor that an organization can visibly see. Nonetheless, psychosocial hazards in the workplace have been proven to be detrimental to employee health and linked to increased sickness absences (Stansfeld, Fuhrer, Shipley, & Marmot, 1999). Therefore, the current paper will review the association between psychosocial workplace hazards and sickness absences to conduct a complete review of the literature.

Psychosocial Workplace Hazards and Employee Absences

Psychosocial hazards in the workplace have been linked to employee absences due to sickness or injury in several studies. One of the most comprehensive reviews concerning working conditions and workplace absences was conducted by Allebeck and Mastekaasa (2004). Allebeck and Mastekaasa (2004) reviewed 20 studies that addressed the association between psychosocial working environment and sickness absence. Most studies appeared to be based on the demand-control-support model. The majority of the studies supported the hypothesis that higher job demands lead to increased sickness absences. Job control was found to be related to lower absences among employees in almost every study examined by Allebeck and Mastekaasa (2004). Mixed results were also found for support, with job support from colleagues or supervisors being associated with lower absences in a few instances (de Jong, Reuvers, Houtman, Bongers, & Komper, 2000). Workplace bullying was also found to be associated with higher absence rates, as well as role uncertainty (Kivimäki, M., Eloainio, M., & Vahtera; Heaney & Clemans, 1995).

Studies have also used data from the Whitehall II study, which confirms the findings from the Allebeck and Mastekaasa (2004) review that psychosocial hazards are
related to increased absences due to sickness. The WhiteHall II study is a large public data-set that was established in 1985 by a team of researchers to investigate the importance of social class for health by following a cohort of 10,308 employed civil servant workers across the United Kingdom (Marmot et al., 2004). North, Syme, Feeney, Shipley, and Marmot (1996) determined that both high demands and low control at work are associated with higher rates of sickness absences among lower grade employees. Ari Väänänen et al. (2003) report that lack of job autonomy and low social support are risk factors for sickness absences among men and women. Sickness absences resulting from psychiatric disorders have also been linked to job control and social support (Stansfeld, Fuhrer, Shipley, & Marmot, 1999).

Since the Allebeck and Matekaasa (2004) review, which was based on studies published up until 2002, several new studies have emerged which have examined the association between psychosocial work hazards and sickness absences in the workplace. Melchior, Niedhammer, Berkamn, and Goldberg (2003) used data from the French GAZAL study (France’s National Gas and Electricity Company) to examine how psychosocial hazards affect sickness absences. The results of the Melchior et al. (2003) 6 year prospective study revealed that low job control and low social support below the median predicted increased absence rates among men (17%) and women (24%). In addition, the Danish IPAW study (Intervention Project on Absence and Well-being) conducted by Nielsen et al. (2004) was a 5 year project that investigated psychosocial hazards as independent predictors of sickness absence days per year. The results of the study indicated that low levels of job control predicted high absence rates among both
men and women. Nielson et al. (2006) also showed that job control and job predictability significantly predicted workplace absences. Another study conducted on a sample of Danish employees also determined that sickness absence was predicted among men by high emotional demands and high demands for hiding emotions. Among women, role conflicts, low rewards, and poor management quality predicted sickness absences (Lund et al., 2005).

Research also suggests that an examination of psychosocial hazards in the workplace and absences due to sickness should not be limited to components of the demand-control-support model. Instead a comprehensive approach to the measurement and definition of psychosocial hazards and sickness absences is needed (Rugulies et al., 2007). Voss, Floderus, and Diderichensen (2001) found that bullying in the workplace was associated with a doubled risk of sickness absence for women. In contrast, for men, the strongest predictor of sickness absence was anxiety about reorganization of the workplace. Kivimaki, Elovainio, and Vahtera (2000) have also confirmed that workplace bullying can lead to increased absences due to sickness in the workplace. Kivimaki et al. (1997) found that income is a strong predictor of sickness absences, with lower income employees at a 1.7 greater odds of reporting sickness absences. Further, D’Errico and Costa (2010) report that psychosocial factors such as job insecurity are related to increased absences due to sickness.

The current study will investigate the relationship between psychosocial workplace hazards and sickness absences. As previously stated, within the literature there is a tendency for studies to focus on the effects of psychosocial hazards or physical
hazards upon sickness absences separately. It is important to examine how psychosocial hazards can affect sickness absence because sickness absence is an accurate predictor of employee health. The present study is unique because the effects of psychosocial hazards upon sickness absences will be examined, while controlling for physical hazards. Controlling for physical hazards allows for an examination of whether psychosocial hazards impact sickness absences beyond the effects of physical hazards. It is reasonable to predict that employees who face high levels of psychosocial hazards will miss more work days due to sickness compared to employees who face few psychosocial hazards. Further, the effects of psychosocial hazards on sickness absence will likely have a unique impact on sickness absence, separate from physical hazards. This leads into the third hypothesis.

**Hypothesis 3b.** Psychosocial workplace hazards will be positively related to absences due to sickness.

The current paper has argued that workplace hazards can have a negative impact on employee health, obesity, mental health, and absences due to sickness. It is important to identify which workplace hazards are present in the workplace; however it is equally important to understand factors that can ameliorate the negative impact that workplace hazards can have on an individuals’ health. One area of research that is growing in occupational health psychology is how physical activity and exercise can enhance worker health and help employees’ cope with workplace stressors (Proper et al., 2003). Before the relationships between workplace hazards, exercise and employee health are examined it can be helpful to gain an understanding of what exercise is and the frequency with
which the European and North American workforce engage in this positive health behavior.

**Physical Activity and Exercise**

According to the World Health Organization (2013), physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure. In contrast, exercise is defined as a subcategory of physical activity that is planned, structured, and repetitive with the goal of maintaining or improving physical fitness. Physical activity includes exercise as well as other activities that require some degree of physical exertion such as manual labor, recreational activities, household chores, or walking to work. Researchers often use the terms physical activity and exercise interchangeably, which leads to an inaccurate understanding of both terms (Harvard School of Public Health, 2012).

A recent study conducted by Hallal et al. (2012) compared physical activity levels worldwide with data from adults 15 years or older, from 122 countries. Worldwide, 31.1% of adults are physically inactive, ranging from 17% in Southeast Asia to approximately 43% in the Americas and the Mediterranean. Physical inactivity tends to rise with increased age, and is higher among women than men and is greater in high-income countries. Subsequently, it is not surprising that rates of physical inactivity are extremely high in the U.S. and the U.K. According to the CDC (2011), physical inactivity in the U.S. ranges from 10% to 43% depending on the region. The U.K., another high-income country also struggles with physical inactivity, with approximately 40% to 49% of adults considered physically inactive.
Physical inactivity has been identified as the fourth leading risk factor for global mortality, accounting for 6% of global deaths. The WHO (2013) estimates that physical inactivity is accountable for 21-25% of breast and colon cancers, 27% of diabetes, and 30% of heart disease cases globally. Physical inactivity is also attributable to 9% of premature mortality worldwide. Importantly, if inactivity could be decreased by 10% or 25% worldwide, more than 1-3 million lives could be saved each year (Lee et al., 2012).

The good news is that increasing physical activity can eliminate or reverse the negative health consequences associated with years of sedentary living. Regular exercise and physical activity can improve overall health and functioning of the body and reduce the likelihood of developing heart disease, diabetes, and is a key element of weight loss (Harvard School of Public Health, 2013). The U.S Department of Health and Human Services (2008) state that being physically active improves longevity and quality of life, helps protect people from developing heart disease, stroke, and high blood pressure. Physical activity also protects people from developing certain cancers, type 2 diabetes, osteoporosis, depression, anxiety, and improves sleep, heart and lung function, and a healthy body weight.

Physical activity, specifically exercise can vary in intensity. Intensity refers to the rate at which an activity is being performed or the amount of effort required to perform an activity such as exercise (WHO, 2011). According to the CDC (2011), moderate physical activity burns approximately 3.5 to 7 calories per minute, and can include activities such as walking, hiking, or roller skating. On the other hand, vigorous activity
burns more than 7 calories per minute, and can include activities such as jogging, circuit training, or mountain climbing.

The Harvard School of Public Health (2013) recommends that healthy adults get a minimum of 2 ½ hours of moderate-intensity aerobic activity or a minimum of 1 ¼ hours per week of vigorous intensity aerobic activity. Increasing the amount of physical activity to 5 hours of moderate or 2 ½ hours of vigorous-intensity aerobic activity provides even more health benefits. Adults should also do muscle-training activities at least two days a week to improve muscle tone and strength (Harvard School of Public Health, 2013). It is well documented that increasing physical activity levels can improve health (WHO, 2011), however a combination of physical activity and a proper diet is most effective in maintaining a healthy body weight and overall health (CDC, 2011). In order to effectively promote health in the workplace researchers and employers need to consider how an employees’ diet influences health and understand how eating habits develop.

**Diet and Eating Habits**

Eating a healthy and well-balanced diet is vital for improving and maintaining good health. According to the WHO (2013) a healthy and well-balanced diet contains essential vitamins and minerals which are necessary to boost the immune system. A healthy diet also protects the human body against certain types of diseases, especially diabetes, cardiovascular diseases, certain types of cancers, and skeletal conditions. Importantly, a well-balanced diet also contributes to a healthy bodyweight (WHO, 2013).

The U.S. government recently revamped their dietary recommendations from a food pyramid to a template called “MyPlate”, which is heavily based on the consumption
of fruits and vegetables. (Harvard School of Public health, 2013). The Harvard School of Public Health has developed a framework named the new healthy eating plate, which is argued to fix the flaws in the USDA’s MyPlate framework. The new healthy eating plate is based on the latest science about how food, drink, and activity choices affect health. The new healthy eating plate uses an illustration of a plate, with 4 main sections inside the plate; vegetables, whole grains, healthy protein, and fruits. There are also sections outside of the plates for healthy oils and water. The rationale is that most people eat off a plate, so a plate is an ideal blueprint for an eating plan. The Harvard School of Public Health (2013) recommends that people fill half their plate with produce such as colorful vegetables and fruits. A quarter of an individuals’ plate should be for whole grains such as brown rice or multigrain bread. A healthy source of protein such as fish, poultry, beans, or nuts can make up the rest of the plate. Additionally, it is recommended that healthy oils are used for cooking such as olive oil. Finally, a meal can be completed with a glass of water, tea, or coffee.

Many people know that eating a healthy, well-balanced diet is good for their health; however, many people struggle to maintain a healthy diet and body weight. The problem is that knowledge of a health behavior does not always lead to the practicing of a health behavior (Ajzen, 1991). The U.S. government can set guidelines about healthy eating, but that is only part of the complex puzzle about how to get people to eat healthy. To truly understand the complex process about how people start and maintain healthy behaviors it is necessary to examine how health behaviors develop into habits.
Health Behaviors and Habit Formation

Although there is no universal definition, health behaviors can be described as behaviors people carry out to enhance or maintain their health (Cohen, Bowness, & Felix, 1990). Positive health behaviors can include exercising and eating healthy. In contrast, negative health behaviors include smoking or being physically inactive. Understanding what kind of health behaviors people should be practicing in order to maintain and/or improve health is the first step towards getting people to make informed choices about their health. However, knowledge of a health behavior does not always lead to an individual practicing a health behavior (Ajzen, 1991). Health behaviors can develop into health habits, which are firmly established and performed behaviors which occur automatically, without awareness (Cohen, Bowness, & Felix, 1990). For example, a negative health behavior such as eating unhealthy snacks late at night can develop into an ingrained behavior, which turns into a negative health habit.

The current paper has reviewed a wide array of health benefits that physical activity and a healthy diet offer to people. One important aspect of physical activity that needs to be discussed in further detail is that physical activity, especially exercise can help reduce stress (Cotton, 1990). There is strong empirical evidence that physical activity reduces stress; however, it is vital to understand how physical activity affects stress at the physiological level. An understanding from the physiological level about how physical activity affects stress has implications for how employees and organizations deal with stress in the workplace.
**Physical Activity and Stress**

According to the Mayo Clinic (2013), physical activity can directly reduce stress in several ways. First, physical activity increases the production of neurotransmitters and endorphins, which are known to increase a positive mood. The Harvard School of Public Health (2013) also states that physical activity reduces the body’s levels of stress hormones, including adrenaline and cortisol. Behavioral factors also contribute to the positive effects of physical activity (Harvard School of Public Health, 2013). For example, a person’s self-image will improve as their strength and stamina increase. Further, regular physical activity can lower symptoms associated with depression and anxiety. Physical activity can also improve sleep quality, which can in turn help an individual cope with stress. The Mayo Clinic (2013) also explains that physical activity can act as a cognitive distraction from daily stressors, allowing a person to relax and forget about their problems.

In order to minimize the negative effects that occupational stress has on employees and organizations many employers have attempted to tackle the problem by promoting physical activity in the workplace (Con et al., 2009). Several factors determine how beneficial physical activity will be for an individual; the type of physical activity, frequency of participation, compliance to exercise programs, and employee interest in exercise (Stein, 2001). The association between physical activity and the reduction of stress has been investigated by a number of researchers (Cotton, 1990). There is strong evidence to support that individuals who are aerobically fit are more resistant to the negative physiological and psychological effects of stress compared to non-aerobically fit
individuals. People who are more aerobically fit may also recover more quickly from stress (Bonita, 1991).

Researchers from different fields have attempted to explore how physical activity and exercise help people cope with stress. Researchers have employed different experimental frameworks when examining the stress buffering effects of exercise (Gerber, Kellman, Hartman, & Puhse, 2009). For example, some studies have explored how acute exercise can lead to reduced reactivity to stressors and increase an individual’s recovery when exposed to an experimentally induced stressor (Boutcher, Hopp, & Boutcher, 2010). In line with research conducted by Boutcher et al. (2010), a meta-analyses found that acute bouts of exercise have a significant impact on blood pressure response to a psychosocial stressor (Hammer, Taylor, & Steptoe, 2006). In contrast, some researchers have chosen to explore how chronic exercise (via increased fitness levels) can suppress an individuals’ stress reactions and boost recovery from experimentally induced stress (Jackson & Dishman, 2006). Salmon (2001) states that several studies have confirmed that habitual exercise habits protect individuals from the harmful effects of stress on physical and mental health, although causality is not clear.

There is a substantial amount of research that has investigated how physical activity and exercise can affect the relationship between stress and stress induced illness/health complaints. One of the first studies to investigate whether exercise can act as a stress buffer was conducted by Kobasa, Maddi, and Puccetti (1982). The Kobasa study revealed that exercise interacted with stressful events, reducing the incidence of illness among business executives. Research by Brown (1991) confirm the early findings
found in the Kobasa et al. (1982) study. Both exercise and aerobic fitness were found to moderate the stress-illness relationship. Physically active and physically fit individuals were healthier and had fewer visits to healthcare facilities when exposed to life stressors as well (Brown, 1991). Carmack et al. (1999) also found evidence that exercise inhibits the development of physical symptoms and anxiety associated with stressors among college students. Based on a similar sample, Louchbaum, Lutz, Sells, Ready, and Carson (2004) found that strenuous exercise was related to lower levels of psychosomatic complaints among individuals subject to increased stress. Ensel and Lin (2004) also found evidence that exercise reduced psychosomatic complaints among people who encounter high levels of stress in their lives.

Recently, Gurber and Puhse (2009) conducted a comprehensive narrative review of studies testing exercise as a stress buffer, reviewing articles from 1982 up until 2008. The main goal of the Gurber and Puhse review was to determine if exercise and fitness protect against stress-induced health complaints. Over half of the studies reviewed supported the premise that people with high exercise levels exhibit less health problems when they encounter stress. Further analyses revealed that the stress-moderation effects were consistently found across different samples and varying methodological approaches. Gurber and Puhse (2009) argue that more studies are needed to provide an understanding about how much exercise is needed to trigger stress-buffer effects.

A research area that has also received substantial attention is how leisure activities outside of work help people recover from occupational stress. Surprisingly, the research area of leisure time activities outside of work has remained segmented from research
investigating exercise as a stress buffer. A key differentiation is that studies that examine leisure time activities include physical activities of varying intensities, ranging from structured, intense exercise to light physical activity such as walking to work (Saftlas et al., 2004). Additionally, studies that have examined leisure time activities include both physical activities such as playing sports and less physical activities such as volunteering (Sonnentag, 2001). In contrast, studies that have looked at exercise as a stress buffer generally focus on structured, moderate-intense exercise (Gerber & Puhse, 2009). Importantly, studies that have investigated the effects of leisure time physical activities on occupational stress have noted that physical activity has psychological as well as physiological implications for recovery (Geurts & Sonnentag, 2006).

Recovery can be described as a process which reverses the negative consequences of job demands and reduces stress levels back to normal, allowing a person to function at the same level prior to induced stress (Craig & Cooper, 1992). Recovery experiences during leisure time physical activity play a critical role in a person’s health and mood. Sonnentag, Binnewies, and Mojza (2008) found that low psychological detachment from work during the evening predicted fatigue and negative affect among employees the following morning at work. Further, mastery experiences during the evening predicted relaxation and positive affect the following morning at work. Additionally, Winwood, Bakker, and Winefield (2007) report that leisure time activities such as social activity, participating in hobbies, and exercise affect the relationship between work strains and sleep quality. The results from the Winwood et al. (2007) study also revealed that participants who engaged in higher levels of leisure time activity reported increased
recovery between work periods and lower chronic fatigue. Importantly, people who consistently recover from work strain between work periods may be able to avoid negative health outcomes related to work strain.

It is important for employers and researchers to understand that leisure activities that include physical activity and exercise can help lower employee stress levels because it can be a tool used to promote total worker health. It is also equally important that researchers demonstrate how physical activity can buffer the negative effects of stress on important health outcomes in the workplace. Research that can demonstrate how physical activity promotion can improve employee health, and in turn lead to increased profits for an organization are vital. From an organizational perspective, unhealthy employees will likely accumulate more sickness absences compared to healthy employees. Subsequently, if researchers can make a strong argument that physical activity promotion can reduce employee absences and increase profits and productivity, organizations will be more motivated to promote employee health. Further, employees who are of a healthy body weight and in good mental health will be more productive, which translates into more money for organizations (Burton et al., 2005).

**Physical Activity and Obesity**

The positive health benefits of physical activity are not limited to stress reduction. Much evidence supports the claim that physical activity is a vital component to maintaining a healthy bodyweight and body composition (Harvard School of Public Health, 2013). Despite the fact that diet and physical activity have been linked to obesity for many years, the connection has recently experienced a renewal of interest. There is
mounting evidence that the current prevalence of obesity is more closely related to a decrease in energy expenditure than the traditionally accepted imbalance between energy consumption and energy expenditure (Struber, 2004). A number of factors influence how many calories a person burns each day, including age, body size, and genes. However, the most variable factor and most modifiable factor that influences obesity is the amount of physical activity people get each day (Harvard School of Public Health, 2013).

Researchers argue that physical activity prevents obesity in several ways (Hu, 2008). According to the Harvard School of Public Health (2013) physical activity increases people’s total energy expenditure, which helps people maintain an energy balance. Physical activity also decreases total body fat and fat around the waist. Resistance exercises such as weightlifting and strength training activities aimed at building muscle mass increases the amount of energy that the body burns throughout the day. Increased muscle mass also results in more calories burned while at rest. Finally, physical activity has been proven to reduce depression and anxiety (U.S. Department of Health and Human Services, 2008). The resulting mood boost from physical activity may motivate people to stick to their exercise regimens over time.

The intensity of physical activity plays a major role in how much fat a person can burn. A study conducted by Slentz, Aiken, and Houmard (2005) randomly assigned overweight and physically inactive participants to 1 of 4 groups; a control group that did not exercise, low intensity, moderate intensity, and high intensity physical activity group. After six months participants from the high intensity group lost a significant amount of abdominal fat, whereas the other three groups had no change in abdominal fat. Studies
conducted by several researchers have also confirmed that vigorous activities are more effective for weight control compared to light physical activities such as slow walking (Mekary et al., 2009).

Evidence also suggests that physical activity may also reduce obesity and body fat storage by interacting with stress. A study by Yin, Davis, Moore, Treiber (2005) examined whether physical activity buffers the effects of chronic stress on body fat composition among a sample of adolescents. Body fat composition was measured by using skin fold measurements, BMI, and waist circumference. Yin et al. (2005) found that physical activity interacted with stress, predicting all three measures of body fat composition. It appears that greater levels of physical activity buffer the effects of chronic stress on adiposity measures.

It is important to note that Yin et al (2005) reported that there were no prior studies investigating physical activity as a moderator of the effect of stress on obesity. A thorough literature review was conducted for the current study. To the best of this authors’ knowledge there have been few if any studies since Yin et al. (2005) to directly test the hypothesis that physical activity moderates the relationship between stress and body fat/body composition. Interestingly, there have been many studies that have confirmed that physical activity can reduce stress (Gerber & Puhse, 2009) and that physical activity can buffer the effects of stress-induced health complaints (Carmack et al., 1999); however there is a large gap in the literature with regards to physical activity buffering the effects of stress on body fat composition. Further, the only apparent study that did examine the stress buffering effects of physical activity on adiposity was based
on a sample of adolescents, which is not a representative sample of the working population. There is a need for researchers to examine how physical activity can buffer the effects of stress on body fat composition among a representative and generalizable sample.

The current study has reviewed literature which suggests that both physical and psychosocial hazards in the workplace increase employee stress levels. Research has confirmed that physical and psychosocial hazards in the workplace can lead to an unhealthy body weight and body fat composition. Additionally, there is a plethora of research which has proven that physical activity can buffer the negative effects of stress (Ensel & Lin, 2004), including body fat composition (Yin et al., 2005). The current paper has already hypothesized physical and psychosocial hazards in the workplace will be associated with increased BMI. Expanding on the previous prediction of this paper, it would be appropriate to predict that physical activity levels will play a role in how stress associated with workplace hazards affects employee body fat composition. Previous research has linked stress to obesity, and has also discussed the stress buffering effects of exercise; however few studies have specifically examined how physical activity can buffer the negative effects of workplace hazards on BMI. For example, an employee who faces many workplace hazards but frequently exercises will likely have a lower BMI compared to a person who is faced with many workplace hazards but does not exercise. Exercise can both directly reduce body fat and increase a person’s ability to cope with stress, indirectly improving body composition. The current study will bridge the gap in the literature, and hypothesize the following:
Hypothesis 4a. Physical activity will moderate the relationship between physical workplace hazards and BMI, meaning that employees who have high levels of physical activity will be better able to cope with exposure to physical hazards, and have a lower BMI compared to employees who have low levels of physical activity.

Hypothesis 4b. Physical activity will moderate the relationship between psychosocial workplace hazards and BMI, meaning that employees who have high levels of physical activity will be better able to cope with exposure to psychosocial hazards, and have a lower BMI compared to employees who have low levels of physical activity.

I have argued that physical activity will buffer the relationship between stress resulting from occupational hazards and BMI. It is important to point out that BMI is only one indicator of a person’s health. It is also important to consider the mental health of a person to truly encompass a complete picture of health. Mental health is an important indicator of a person’s overall health because mental health problems can have a psychological as well as a physiological impact on the human body (CDC, 2011). Mental health is not completely controlled by genetics and can be influenced by the environment and an individual’s health habits (CDC, 2011).

Physical Activity and Mental Health

One of the most modifiable behaviors that affects mental health is physical activity (Harvard School of Public Health, 2013). Physical activity plays an important role in the management of mild to moderate mental health problems, especially depression and anxiety (Paluska & Schwenk, 2000). People with mental health problems tend to be less physically active; however increased physical activity, including both
aerobic and resistance training have been shown to reduce depressive symptoms. In addition, anxiety symptoms and panic disorders improve with regular exercise, similar to the effects of meditation or relaxation (Pauluska & Schwenk, 2000). Exercise can also enhance mental health by improving self-esteem, cognitive function, and can alleviate symptoms of social withdrawal (Sharma, Madaan, & Petty, 2006).

According to the Mental Health Foundation (2013) physical activity and exercise release chemicals in the brain that are associated with mood enhancing effects. Specifically, exercise releases endorphins which have been shown to reduce pain and create a euphoric state (Paluska & Schwenk, 2000). Improvements in mood by means of exercise can partly be explained by exercise-induced increases in blood circulation to the brain and by an influence on the hypothalamic-pituitary-adrenal (HPA) axis (Sharma, Madaan, & Petty, 2006). The Mental Health Foundation (2013) lists several benefits of physical activity which can impact mental health; improved sleep, increased interest in sex, better endurance, stress relief, improved mood, increased energy and stamina, and increased mental alertness.

Physical activity may also buffer stress and reduce stress-induced mental health problems by creating a temporary distraction from one’s problems and increase social interactions (Peluso & Andrade, 2005). Physical activity can offer a diversion from unpleasant stimuli, leading to improved affect and strengthen mental health (Pauluska & Schwenk, 2000). Further, social interactions gained from group exercise routines or meeting new people when being physically active can reduce feelings of loneliness and buffer stress (Pauluska & Schwenk, 2000). Further, many of the studies reviewed have
shown that physical activity can distract people from their problems and increase social interactions, both of which increase resilience to stress and promote a healthy mental state (Fox, 1999).

One of the main ways that physical activity and exercise are thought to improve or maintain mental health is by reducing a person’s physiological reactivity to stress (Guszkowska, 2003). In essence, it is believed that physical activity acts as a stress buffer between a stressor and mental illness. In line with the stress buffering hypothesis, Norris, Carroll, and Cockrane (1992) examined the effects of physical activity and exercise training on psychological stress and well-being in an adolescent population. Adolescents were assigned to either high or moderate intensity aerobic training, flexibility training, or a control group. Analyses revealed that participants in the high intensity exercise group reported significantly less stress compared to the other experimental groups. The relationship between stress and anxiety/depression/hostility was considerably weakened for the high intensity exercise group. An experiment conducted by Rejeski, Thompson, Brubaker, and Miller (1992) further confirmed the positive effects of physical activity on stress and mental health by examining how acute exercise buffers psychosocial stress responses. Rejeski et al. (1992) revealed that exercise reduced blood-pressure reactivity when participants were exposed to mental and interpersonal threat. Additionally, aerobic exercise reduced both the frequency and intensity of anxiety-related thoughts that occur in anticipation of a threat.

More recently, Salmon (2001) conducted a literature review on the effects of physical exercise on anxiety, depression and sensitivity to stress. Salmon (2001) notes
that there is strong evidence to support the theory that exercise leads to enduring resilience to stress. Salmon also cites that results of cross-sectional and longitudinal studies are consistent in indicating that aerobic exercise has antidepressant and anxiolytic effects which protects against the harmful consequences of stress. More recent research also confirms that physical activity can increase resilience to stress and reduce stress-induced mental health problems, especially depression (Southwick, Vythilingam, & Charney, 2005).

The beneficial effects of physical activity on stress and mental health are not limited to aerobic exercise. Recently, Hartfield, Havenhand, Khalsa, and Krayer (2011) tested the effectiveness of yoga for the improvement of well-being and resilience to stress among a sample of British employees. Compared to a control group, participants who practiced yoga for 6 weeks reported improvements in energy, confidence, increased life satisfaction, and self-confidence during stressful situations. A study by Streeter, Gerbarg, Saper, Ciraulo, and Brown, (2012) also confirms that low-impact physical activity such as yoga or stretching can be effective for increasing resilience to stressful situations. It is believed that yoga practices reduce allostatic load in stress response systems, returning the body to optimal homeostasis. Both depression and PTSD can increase the allostatic load on the body, exacerbating stress. Steeter et al. (2012) state that yoga can reduce the allostatic load on the body and promote mental health via buffering the negative effects of stress. Field (2011) conducted a review concerning the health benefits of yoga. In line with the research discussed thus far an overwhelming amount of research suggests that
yoga both decreases stress and reduces the prevalence of psychological conditions such as anxiety and depression.

The current paper has reviewed how stress resulting from workplace hazards can negatively impact mental health (Leka, 2010). Further, there is strong evidence that physical activity can buffer the negative effects of stress and reduce the incidences of stress-induced mental health problems (Guszkowska, 2003). Importantly, varying forms of physical activity can be beneficial for mental health, ranging from yoga to aerobic exercise (Streeter et al., 2012). Despite strong evidence that physical activity can buffer stress-induced mental health problems, few if any studies have specifically examined how physical activity can moderate the relationship between workplace hazards and mental health. It is likely that physical hazards are perceived as stressful, and participating in physical activity releases neurotransmitters which are known to increase mood and mental health. Further, employees who are physically fit may be more resilient to the effects of stress caused by both physical and psychosocial hazards, reducing the risk of developing mental health problems. Additionally, there is a need for researchers to develop strategies for employees to deal with occupational stress stemming from workplace hazards and the resulting impact stress can have on mental health. This leads into the fifth set of hypotheses.

**Hypothesis 5a.** Physical activity will moderate the relationship between physical workplace hazards and mental health, meaning that employees who have high levels of physical activity will be better able to cope with exposure to physical hazards, and have better mental health compared to employees who have low levels of physical activity.
**Hypothesis 5b.** Physical activity will moderate the relationship between psychosocial workplace hazards and mental health, meaning that employees who have high levels of physical activity will be better able to cope with exposure to psychosocial hazards, and have better mental health compared to employees who have low levels of physical activity.

As previously discussed, BMI and mental health can both be considered proximal indicators of health. Proximal indicators of health (signs and symptoms of health, disease-specific outcomes) are ideal for determining an individuals’ health (Brenner, Curbow, & Legrow, 1995). However, it is also important to measure distal outcomes of health to determine how the health of an employee can impact an organization. Distal indicators are not a direct result of health, but can be indirectly related to health. For example, employees may report poor health but still make it to work every day. Therefore measuring a more distal outcome of health such as absences due to sickness can help demonstrate how an employees’ health impacts both the organization (e.g. productivity) and the employee (frequency of sicknesses). Further, examining how modifiable behaviors such as physical activity can affect distal health outcomes such as employee absences may motivate employers to pay closer attention to their employees’ health since it affects organizational profitability.

**Physical Activity and Absences Due to Sickness**

Research clearly indicates that physical activity and exercise are beneficial for maintaining and improving physical and mental health (Harvard School of Public Health, 2013). Notably, the link between physical activity levels and employee absences due to
sickness is not always straightforward. For example, physical activity can directly improve health and reduce the likelihood of developing chronic illnesses such as type 2 diabetes, metabolic syndrome, some forms of cancers and cardiovascular disease (CDC, 2011). Chronic illnesses negatively impact quality of life and health (CDC, 2011), which in turn could result in employees missing work due to health problems. Studies that have examined the association between physical activity/fitness and employee absences can be grouped into 2 main categories; the effect of fitness program participation on employee-related absences and the association between fitness/physical activity and absenteeism (Aldana & Pronk, 2001).

Studies have confirmed that physical activity programs in the workplace can buffer stress and reduce the prevalence of employee absences. An early study by Cox, Shephard, and Corey (1981) used a control trial to determine the effects of a fitness program on physiological fitness and work absences. Analyses revealed that employees who participated in the fitness program increased their cardiovascular fitness and decreased their body fat, resulting in a 22% drop in workplace absences. Further, employees with high program participation showed the greatest decreases in workplace absences. Nine years after the Cox et al (1981) study Lynch, Golaszewski, Clearie, Snow, and Vickery (1990) conducted a longitudinal study comparing absenteeism rates between fitness program participants and non-participants before and after 1 and 2 years of participation. The Lynch study found that employees who participated in the fitness program demonstrated a 1.2 day decrease in yearly absences compared to employees who did not participate in a fitness program. Overall, greater participation in the fitness
program was associated with greater decreases in workplace absences. Similarly, Lechner, deVries, Adriaansen and Drabbels (1997) examined the effectiveness of different levels of participation in an employee fitness program on absenteeism over the course of 2 years. Results revealed that high program participation was associated with a significant decline in absences due to sickness. The high participation group showed an average of 4.8 days of reduced sickness absence compared to the low participation group and the control group.

More recently, many high quality studies have also examined physical fitness programs in the workplace and employee absences due to sickness. Rongen et al. (2013) conducted a meta-analysis, evaluating the effectiveness of workplace health promotion programs. Many of the studies examined by Rongen et al. (2013) used employee sickness absences as an outcome variable. For example Tveito and Erikson (2009) found that physical exercise programs in the workplace were related to decreased sickness absence rates. In addition, Zavanela et al. (2012) evaluated the effectiveness of resistance training on employee absences. Analyses revealed that employee sickness absences dropped over a 24 week period. Further, Reijonsaaire et al. (2012) looked at the effectiveness of a web-based physical activity promotion program for employees. Reijonsaaire et al. (2012) found that sickness absences were significantly reduced among employees with the highest participation rates in the physical activity program.

A few studies have also examined the association between physical/cardiovascular fitness and employee absences due to sickness. Early studies such as Baun, Bemacki, and Tsai (1986) was one of the first studies to find an association
between exercise and decreased absences due to sickness. Sickness absences were also found to be higher among people who did not exercise. In line with earlier research, both Tucker, Aldana, and Friedman (1990) and Steinhart, Greenhow, and Stewart (1991) found a strong association between high cardiorespiratory fitness and physical activity levels with decreased sickness absences.

Building upon previous research, Jacobson and Aldana (2001) examined the relationship between frequency of aerobic activity and illness related absenteeism among a large sample of U.S. employees. After controlling for confounding variables (gender, SES) a significant relationship was found between absenteeism and exercising. Differences in absenteeism were found between people who didn’t exercise and people who exercised for 20 minutes, once or twice per week. The results revealed that even small amounts of physical activity can have an impact on employee absences.

Additionally, Kyröläinen et al. (2008) examined the relationship between physical fitness, BMI, and sickness absence among military personnel. Results showed that individuals with the greatest number of sickness absences exhibited lower muscle fitness and shorter running distance compared to individuals with shorter sickness absences. In addition, high BMI and poor aerobic endurance were related to a higher incidence of absenteeism. Van den Heuvel et al. (2005) took a unique approach to investigating the link between physical activity and absenteeism rates by focusing on sporting activity and work absences. Analyses showed that employees who practiced sports over a four year time period missed work 20 days less than employees who did not practice any sporting
activities. Van den Heuvel et al. (2005) concluded that employees practicing sports take sick leave less often than people who do not participate in sports.

The current paper has reviewed that both workplace physical activity programs (Rongen et al., 2013) and physical fitness/physical activity (Steinhart, Greenhow, & Stewart, 1991) are related to decreased sickness absences across diverse samples of employees. Research also cites that physical activity can buffer the negative effects of occupational stress (Salmon, 2001), which can also lead to increased absenteeism. Most studies that have investigated the link between physical activity and sickness absences have not given proper attention to the root causes of employee absences e.g., stress-induced health problems.

There is a need for studies to identify which kinds of stressors impact employee absences in order to specify which workplace factors are most harmful to employees. Further, many studies have investigated the link between physical activity and sickness absence without investigating how physical activity can interact with stress and predict employee absences due to sickness (Rongen et al., 2013). The current study will bridge the gap in the literature by looking beyond the casual link between physical activity and sickness absences. The present paper has argued that physical activity can both reduce stress and make people more resilient to stress. It has also been argued that employees who face many workplace hazards will suffer from increased stress levels and sickness absences. In contrast, employees who exercise the most will likely have lower levels of stress and sickness absences compared to employee who do not exercise often. This leads into the sixth set of hypotheses.
Hypothesis 6a. Physical activity will moderate the relationship between physical workplace hazards and absences due to sickness, meaning that employees who practice high levels of physical activity will be better able to cope with exposure to physical hazards, and have less sickness absences compared to employees who practice low levels of physical activity.

Hypothesis 6b. Physical activity will moderate the relationship between psychosocial workplace hazards and absences due to sickness, meaning that employees who practice high levels of physical activity will be better able to cope with exposure to psychosocial hazards, and have less sickness absences compared to employees who practice low levels of physical activity.

Despite the clear stress buffering effects and health benefits of physical activity (Harvard School of Public Health, 2013) the current study is one of few studies to specifically examine how physical activity can buffer stress resulting from occupational hazards and the resulting impact on obesity, mental health, and sickness absences. It is important to note that physical activity is not the only positive health behavior that can help employees deal with stress and impact individual and organizational outcomes. Studies have researched how stress may impact the eating habits of people (Kim & Kim, 2009), however there is a need for researchers to also examine how a person’s diet can affect stress and health. Although studies have confirmed that people under stress eat less healthy foods (Ng & Jeffery, 2003), it may also be the case that people who eat a healthy diet are better equipped to deal with stress. The current study will take an unconventional approach and examine how a healthy diet may help employees deal with stress.
Diet and Stress

A person’s diet and stress are interrelated, however it is often difficult to determine whether stress affects a person’s diet or whether a person’s diet affects stress. The most plausible answer is that the cause and effect relationship can go both ways. Stress can affect what an individual eats (Ng & Jeffery, 2003), and what an individual eats may affect stress levels. According to Dallman (2003) people under chronic stress have high levels of a chemical called glucocorticoid in their bloodstream. Glucocorticoids initiate the release of stress hormones, which increase cravings for sugary foods. Dallman (2003) argues that people eat comfort foods in an attempt to reduce the chronic stress response in the body. Chronic stimulation of neurotransmitter sites can lead to a depletion in neurotransmitters over time. One key modifiable behavior that can affect neurotransmitter receptor cite is a person’s diet (Dallman, 2003).

High glycemic carbohydrates such as potatoes or white rice can cause spikes in blood sugar, dopamine, serotonin, as well as opioids, which can desensitize neurotransmitter receptor sites. A decrease of neurotransmitters released into the bloodstream can lead to mental as well as behavioral problems over time, making people more susceptible to stress (National Institute of Mental Health, 2013). A diet low in protein can also cause a depletion in neurotransmitters. A high protein meal can actually raise levels of certain neurotransmitters such as epinephrine (Dallman, 2003). Omega-3 fatty acids, which are routinely found in fish such as salmon can also affect brain biochemistry, physiology, functioning, and play a role in some neuropsychiatric diseases and cognitive decline (Bourre, 2005). Importantly, dietary omega-3 fatty acids appear to
be effective in the prevention of stress and disorders such as depression (Bourre, 2005). Researchers also recommend that certain nutrients are helpful for the body when people are under stress. Helpful nutrients include antioxidants such as vitamin C, vitamin E, Beta carotene, phytochemicals, B-vitamins, and water (Purdue University, 2013).

Roberts, Vaziri, and Barnard (2002) also note that diet can affect blood pressure, which is a key indicator of stress as well as a good determinant about how someone will respond to a stressful situation. A diet high in fat and refined carbohydrates has been shown to increase blood pressure and increase stress on the body. In contrast, a low-fat diet, with fruits, vegetables, and low fat dairy can reduce blood pressure (Appel et al., 2005). High-fat diets can lead to increased blood pressure when cholesterol accumulates in the arteries, making it more difficult for blood to flow freely (Harvard School of Public Health, 2013). Further, diets high in sodium can also increase blood pressure. When sodium is released into the bloodstream, sodium causes blood to expand in the arteries, which increases internal pressure within the arteries (CDC, 2013). Reducing sodium intake can dramatically decrease blood pressure and reduce the risk of hypertension (Sacks et al., 2001). Research supports the association between stress and blood pressure; however research tends to focus on stress as a predictor of blood pressure (Vrijkotte, Doornen, & de Geus, 2000). It is important to note that people who suffer from high blood pressure are also less capable of coping with stress compared to individuals with lower blood pressure (Hixson, Gruchow, & Morgan, 1998). Therefore, a well-balanced diet that promotes healthy blood pressure should help buffer effects on physical health. A
well-balanced diet is also vital for maintaining a healthy body weight, which can further improve health and reduce the risk of hypertension (CDC, 2011).

Diet and Obesity

The relationship between diet and obesity is surprisingly straightforward; consume the same number of calories that the body burns over time and weight will stay stable. Consume more calories than the body burns, weight will go up (Harvard School of Public Health, 2013). Importantly, not all foods are created equal, and some types of foods are more useful for controlling weight and preventing chronic diseases. For example, foods such as whole grains, vegetables, fruits, and nuts can help control weight and prevent diseases, including heart disease, stroke, and diabetes (Dansinger et al., 2005). Importantly, the type of fat people eat is more important than the amount of fat consumed. A study which examined the health behaviors of 42,000 nurses found a link between weight gain and consumption of unhealthy fats (trans fats, saturated fats) but consumption of healthy fats (monounsaturated fats, polyunsaturated fats) were not linked to weight gain (Field, Willett, Lissner, & Colditz, 2007). There is also evidence that diets high in protein are beneficial for weight loss because people tend to feel fuller on fewer calories after high protein meals compared to high carbohydrate meals (Halton & Hue, 2004). The current paper has reviewed the stress buffering effects of a healthy diet as well as the significant role that a healthy diet plays in weight management and obesity. There is a need for studies to examine how stress resulting from occupational hazards can impact employee obesity. Further, to the best of this author’s knowledge, few studies have investigated how diet can buffer the negative effects of occupational hazards upon
employee obesity rates. Many studies have reviewed how occupational stress can lead to poor eating habits (Dallman, 2003), however there is a need for occupational health psychologists to recognize that eating habits can also affect an employee’s ability to cope with stress, which can also impact body composition (Hixson, Gruchow, & Morgan, 1998).

The current study will bridge the gap in the literature and examine how diet interacts with stress resulting from occupational hazards and impact obesity in the workplace. Based on research reviewed in this paper, employees who face more occupational hazards will be more stressed, which can lead to increased fat accumulation. Further, employees who eat a well-balanced diet will be healthier and better able to cope with stress and regulate calorie consumption, reducing the risk of becoming overweight. Therefore, it is likely that employees who eat a healthy diet will have a lower BMI compared to employees who eat an unhealthy diet. This leads into the seventh set of hypotheses for the current study.

**Hypothesis 7a.** Diet will moderate the relationship between physical workplace hazards and BMI, meaning that employees who eat a healthy diet will be better able to cope with exposure to physical hazards, and have a lower BMI compared to employees who eat an unhealthy diet.

**Hypothesis 7b.** Diet will moderate the relationship between psychosocial workplace hazards and BMI, meaning that employees who eat a healthy diet will be better able to cope with exposure to psychosocial hazards, and have a lower BMI compared to employees who eat an unhealthy diet.
It is evident that a person’s diet has a large impact on overall health. For example, there is strong evidence to suggest that a healthy, well-balanced diet is vital for maintaining physical health, a healthy weight and preventing the onset of chronic diseases (Dansinger et al., 2005). In order to promote total worker health employers and researchers need to recognize that the eating habits of employees can affect both the health of the employee and the organization. Importantly, diet can also affect more than physical health. The food people eat can play a large role in maintaining good mental health and preventing the development of mental illnesses (Mental Health Foundation, 2013). Thus far the effects of diet on physical health have been reviewed; however a full review of the health benefits of a healthy diet would not be complete without examining how diet also affects mental health.

**Diet and Mental Health**

According to the Mental Health Foundation (2013) good nutrition is essential for maintaining good mental health and a number of mental health conditions may be influenced by dietary factors. An individual’s diet can impact both short-term and long-term mental health. Evidence also suggests that foods play an important role in the development, management, and prevention of specific mental health problems such as depression, schizophrenia, attention deficit disorder, and Alzheimer’s disease. Mental health can be maintained and improved by ensuring that an individuals’ diet provides adequate amounts of complex carbohydrates, essential fats, amino acids, vitamins, minerals, and water (Mental Health Foundation, 2013).
A number of studies have linked the intake of certain nutrients with mental health disorders, including several different types of depression. For example, countries with lower levels of fish in their diet suffer from higher rates of depression (Hibbeln, Nieminen, Blasbalg, Riggs, & Lands, 2006). Fish contain healthy omega-3 fatty acids and B vitamins, which have been linked to improved mental functioning and decreased rates of depression (Frasure-Smith, Lesperance, & Julien, 2004). In contrast, countries with higher consumption rates of fish, such as Japan have significantly lower rates of depression (Hibbeln et al., 2006). Complex carbohydrates and food components such as folic acid, selenium, and tryptophan have also been linked to a decrease in depressive symptoms (Leung & Kaplan, 2009). Studies have found that individuals with low levels of folate or folic acid in their diet are significantly more likely to be diagnosed with mental health problems compared to people with higher intake levels (Morris, Fava, Jacques, Selhub, & Rosenberg, 2003). Similarly, mental health disorders have been linked to diets low in zinc, and vitamins B1, B2, and C (Bourre, 2006).

Fluid intake can also affect mood and mental health. Mild dehydration can impair cognitive performance, decrease mood, and affect behavior (Ganio et al., 2011). An average adult loses approximately 2.5 litres of water daily through the lungs as water vapour, through skin perspiration, and through the kidneys as urine (Naghii, 2000). If an individual does not adequately replenish lost fluids, symptoms of dehydration can occur, including irritability, loss of concentration, and reduced mental functioning (Mental Health Foundation, 2013). Another contributing factor to dehydration and mental health problems is the overconsumption of caffeinated beverages. Consuming too much caffeine
can increase blood pressure, anxiety, depressive symptoms, disrupt sleep, and dehydration (Rogers, Smith, Heatherley, & Pleydell-Pearce, 2008).

The current study has reviewed the wide array of health benefits that a healthy, well-balanced diet can offer. A healthy diet can buffer stress and improve both physical and mental health (Mental Health Institute, 2013). Interestingly, research from the biological and health sciences has remained segmented from organizational and occupational health psychology. For example, there are studies linking diet to mental health (Hibbeln et al., 2006); however the link between diet and mental health have rarely been examined in an organizational context. There is a need for occupational and organizational psychologists to investigate how improving employee eating habits and mental health can be applied to a workplace setting. Additionally, there is a need for studies to examine how a healthy diet can interact with stress resulting from occupational hazards and impact employee mental health.

The present study will examine how a healthy diet can affect the relationship between workplace hazards and mental health. The current study has argued that employees who eat a well-balanced diet are at a reduced risk for developing mental health problems and are also better equipped to cope with stress. In line with the current argument, employees who eat a healthy diet are better able to cope with stress and less likely to develop mental health problems compared to people who eat an unhealthy diet. This leads into the eighth set of hypotheses.

**Hypothesis 8a.** Diet will moderate the relationship between physical workplace hazards and mental health, meaning that employees who eat a healthy diet will be better
able to cope with exposure to physical hazards, and have better mental health compared to employees who have an unhealthy diet.

**Hypothesis 8b.** Diet will moderate the relationship between psychosocial workplace hazards and mental health, meaning that employees who eat a healthy diet will be better able to cope with exposure to psychosocial hazards, and have better mental health compared to employees who have an unhealthy diet.

Research strongly supports that an individual’s diet can impact many aspects of health, ranging from mental health to obesity (Hassan et al., 2003). The role of an occupational health psychologist is to promote worker health (Fox & Spector, 2013). In order to promote worker health, occupational health psychologists need to be able to demonstrate to employers that the health of their employees can have financial implications for the organization. Research shows that absences due to sickness are a huge financial burden for organizations (Mercer, 2010). There is also strong evidence that a healthy diet can improve health and buffer stress (Bourre, 2005), which could potentially reduce the amount of sickness absences employees take. Linking employee health practices to organizational outcomes such as absenteeism is a method psychologists can use to push employers to invest in the health of their employees.

**Diet and Sickness Absences**

There is clear evidence that obesity and an unhealthy diet are related to poor health (CDC, 2013). Further, several studies have linked obesity and general health to sickness absences in the workplace (Bertera, 1990). Despite clear evidence that diet has a profound effect on health (Hibbeln et al., 2006) and can affect an individual’s ability to
cope with stress (Dallman, 2003), there is a lack of research specifically examining how an individual’s diet can impact sickness absences in the workplace. Many studies that have examined health and sickness absences have focused on obesity and chronic health problems (Ferrie et al., 2007). Previous research may have given less attention to the link between diet and sickness absences because diet may be considered a more distal predictor of health status and sickness absences. For instance, a poor diet may not directly lead to increased sickness absences, nonetheless diet can impact a person’s ability to cope with stress (Bourre, 2005), which in turn can affect sickness absence. It may be the case that researchers choose to focus on obesity and sickness absences because the association is more direct, possibly resulting in a stronger association.

Although there are few studies that have specifically examined the link between diet and sickness absences, there are studies that have focused on workplace health promotion programs and absenteeism (Bertera, 1990). The main weakness in the literature is that workplace health promotion programs provide information about how to practice healthy behaviors without evaluating whether there were any changes in the actual practice of health behaviors (Arneson & Ekberg, 2005). Further, many health promotion studies in the workplace focus on whether a program brought about changes in the outcome variable (e.g. absences or employee stress), without giving any attention to health behavior changes (Harden, Peersmen, Oliver, Mauthner, & Oakley, 1999). Harden et al. (1999) also point out that health promotion programs need more rigorous evaluation for their effectiveness. Studies have tended to give more attention to the link between work characteristics and sickness absences (Head et al., 2006), without acknowledging
that health behaviors such as diet can buffer occupational stress (Bourre, 2005) and potentially reduce sickness absences.

In addition there are studies that have investigated how to promote healthy eating in the workplace without examining the link between diet and organizational outcomes such as absenteeism or productivity. For example, Plotnikoff et al. (2005) examined the use of email in promoting nutrition behavior in a work context. Employees who received the email information showed increases in healthy eating behaviors and balancing food intake with physical activity levels. Studies have also examined factors that can predict employee participation in healthy eating programs in the workplace, ranging from company size to the presence of a cafeteria (Lassen et al., 2007). Although it is critical to understand how to promote health behaviors in the workplace, it is also important to evaluate whether health promotion in the workplace has an impact on organizations such as employee absences.

The current study has reviewed how a healthy diet can significantly improve the health of an employee, and help employees deal with stress (Hixson, Gruchow, & Morgan, 1998). Further, the current study has argued that there is a need for researchers to examine how the health behaviors employees practice can affect both individual health and organizational outcomes such as absenteeism. Given the strong link between diet and health, and health and sickness absences it is surprising that previous researchers have not investigated the potential stress buffering effects of diet upon employee sickness absences. It is likely that employees who eat a well-balanced diet are healthier than employees who eat an unhealthy diet, allowing their body’s to better cope with stress.
from occupational hazards. Further, employees who are healthier and better able to cope with stress would likely suffer from less health problems and less sickness absences. This leads into the ninth set of hypotheses for the present study.

**Hypothesis 9a.** Diet will moderate the relationship between physical workplace hazards and sickness absences, meaning that employees who eat a healthy diet will be better able to cope with exposure to physical hazards, and have less sickness absences compared to employees who have an unhealthy diet.

**Hypothesis 9b.** Diet will moderate the relationship between psychosocial workplace hazards and sickness absences, meaning that employees who eat a healthy diet will be better able to cope with exposure to psychosocial hazards, and have less sickness absences compared to employees who have an unhealthy diet.

**Aging Workforce**

Promoting total worker health involves more than promoting modifiable health behaviors among the working population. In some instances, factors beyond an employees’ control can affect health and safety both within and outside the workplace. Specifically, an employee’s age can affect their health and safety. For example, older workers are more likely to sustain severe injuries in the workplace compared to younger workers and miss more workdays due to poor health (Wegman & McGee, 2004). According to the Healthy Aging for a Sustainable Workforce Report (University of Iowa, 2009), current knowledge about keeping older workers safe and healthy is insufficient. Organizations and researchers must explore new ways to promote healthy aging in the workplace.
Longer life expectancies, low birth rates, and the aging of the “baby boomer” generation all impact the demographics of the current and future workforce (Harrington & Heidkamp, 2013). The aging workforce creates significant economic, health, and social challenges in the U.S. and internationally (United Nations, 2007). The U.S. census predicts that by 2050, 19.6 million American workers will be 65 or older, making up 19% of the total U.S. workforce. Further, the number of people in the workforce who are 65 years or older is expected to grow by 75% while the number of people in the workforce who are 25 to 54 is only expected to grow by 2% (Harrington & Heidkamp, 2013).

Given the growing proportion of older individuals in the workplace it is necessary to promote working conditions that allow aging workers to continue to work productively and safely. Organizations and researchers can use the total worker health framework set forth by NIOSH (2013) to enhance the health of older employees. Specifically, the CDC (2013) states that emerging factors beyond the workplace jointly contribute to many health and safety problems that confront workers. One important factor that can affect health and safety beyond workplace factors is a person’s age. According to the 2004 National Academic Panel report on “Health and Safety Needs of Older Workers” more research is needed to understand how to prevent work-related injury, illness, and promote health among older workers. Further, knowledge gaps need to be filled to better understand the biological, physiochemical, and psychosocial factors that affect aging workers.

Despite negative stereotypes towards aging individuals, older individuals or employees are just as cognitively capable of completing work compared to their younger
counterparts (National Institute of Mental Health, 2013). Further, older employees are no more likely to suffer from mental health problems than younger employees (National Institute of Mental Health, 2013). Distribution of onset of mental health problems can differ by age, however older individuals appear to be just as mentally healthy, or healthier than their younger peers. For example, younger adults (18-29 years old) suffer from the highest rates of depression of any age group. In addition, the age group of 18-25 is most likely to suffer from serious mental illness (National Institute of Mental Health, 2013). In contrast, older adults are at an increased risk for mental health problems such as post-traumatic stress disorder and panic disorder (Kessler et al., 2007). Despite the fact that the current paper has reviewed many predictors of mental health, the research on the association between age and mental health is not clear cut. Based on the current literature review it appears that age is not an accurate predictor of overall, general mental health. Rather, age may be better suited for predicting which kinds of mental health problems an individual is at risk for developing. Importantly, one area of health where age can play a significant factor is in the body composition (e.g., body fat vs. lean muscle tissue) of an individual.

**Age and BMI**

One major health concern about the aging workforce is the increase in obesity rates. Adults age 60 and over are more likely to be obese compared to younger adults (Ogden et al., 2012). Further, BMI appears to linearly increase with age among women, and increases with age among men in two stages; a dramatic increase between 20-40 years and then a slower increase between 40-60 years of age (Welon, Szklarska, Bielicki,
& Malina, 2002). Research also cites that BMI is age dependent when used as an indicator of body fatness, meaning a person’s age is a strong predictor of their BMI (Gallagher et al., 1996).

To further complicate matters, increases in BMI are related to several chronic diseases and a compromised immune system (Harvard School of Public Health, 2013). Excess body fat can lead to an impaired immune system, further leading to a greater incidence and severity of infectious diseases (Marti, Marcos, & Martinez, 2001). Further, older individuals who have an impaired immune system or suffer from chronic health problems have increased difficulty coping with occupational stress (Harvard School of Public Health, 2013). Older employees are at a high risk for being obese (Ogden et al., 2012), and a lack of physical or psychological resources to cope with stress can lead to weight gain through two main mechanisms; weight gain related to an increased release in stress hormones and weight gain associated with emotional eating (Torres & Nowson, 2007). To summarize, age is a risk factor for obesity, which negatively impacts the immune system, which in turn can reduce a person’s ability to cope with stress, which can eventually lead to more weight gain.

In order to promote total worker health, researchers and organizations need to recognize that age-related increases in body fat can negatively impact employee health and can be a financial burden for organizations (Finkelstein, Fiebelkorn, & Wang, 2005). Organizations should actively promote physical activity and positive health behaviors in the workplace; however employers need to target older employees, who are at the greatest risk for obesity (Ogden et al., 2012). Many studies have examined health
promotion/interventions in the workplace (Franche et al., 2005); however research has failed to discuss the implications of workplace health promotion for older employees.

Based on the information reviewed in the current paper, employees accumulate more body fat as they age. Additionally, high rates of occupational hazards and stress also predict weight gain. It is likely that 2 major risk factors for obesity (stress and age) will interact to amplify the probability of weight gain. For example, an employee who is in their fifties and encounters a high rate of occupational hazards will most likely be at a greater risk for being obese compared to an employee in their twenties, who encounters many workplace hazards. This leads into the tenth set of hypotheses for the present study.

**Hypothesis 10a.** Age will moderate the relationship between physical workplace hazards and BMI, meaning that younger employees will be better able to cope with exposure to physical hazards, and have lower BMI compared to older employees.

**Hypothesis 10b.** Age will moderate the relationship between psychosocial workplace hazards and BMI, meaning that younger employees will be better able to cope with exposure to psychosocial hazards, and have lower BMI compared to older employees.

The current paper has discussed the implications that age can have for employee health. Specifically, age is a significant predictor of obesity (Welon et al., 2002), and obesity is predictive of many chronic diseases, such as Type 2 diabetes, heart disease, and certain types of cancers (CDC, 2011). In light of the fact that age is a significant predictor of health status, including obesity and chronic health diseases, it is likely that age will also impact a more distal outcome such as sickness absence. For example, age can play a
role in obesity related chronic diseases, which in turn may affect how many sick days employees take. Finally, Kivimäki et al. (2003) have argued that sickness absence can be used as a global measure of health.

**Age and Sickness Absence**

Studies that have examined employee sickness absence need to give proper attention to the effects that age can have on sickness absence. Data on age are often presented as confounding variables, without any attempt to explain how age can impact sickness absence (Allebeck et al., 2004). Further, some studies have controlled for age when examining sickness absences without giving a proper explanation as to why age was controlled for (Nielsen et al., 1996). For example, Niedhammer et al. (1998) cites age as a potential confounder variable when examining sickness absence, without giving any explanation why age could be a confounding variable.

The limited number of studies that have examined the effects of age on sickness absence have revealed important information. Brage, Nygard, and Tellnes (1998) found evidence that long-term sickness absence due to musculoskeletal health problems was strongly associated with age. Older employees are also at a greater risk for suffering lower back injuries (Guo et al., 1995) and long-term work-related disability (Cheadle et al., 1994). Further, Voss et al. (2008) compared self-reported sickness absence with registered records of sickness absence. The results indicated that employees 50 years and older had both the highest self-reported sickness absence and the most registered sickness absences compared to younger age groups.
The likely explanation for increased rates of sickness absence among older employees is that sickness absence is a distal predictor of health. Specifically, sickness absence rates are likely a result of a decline in physical health, which can come with older age (Houx & Jolles, 1993). Further, age-related health decline may make it more likely that stress resulting from occupational hazards will have a greater impact on health and sickness absences among older employees. For example, older employees who are exposed to occupational hazards will likely incur more sickness absences compared to younger employees who are exposed to the same workplace hazards. The current study will bridge the gap in the literature by being one of few studies to examine the relationship between age and sickness absence without using age as a control variable. The current study will propose the following:

**Hypothesis 11a.** Age will moderate the relationship between physical workplace hazards and sickness absences, meaning that younger employees will be better able to cope with exposure to physical hazards, and have less sickness absences compared to older employees

**Hypothesis 11b.** Age will moderate the relationship between psychosocial workplace hazards and sickness absences, meaning that younger employees will be better able to cope with exposure to psychosocial hazards, and have less sickness absences compared to older employees.
CHAPTER 2

METHOD

Participants

Participants from the Northern Ireland Civil Service Workforce Health Survey (Addley, Douglas, Mallon, & Mathewson, 2000), commissioned by the Northern Ireland Civil Service (NICS) Workplace Health Committee was used for the current study. Refer to Figure A1 in Appendices for an overview of the NICS research model. The study was part of the NICS Workplace Health Improvement Programme. The Programme was developed based on the idea that workplace health promotion has the potential to address many of the antecedents of individual as well as public health while also making an important contribution to organizational performance. The goal of the NICS Workplace Health Improvement Programme was to complement pre-existing structures already in place to support staff and promote their health. Health promotion areas of interest include health and safety, welfare and occupational health services, work-life balance and health promotion activities that take place across all departments and agencies on a regular basis.

The entire data set consisted of 16,651 civil servant workers from Northern Ireland, collected over the course of three months. Participants were 50.4% female and 49.6% male. The average age of participants was 38, ranging from 16 to 70 years of age. Approximately 26% of the sample reported being single, 63% married, 5% cohabiting and 6% separated or divorced. Approximately 94% of participants were permanent
employees, 2% were on a fixed term/contract, and 4% were temporary workers. No data was collected on ethnicity. Participant response rates varied by job grade. Response rates were highest among Senior civil service workers (88.2%) and lowest among Industrial staff (29.1%). For a complete description of all the job grades refer to Table B1 in Appendices.

**Measures**

**Physical Workplace Hazards.** The following question was asked to participants to measure physical hazards in the workplace: “Which of the following, in your view, are causing your workplace to be unsafe or unhealthy?” Participants were then presented with 13 potential hazards to choose from and select. Example options include the lighting, noise levels, and unsafe floor surfaces. All items were summed, and participants received a score ranging from 0 to 13, with higher scores indicating higher exposure levels to physical hazards. Refer to Appendix A for the full list of options.

Based on previous research, physical hazards such as noise, lighting, and ventilation are not always related to one another, although each factor is considered a potential physical hazard in the workplace (Cox, 1993). For example, a workplace may be excessively noisy but have adequate lighting. Both ventilation and lighting can affect employees, however the absence or presence of one physical hazard is not related to the absence or presence of another physical hazards. Each potential hazard can uniquely contribute to and define the construct of workplace physical hazards. In line with the current argument, the current paper argues that the construct of physical workplace hazards is a formative model. The direction of causality is from the items to the construct.
in a formative model, whereas the direction of causality is from the construct to the items in a reflective model (Edwards & Bagozzi, 2000). Therefore, a measure of internal consistency would not be appropriate for a measure of physical hazards because items are not expected to be correlated in a formative model.

**Psychosocial Workplace Hazards.** An adapted version of the U.K. Health and Safety Executive’s Management Standards Work-Related Stress Indicator Tool (HSE MS) was used to measure psychosocial hazards in the workplace. A general question was first presented to participants: “Which if any of the following are causing you unwanted stress in your job?” Example options include having too much work to do, poor communication, and sexual harassment. All items were summed, and participants received a score ranging from 0 to 45, with higher scores indicating higher exposure levels to psychosocial hazards. Refer to Appendix B for a full list of questions.

The U.K. Health and Safety Executive’s Management Standards Work-Related Stress indicator tool (HSE MS) is a widely used tool to measure stress in the U.K. (Edwards et al., 2008). Recently, Edwards et al. (2008) conducted an analysis of the psychometric properties of HSE MS using data from 39 organizations. Although the original HSE MS has subscales for job demands, support, and control, analyses by Edwards et al. (2008) suggest that deriving a single measure of work-related stress by combining the subscales is appropriate.

The current study expands on the work of Edwards et al. (2008) and not only derive a single score from the HSE MS, but also argue that the scale is based on a formative model in contrast to a reflective model. The direction of causality is from the
items to the construct in a formative model, whereas the direction of causality is from the construct to the items in a reflective model. For the HSE MS scale, it would not be expected that individual items will be highly correlated because each indicator uniquely contributes to the meaning of the construct (MacKenzie, Podsakoff, & Jarvis, 2005). For example, an employee may have high work demands such as unreasonable deadlines, but also have boring or repetitive work. Both unreasonable deadlines and boring work can independently contribute to stress, and both need not be related to contribute to stress. Therefore, a measure of internal consistency would not be appropriate because it would not be expected that indicators will be correlated or covary in a formative model (Edwards & Bagozzi, 2000).

Physical Activity. The current study used self-report measures of physical activity. The main advantage to the use of self-report measures of physical activity is that these measures are practical, low cost, have a low participation burden and are well accepted among researchers (Prince et al., 2008). In contrast, direct measures of exercise and physical activity are often time and cost intensive, intrusive for participants, and require specialized training and physical proximity of the participant for data collection (Prince et al., 2008). In addition, self-report measures of physical activity have been shown to be extremely reliable and demonstrate acceptable validity (Baranowski, 1988). A main strength of the current study is that both exercise frequency and intensity are measured. Sallis (1991) points out that researchers have not consistently measured frequency and intensity of exercise despite the fact that both factors are necessary to understand physical activity and fitness (Harvard School of Public Health, 2013).
Three questions were used to measure the frequency and intensity of exercise. Each item begins with the following question: “How many times a week on average do you do the following kinds of exercise for more than 20 minutes?” Next, participants were presented with three options. For example, “Strenuous exercise (Heart beats rapidly) (e.g., running, jogging, football, squash, basketball, vigorous swimming)”. Participants then list the times per week they participated in a certain activity. The same format follows for moderate exercise and mild exercise. Refer to Appendix C for the full list of questions.

**Diet.** Dietary habits were measured using one question, with seven different options for a response. For example, a question asks “Which of the following, if any, do you consciously try to limit or avoid? (Tick all that apply). Participants are then given the option to indicate which foods they try and avoid, e.g., sugar, fast foods, salt, fat/fatty foods, caffeine, and red meat. Refer to Appendix D to view the full list of questions. For the current study, a principal components analysis revealed one factor past the point of inflection on a scree plot test. An exploratory factor analysis revealed that one factor was present, with factor loadings ranging from .45 to .60. Overall, the internal consistency was acceptable (α=.70).

The current measure of dietary intake is appropriate for the current study because all six options used in the current study are predictive of health and well-being. For example, consumption of fast foods and foods high in fat have been linked to coronary heart disease (Ascherio, Katan, Zock, Stampfer, & Willett, 1999). High consumption of sugary foods have been linked to obesity (Gibson, 2006) and high intake of sodium is
associated with higher blood pressure (Vollmer et al., 2001). Consumption of red meat has been linked to an increased risk of mortality (Sinha et al., 2009) and overconsumption of caffeine can cause health problems such as anxiety and heart palpitations (National Institute of Health, 2013). Overall, the items used in the current study to measure dietary intake are predictive of an individual’s diet and health.

**BMI.** Two questions were used to determine participants’ BMI. The first question asked “What is your weight without clothes?” Participants then list their weight in stones, pounds, of kilograms. The second question used to determine BMI asked participants “What is your height in bare feet?” Participants then listed their height in feet, inches, or centimeters. All weight measurements were converted to kilograms and all height measurements were converted to meters. Next the metric system formula was used to calculate BMI. Based on the recommendations of the CDC (2013) BMI was calculated by using the following formula: weight in kilograms divided by height in meters squared.

BMI scores < 18.5 are considered underweight. A normal weight score would be 18.5-24.9, overweight would be 25-29.9, and obesity would be a BMI of 30 or greater. BMI is an accurate predictor for certain diseases such as heart disease, high blood pressure, Type 2 diabetes, gallstones, breathing problems, and certain cancers for both men and women (National Heart, Ling, and Blood Institute, 2013). Despite the strengths of using BMI there are some limitations. BMI may overestimate body fat in athletes and others who have a muscular build and BMI may underestimate body fat in older individuals and others who have lost muscle (National Heart, Lung, and Blood Institute, 2013). Nonetheless, BMI is an efficient tool for measuring body composition because it is
less time intensive and more cost effective than using other methods such as bioelectrical impedance or hydrostatic underwater weighing.

**General Mental Health-12 Questionnaire (GHQ-12).** The GHQ-12 (Goldberg & Williams, 1988) was used to measure the general mental health of participants. The GHQ-12 is used to detect mental health problems in the general population. The questionnaire assesses participants’ current state and asks if that differs from his or her usual state. An example question from the questionnaire is “Have you recently been able to concentrate on whatever you are doing?” Participants then choose between 4 options; better than usual, same as usual, less than usual, or much less than usual. The first two options on the questionnaire are scored as zero, and the third and fourth options are scored as 1. Thus, each participant will produce an overall score out of a maximum possible score of 12. A score of 4 or more is indicative of mild psychiatric symptoms. Refer to Appendix E to view a copy of the GHQ-12. For the current study a principal components analysis revealed one factor past the point of inflection on a scree plot test. An exploratory factor analysis revealed that one factor was present, with factor loadings ranging from .64 to .82. The reliability of the questionnaire was also found to be very high in the current study (α = .92).

The validity of the GHQ-12 as a tool for detecting mental health problems has been established by comparing the GHQ-12 scores with the Composite International Diagnostic Interview, which can generate diagnoses using the DSM-IV systems (Goldberg et al., 1997). Further, the GHQ-12 has been shown to produce similar diagnoses of psychiatric problems as compared to clinical interviews. For example,
Hardy et al. (1999) validated the GHQ-12 with a sample of the U.K. workforce and found a strong correlation (.70) with an independent standardized clinical interview. Both Goldberg et al. (1997) and Hardy et al. (1999) report that people scoring four or more points on the GHQ-12 (GHQ-12 scoring method) are identified as likely cases for minor psychiatric disorders while individuals scoring three or less points are classified as psychologically healthy. Further, the GHQ-12 scoring method has been found to be a more reliable scoring method compared to the likert scoring method (Hankins, 2008). According to Houdmont et al. (in press) the GHQ-12 scoring method was designed to reduce measurement errors that might be introduced by an individuals’ tendency to endorse extreme responses or to over-use the scale mid-points. The current paper used the GHQ-12 scoring method in order to reduce measurement errors and accurately measure psychiatric problems among employees.

Absences Due to Sickness. Workplace absences were measured with the following question: “In the last year, how many working days were you absent from work because you were sick, injured, or disabled?” Participants were then instructed to write the approximate number of days. Sickness absences are an important variable to measure because it can be used as both a global measure of health (Kivimäki et al., 2003) and be used as an organizational outcome which affects an employer’s profits. There is some debate as to whether self-reported sickness absences is as reliable as certified sickness absence records (Marmot et al., 1995); however research suggests that employees are fairly accurate at reporting absences due to sickness (Voss, Stark, Alfredsson, Vingard, & Josephson, 2008). Ferrie et al. (2005) also confirms that there is a strong agreement
between self-reported sickness absences and number of annual recorded sickness absence days among both sexes. Self-reported sickness absences are also strongly related to overall health. Finally, data on absences are often collected routinely by employers, which reduces the potential recall and response set biases attributable to self-reported indicators of health (Folger & Belew, 1985).

**Control Variables.** Gender was controlled for in the current study. Research has shown that there are gender differences in body mass index between men and women. For example, Kuan, Ho, Shuhaili, and Gudum (2011) found that men are more likely to be obese compared to women and women are more likely to be underweight. Males and females differ in their “ideal” body image, which likely contributes to differences in BMI. Kuan et al. (2011) report that females preferred their ideal figure to be underweight whereas more males chose an overweight figure as an ideal body type. Kuan et al. (2011) also found that women were more likely to diet, use self-induced vomiting to lose weight and use laxatives and exercise as a weight-loss strategy. Therefore, the effects of gender on BMI were controlled for in the current study.

Gender is also a critical determinant of mental health and mental illness (WHO, 2013). Eaton et al. (2012) report that women are more likely to be diagnosed with anxiety or depression, while men are at a higher risk for substance abuse or antisocial disorders. Eaton et al. (2012) explain that women are more likely to internalize emotions, which can lead to withdrawal, loneliness, and depression. In contrast, men are more likely to externalize emotions, which can lead to aggression and impulsive behavior. Therefore,
the current study controlled for any effects that gender may have on self-reported mental health.

There are also gender differences in sickness absences among employees. Laaksonen, Martikainen, Rahkonen, and Lahelma (2008) found that women had a 46% higher risk for sickness absences compared to men. Importantly, the overall gender differences in sickness absence are due to women being more likely to suffer from short absences spells and men more likely to have longer-term sickness spells. Laaksonen et al. (2010) report that gender differences in sickness absence are also attributable to the differences in mental and behavioral disorders and musculoskeletal disease. North et al. (1993) also found gender differences in sickness absence. North et al. (1993) concluded that gender differences in sickness absence were due to socioeconomic differences between working men and women. Based on the discussed research above the current study controlled for the effects of gender on sickness absence.

**Procedures**

Refer to Figure A1 in Appendices for an overview of the NICS Workplace Health Improvement Programme model. First, a pilot test of the questionnaire was conducted with a random sample of employees from NICS to ensure the questionnaire was easy to complete. The pilot test was also used to predict what the response rates would look like for the full survey. The results from the pilot test proved that the survey worked well. Nonetheless, some minor changes were made to the wording and format of the survey as a result of the pilot test.
Next, self-completion postal questionnaires were sent out to all 28,937 NICS staff. The questionnaire was designed to specifically meet the needs of NICS and incorporate key benchmark variables regarding employee health and organizational needs. The survey was sent out on Monday, March the 27th, 2000. Reminder letters were sent out to all participants 3 weeks after the initial survey was sent out and the survey was closed on May the 30th, 2000. At the closing date of the survey a total of 16,651 employees completed the questionnaire. The response rate was approximately 57.5%.

**Splitting the Data by Pay Grade.** The data in the current study were split into 2 groups; employees in the senior level pay grade and employees in the lower level pay grade. Employees in the senior level pay grade included senior civil service workers and senior principal workers. The lower level pay grade group consisted of deputy principals, staff officers, industrial staff, administrative assistants and officers, and executive officers. The rationale for testing the hypotheses separately was that occupational pay grade has been shown to be an important predictor of health, especially among British civil servant workers (Marmot et al., 1991). Further, Emslie, Hunt, and Macintyre (1999) found that employees in the lower pay grades were more likely to be exposed to poor working conditions and suffer an increased incidence of health problems. Employees in lower pay grades are also more likely to miss work due to sickness or injury (Hemingway et al., 1997), and be less physically and mentally healthy (North et al., 1993) compared to higher pay grade employees.

Although studies have found health differences between pay grades (Marmot et al., 1996), more studies need to compare the highest pay grade employees to those from
the lower pay grades. For example, it is likely that the differences in exposure to workplace hazards are greater between the senior pay grade and the remaining pay grades compared to the differences between each individual pay grade. Further, differences in health status between lower pay grades have been shown to be less extreme than the differences between the health status of the highest pay grade employees and the remaining lower pay grades (Marmot, Rose, Shipley, & Hamilton, 1978; Marmot et al., 1995).
CHAPTER 3
RESULTS

Data Screening

All statistical analyses were conducted using SPSS 16.0. The data consisted of 16,636 participants. Before beginning the analyses, the data were standardized and examined for outliers with unusually large \( z \)-scores. Case ID 12644 and 6952 had unusually high \( z \)-scores of 8.9 for the exercise variable, and were therefore deleted. Case 3313 had a high \( z \)-score of 6.8 for the psychosocial hazard variable, and was deleted. Case 12690 had a \( z \)-score of 8.0 for the BMI variable and was deleted. Cases 12029, 2747, 11487, 7723, 5055, 3516, 11543, 11459, 14459, 14937 and 5966 had unusually high \( z \)-scores of 11.65 for the sickness absence variable, and were therefore deleted.

Next, multivariate outliers were examined for Hypotheses 1a through 11b, examining Standardized residuals, Cook’s Distance, and Standardized DfBetas. Case 6065 was deleted because the standardized residual was 12.18, which is unusually high. Due to missing data, pairwise deletion was used in all subsequent analyses for both data sets.

Descriptive Statistics of the Measured Variables

The descriptive statistics for the entire sample were computed. Means and standard deviations for all of the scales and questions are presented in Table B2. The mean score for physical hazards was 1.33, with a standard deviation of 1.98. The mean score for psychosocial hazards was 5.98, with a standard deviation of 5.43. In addition, the mean score for BMI was 25.53, with a standard deviation of 4.23. The mean score for
the GHQ-12 measure of general mental health was 2.44, with a standard deviation of 3.48. The mean days of sickness absence were 11.44, with a standard deviation of 28.84. Further, the mean days of exercise were 7.69, with a standard deviation of 3.94. The mean score for diet was 2.61, with a standard deviation of 1.61. Finally, the mean age was 38.87, with a standard deviation of 10.13.

The descriptive statistics for the senior level pay grade \((N = 1025)\) and lower level pay grade employees \((N = 14,873)\) were computed and compared. Means, standard deviations and \(t\)-test results for all of the scales and questions are presented in Table B3. Senior level pay grade employees \((M = 0.74, SD = 1.57)\) were exposed to significantly less physical hazards compared to lower level pay grade \((M = 1.38, SD = 2.00), t(15,896) = -10.05, p < .001\). In contrast, senior level pay grade \((M = 5.83, SD = 4.66)\) did not significantly differ in exposure to psychosocial hazards compared to lower level pay grade \((M = 6.05, SD = 5.49), t(15,896) = -1.27, p > .05\). Further, senior level pay grade \((M = 25.31, SD = 3.21)\) did not significantly differ from lower level pay grade in BMI \((M = 25.52, SD = 4.29), t(14,909) = -1.49, p > .05\). In addition, senior level pay grade did report better mental health scores, via lower scores \((M = 2.10, SD = 3.06)\) compared to lower level pay grade \((M = 2.48, SD = 3.47), t(15,896) = -3.36, p < .05\). Furthermore, senior level pay grade reported significantly less sickness absences \((M = 5.57, SD = 18.44)\) compared to lower level pay grade \((M = 11.81, SD = 29.03), t(14,736) = -6.53, p < .001\). Additionally, senior level pay grade \((M = 7.67, SD = 3.64)\) did not significantly differ in exercise frequency compared to lower level pay grades, \((M = 7.71, SD = 3.96), t(12,757) = -0.24, p > .05;\) however senior level pay grade did report a healthier diet \((M =
3.05, SD = 1.57) compared to lower level pay grade (M = 2.59, SD = 1.60), t(15,896) = 8.81, p < .001. Finally, senior level pay grade (M = 47.59, SD = 7.85) had a significantly higher mean age compared to lower level pay grade (M = 38.18, SD = 9.95), t(15,735) = 29.40.

Finally, Skewness and Kurtosis were calculated for each variable, for both senior pay grade and the lower pay grade group. For the senior pay grade, the Skewness and Kurtosis of the measured variables are as follows: BMI (0.66, 1.76); GHQ-12 score (1.60, 1.70); sickness absence (2.02; 3.84); physical hazards (2.58, 7.38); psychosocial hazards (1.22, 1.93); physical activity (2.18, 8.85); diet (-.14, -.52); and age (-.64, .09).

For the lower pay grade, the Skewness and Kurtosis of the measured variables are as follows: BMI (1.08, 2.77); GHQ-12 score (1.39, .78); sickness absence (1.13, .18); physical hazards (1.44, 1.52); psychosocial hazards (1.12, 1.20); physical activity (1.75, 5.65); diet (.20, -.65); and age (.19, -.57). The Kurtosis for physical activity was high for both senior and lower pay grades (8.85 & 5.65). Additionally, physical hazards had a high kurtosis for the senior pay grade (7.38), indicating a Leptokurtic distribution. The distributions suggests that values are concentrated around the mean, with thicker tails, meaning there is a high probability for extreme values.

**Correlation Analyses**

Hypotheses 1-11 were examined for the entire sample (N = 16,636), looking at the relationships between the independent variables, dependent variables and moderator variables. Table B2 presents the correlations among all the variables. In support of hypothesis 1a, physical hazards were positively related to BMI, (r = .02, p < .05). In
support of hypothesis 1b, psychosocial hazards were positively related to BMI, \( r = .07, p < .05 \). In support of hypothesis 2, physical hazards were positively related to a higher score on the GHQ-12 mental health questionnaire, with higher scores signifying worse mental health, \( r = .16, p < .001 \). Although not a hypothesis, psychosocial hazards were significantly related to a higher score on the GHQ-12, \( r = .46, p < .001 \). In support of hypothesis 3a, physical hazards were significantly related to sickness absence, \( r = .07, p < .001 \). In support of hypothesis 3b, psychosocial hazards were significantly related to sickness absence, \( r = .10, p < .001 \). In partial support of hypotheses 4a, 4b, 5a, 5b, 6a, and 6b, exercise was significantly related to BMI \( r = -.07, p < .001 \), GHQ-12 \( r = -.09, p < .001 \) and sickness absence \( r = -.040, p < .001 \). In partial support of hypothesis 7a and 7b, diet was negatively related to BMI, \( r = -.03, p < .001 \), however diet was not significantly related to GHQ-12 \( r = -.002, p > .05 \) or sickness absence \( r = .02, p > .05 \). In partial support of hypotheses 10a and 10b, age was positively related to BMI \( r = .17, p < .001 \), however age was not significantly related to sickness absence, \( r = .003, p > .05 \).

Hypotheses 1-11 were also examined for the senior level pay grade sample, looking at the relationship between the independent variables, dependent variables and moderator variables. Table B4 presents the correlations among all the variables. Failing to support hypothesis 1a, physical hazards were negatively related to BMI, \( r = -.08, p < .05 \). In support of hypothesis 1b, psychosocial hazards were positively related to BMI, \( r = .08, p < .05 \). In support of hypothesis 2, physical hazards were positively related to a higher score on the GHQ-12 mental health questionnaire, with higher scores signifying
worse mental health, \( r = .12, p < .001 \). Although not a hypothesis, psychosocial hazards were significantly related to a higher score on the GHQ-12, \( r = .48, p < .001 \). Failing to support hypothesis 3a, physical hazards were not significantly related to sickness absence, \( r = .05, p > .05 \). Failing to support hypothesis 3b, psychosocial hazards were not significantly related to sickness absence, \( r = .05, p > .05 \). In partial support of hypotheses 4a and 4b, exercise was significantly related to BMI \( r = -.14, p < .001 \); however exercise was not related to GHQ-12 \( r = -.01, p > .05 \) and sickness absence \( r = -.003, p > .05 \). In partial support of hypothesis 7a and 7b, diet was negatively related to BMI, \( r = -.12, p < .001 \), however diet was not significantly related to GHQ-12 \( r = .04, p > .05 \) or sickness absence \( r = .02, p > .05 \). In partial support of hypotheses 10a and 10b, age was positively related to BMI \( r = .15, p < .001 \), however age was not significantly related to sickness absence, \( r = -.01, p > .05 \).

Hypotheses 1-11 were also examined for the lower level pay grade sample, looking at the relationship between the independent variables, dependent variables and moderator variables. Table B5 presents the correlations among all the variables.

Supporting hypothesis 1a, physical hazards were positively related to BMI, \( r = .03, p < .05 \). In support of hypothesis 1b, psychosocial hazards were positively related to BMI, \( r = .07, p < .01 \). In support of hypothesis 2, physical hazards were positively related to a higher score on the GHQ-12 mental health questionnaire, with higher scores signifying worse mental health, \( r = .16, p < .001 \). Although not a hypothesis, psychosocial hazards were significantly related to a higher score on the GHQ-12, \( r = .46, p < .001 \). In support of hypothesis 3a, physical hazards were significantly related to sickness absence, \( r = .07, \)
Additionally, in support of hypothesis 3b, psychosocial hazards were significantly related to sickness absence, \((r = .11, p < .001)\). In partial support of hypotheses 4a, 4b, 5a, 5b, 6a and 6b exercise was significantly related to BMI \((r = -.06, p < .001)\), GHQ-12 \((r = -.10, p < .001)\) and sickness absence \((r = -.04, p < .001)\). In partial support of hypothesis 7a, 7b, 9a and 9b diet was negatively related to BMI, \((r = -.02, p < .05)\) and sickness absence \((r = .02, p < .05)\); however diet was not significantly related to GHQ-12 \((r = -.004, p > .05)\). In partial support of hypotheses 10a, 10b, 11a and 11b age was positively related to BMI \((r = .18, p < .001)\) and sickness absence, \((r = .02, p < .05)\).

**Regression Analyses**

Regression analyses were conducted to test hypotheses 1-3. The results for the linear regression analyses for hypotheses 1-3 are presented in Tables B6 to B8. The linear regression analyses failed to support Hypothesis 1a for the senior level pay grade employees. Although significant, the effect was in the opposite direction, with physical workplace hazards being negatively related BMI, controlling for gender and psychosocial hazards, \(B = -.17, t(891) = -2.50, p < .05\). The results for Hypothesis 1a indicate that physical hazards are associated with a reduced BMI for the senior level pay grade.

Physical hazards and the control variables also explained a significant proportion of variance in BMI, \(R^2 = .10, F(3, 892) = 31.30, p < .01\). The linear regression analyses supported Hypothesis 1a for the lower level pay grade employees, in which physical workplace hazards significantly predicted BMI, controlling for gender and psychosocial hazards, \(B = .04, t(14,000) = 2.16, p < .05\). The results for Hypothesis 1a indicate that physical hazards are associated with an increased BMI for the lower level pay grade.
Physical hazards and the control variables also explained a significant proportion of variance in BMI, $R^2 = .03$, $F(3, 14,001) = 165.18$, $p < .05$. Refer to Table B6 for results.

The linear regression analyses supported Hypothesis 1b for the senior level pay grade employees, in which psychosocial workplace hazards significantly predicted BMI, controlling for gender and physical hazards, $B = .08$, $t(891) = 3.64$, $p < .01$. The results for Hypothesis 1b indicate that psychosocial hazards are associated with an increased BMI for the senior level pay grade employees. Psychosocial hazards and the control variables also explained a significant proportion of variance in BMI, $R^2 = .10$, $F(3, 892) = 31.27$, $p < .01$. The linear regression analyses also supported Hypothesis 1b for the lower level pay grade employees, in which psychosocial workplace hazards significantly predicted BMI, controlling for gender and physical hazards, $B = .05$, $t(14,000) = 7.09$, $p < .01$. The results for Hypothesis 1b indicate that psychosocial hazards are associated with an increased BMI for the lower level pay grade. Psychosocial hazards and the control variables also explained a significant proportion of variance in BMI, $R^2 = .03$, $F(3, 14,001) = 165.18$, $p < .01$. Refer to Table B6 for results.

The linear regression analyses failed to support Hypothesis 2 for the senior level pay grade employees, in which physical workplace hazards did not significantly predict GHQ-12 scores, while controlling for gender and psychosocial hazards, $B = -.04$, $t(1015) = -.76$, $p > .05$. The results for Hypothesis 2 indicate that physical hazards are not associated with improved mental health for the senior level pay grade. However, physical hazards and the control variables explained a significant proportion of variance in GHQ-12 scores, $R^2 = .21$, $F(3, 1016) = 31.27$, $p < .05$. The linear regression analyses also
failed to support Hypothesis 2 for the lower level pay grade employees, in which physical workplace hazards did not significantly predict GHQ-12 scores, while controlling for gender and psychosocial hazards, \( B = -.03, t(14,852) = -1.89, p > .05 \). The results for Hypothesis 2 indicate that physical hazards are not associated with improved mental health for the lower level pay grade. However, physical hazards and the control variables explained a significant proportion of variance in GHQ-12 scores, \( R^2 = .21, F(3, 14,853) = 1.33, p < .05 \). Refer to Table B7 for results.

The linear regression analyses failed to support Hypothesis 3a for the senior level pay grade employees, in which physical workplace hazards did not significantly predict sickness absences, controlling for gender and psychosocial hazards, \( B = .28, t(940) = .70, p > .05 \). The results for Hypothesis 3a indicate that physical hazards are not associated with increased sickness absences for the senior level pay grade. However, physical hazards and the control variables explained a significant proportion of variance in sickness absences, \( R^2 = .01, F(3, 941) = 4.48, p < .01 \). The linear regression analyses supported Hypothesis 3a for the lower level pay grade employees, in which physical workplace hazards significantly predicted sickness absences, controlling for gender and psychosocial hazards, \( B = .43, t(13,770) = 3.22, p < .01 \). The results for Hypothesis 3a indicate that physical hazards are associated with increased sickness absences for lower level pay grade. Physical hazards and the control variables also explained a significant proportion of variance in sickness absences, \( R^2 = .02, F(3, 13771) = 97.03, p < .01 \). Refer to Table B8 for results.
The linear regression analyses failed to support Hypothesis 3b for the senior level pay grade employees, in which psychosocial workplace hazards did not significantly predict sickness absences, controlling for gender and physical hazards, $B = .14, t(940) = 1.06, p > .05$. The results for Hypothesis 3b indicate that psychosocial hazards are not associated with increased sickness absences for the senior level pay grade. However, psychosocial hazards and the control variables explained a significant proportion of variance in sickness absences, $R^2 = .01, F(3, 941) = 4.48, p < .01$. The linear regression analyses did support Hypothesis 3b for the lower level pay grade employees, in which psychosocial workplace hazards significantly predicted sickness absences, controlling for gender and physical hazards, $B = .53, t(13,770) = 10.93, p < .01$. The results for Hypothesis 3b indicate that psychosocial hazards are associated with increased sickness absences for the lower level pay grade. Psychosocial hazards and the control variables also explained a significant proportion of variance in sickness absences, $R^2 = .02, F(3, 13,771) = 97.03, p < .01$. Refer to Table B8 for results.

**Supported Interactions**

Refer to Table B27 for a results summary of supported interactions. For all moderation analyses workplace hazards and the moderator variable were mean centered to reduce multicollinearity between the standard errors of the IV and moderator. Next, the mean centered IV and moderator were multiplied together to create an interaction variable.

Age was examined as a moderator between physical hazards and sickness absence. The results for the moderation analyses are presented in Table B23. First,
physical hazards and age, along with the control variables gender and psychosocial hazards were entered as predictors of the dependent variable, sickness absence. The results for the lower level pay grade indicated that there was a direct effect for physical hazards on sickness absence, $B = .42, t(13,657) = 3.18, p < .05$. The addition of the interaction term between physical hazards and age significantly added to the prediction of sickness absence, $F_{\text{Change}} = 2.92, p < .05$, supporting Hypothesis 11a. Further, the simple slopes were tested for significance using an interaction effects spreadsheet (Dawson, 2011). The simple slopes were found to be significant, $B = .09, t(13,657) = .04, p < .05$ and $B = 1.55, t(13,657) = .03, p < .05$. (Age values set to 20 & 50). (See Figure A16 for simple slopes plot).

Finally, age was examined as a moderator between psychosocial hazards and sickness absence. The results for the moderation analyses are presented in Table B24. First, psychosocial hazards and age, along with the control variables gender and physical hazards were entered as predictors of the dependent variable, sickness absence. The results for the lower level pay grade indicated that there was a direct effect for psychosocial hazards on sickness absence, $B = .54, t(13,657) = 11.11, p < .05$. The addition of the interaction term between psychosocial hazards and age significantly added to the prediction of sickness absence, $F_{\text{Change}} = 3.58, p < .05$, supporting Hypothesis 11b. Further, the simple slopes were tested for significance using an interaction effects spreadsheet (Dawson, 2011). The simple slopes were found to be significant, $B = .77, t(13,657) = .02, p < .05$ and $B = 1.07, t(13,657) = .01, p < .05$. (Age values set to 20 & 50). (See Figure A17 for simple slopes plot).
Non-Supported Interactions

Physical Activity. Refer to Table B9 for results. Physical activity did not moderate the relationship between physical hazards and BMI for the senior level pay grade, $F_{\text{Change}} = .37, p > .05$, and the lower level pay grade, $F_{\text{Change}} = .47, p > .05$, failing to support hypothesis 4a. See Figure A2 for simple slopes. Additionally, physical activity did not moderate the relationship between psychosocial hazards and BMI for the senior level pay grade, $F_{\text{Change}} = .003, p > .05$, and the lower level pay grade, $F_{\text{Change}} = .08, p > .05$, failing to support Hypothesis 4b. Refer to Table B10 for results and Figure A3 for simple slopes.

Further, physical activity did not moderate the relationship between physical hazards and mental health for the senior level pay grade, $F_{\text{Change}} = .19, p > .05$, and the lower level pay grade, $F_{\text{Change}} = .48, p > .05$, failing to support Hypothesis 5a. Refer to Table B11 for results and Figure A4 for simple slopes. In addition, physical activity did not moderate the relationship between psychosocial hazards and mental health for the senior level pay grade, $F_{\text{Change}} = .04, p > .05$, and the lower level pay grade, $F_{\text{Change}} = 3.24, p > .05$, failing to support Hypothesis 5b. Refer to Table B12 for results and Figure A5 for simple slopes.

Next, physical activity did not moderate the relationship between physical hazards and sickness absence for the senior level pay grade, $F_{\text{Change}} = .10, p > .05$, and the lower level pay grade, $F_{\text{Change}} = 1.29, p > .05$, failing to support Hypothesis 6a. Refer to Table B13 for results and Figure A6 for simple slopes. Finally, physical activity did not moderate the relationship between psychosocial hazards and sickness absence for the
senior level pay grade, \( F \) Change = 2.41, \( p > .05 \), and the lower level pay grade, \( F \) Change = .01, \( p > .05 \), failing to support Hypothesis 6b. See Table B14 for results and Figure A7 for simple slopes.

**Diet.** Diet did not moderate the relationship between physical hazards and BMI for the senior level pay grade, \( F \) Change = .91, \( p > .05 \), and the lower level pay grade, \( F \) Change = 1.85, \( p > .05 \), failing to support Hypothesis 7a. Refer to Table B15 for results and Figure A8 for simple slopes. Additionally, diet did not moderate the relationship between psychosocial hazards and BMI for the senior level pay grade, \( F \) Change = 2.46, \( p > .05 \), and the lower level pay grade, \( F \) Change = .52, \( p > .05 \), failing to support Hypothesis 7b. Refer to Table B16 for results and Figure A9 for simple slopes.

Next, diet did not moderate the relationship between physical hazards and mental health for the senior level pay grade, \( F \) Change = 1.75, \( p > .05 \), and the lower level pay grade, \( F \) Change = .72, \( p > .05 \), failing to support Hypothesis 8a. Refer to Table B17 for results and Figure A10 for simple slopes. In addition, diet did not moderate the relationship between psychosocial hazards and mental health for the senior level pay grade, \( F \) Change = 1.76, \( p > .05 \), and the lower level pay grade, \( F \) Change = .06, \( p > .05 \), failing to support Hypothesis 8b. Refer to Table B18 for results and Figure A11 for simple slopes.

Additionally, diet did not moderate the relationship between physical hazards and sickness absence for the senior level pay grade, \( F \) Change = .52, \( p > .05 \), and the lower level pay grade, \( F \) Change = .00, \( p > .05 \), failing to support Hypothesis 9a. Refer to Table B19 for results and Figure A12 for simple slopes. Finally, diet did not moderate the
relationship between psychosocial hazards and sickness absence for the senior level pay grade, $F_{\text{Change}} = .11$, $p > .05$, and the lower level pay grade, $F_{\text{Change}} = 1.64$, $p > .05$, failing to support Hypothesis 9b. Refer to Table B20 for results and Figure A13 for simple slopes.

**Age.** Age also did not moderate the relationship between physical hazards and BMI for the senior level pay grade, $F_{\text{Change}} = 1.67$, $p > .05$, and the lower level pay grade, $F_{\text{Change}} = .26$, $p > .05$, failing to support Hypothesis 10a. Refer to Table B21 for results and Figure A14 for simple slopes. Further, age did not moderate the relationship between psychosocial hazards and BMI for the senior pay grade, $F_{\text{Change}} = 3.43$, $p > .05$, and the lower level pay grade, $F_{\text{Change}} = .06$, $p > .05$, failing to support Hypothesis 10b. Refer to Table B22 for results and Figure A15 for simple slopes.

Moreover, age did not moderate the relationship between physical hazards and sickness absence for the senior level pay grade, $F_{\text{Change}} = 1.18$, $p > .05$, failing to support Hypothesis 11a. Refer to Table 23 for results and Figure A16 for simple slopes. Finally, age did not moderate the relationship between psychosocial hazards and sickness absence for the senior level pay grade, $F_{\text{Change}} = .02$, $p > .05$, failing to support Hypothesis 11b. Refer to Table B24 for results and Figure A17 for simple slopes.

**Alternative Analyses**

Literature discussed throughout the current paper has suggested that both BMI and sickness absences can be affected by a person’s age. Therefore, hypotheses 1-3 were also tested by splitting employees into groups based on age; under 30, 30-40, 40-50, and above 50. The rationale is that employees in the younger age groups will have a lower
BMI and less sickness absences. The current paper examined age as a moderator between hazards and health outcomes; however it is also important to examine whether health can differ within particular age groups. Identifying the health needs of specific age groups can aid policy makers in the creation of age-specific health interventions. The results from the regression analyses indicated small, but no major differences in health outcomes by grouping employees into age groups. Refer to Table B25 for Results.

Research reviewed in the current paper has also suggested that an employees’ salary/pay grade can influence health outcomes. Specifically, employees in lower level pay grades may face more occupational stress and have less resources to cope with stress and health problems compared to senior level pay grade employees. In order to examine whether there were differences in health outcomes among lower pay grade employees the lower level pay grade employees were divided into 4 groups; pay grade B, pay grade C, pay grade D and industrial staff. Regression analyses were conducted to re-test hypotheses 1-3, using the new grouping scheme. The results indicated that there were small differences in health outcomes based on splitting the lower pay grade into 4 smaller groups; however, there was no clear trend demonstrating stronger effects of hazards on health as you get to lower pay grades. The results confirmed that the initial grouping of employees into senior level and lower level pay grade may be optimal for examining health differences between pay grades. The differences in health outcomes appear to be strongest between senior level pay grade and lower level pay grade. Refer to Table B26 for results.
CHAPTER 4
DISCUSSION

The purpose of this dissertation was to investigate the link between workplace hazards and employee health. More specifically, I examined how physical and psychosocial hazards in the workplace can impact body mass index (BMI), mental health, and sickness absence. Further, the purpose of this dissertation was to examine how modifiable health behaviors and personal factors can buffer the negative effects of workplace hazards on health. Specifically, I examined how physical activity, diet, and age affect how physical and psychosocial hazards impact BMI, mental health, and sickness absence.

Although the link between occupational stress and employee health has been well-studied, the link between specific workplace hazards and employee physical and mental health has not. Additionally, there is a need for studies to operationally define what a workplace hazard is. Moreover, there is a need for researchers to determine which factors can buffer the negative effects that workplace hazards can have on employee health. This dissertation has bridged the gap in the literature by proposing a unifying definition of workplace hazards and by examining how both physical and psychosocial workplace hazards can impact different health outcomes.

Finally, this dissertation expanded upon previous research by investigating how modifiable health behaviors and age can interact with workplace hazards to predict employee health. It was predicted that both physical and psychosocial workplace hazards
would negatively impact employees’ physical and mental health. Overall, the results confirmed the prediction that physical and psychosocial hazards would be related to a higher BMI among employees; however there was one instance where physical hazards were related to a lower BMI for the senior level pay grade. Contrary to what I predicted, physical hazards were not related to mental health; however psychosocial hazards were related to worse mental health. Further, I predicted that physical and psychosocial workplace hazards would be positively related to sickness absences. Among the lower level pay grade employees, both physical and psychosocial hazards predicted sickness absences. Interestingly, physical and psychosocial hazards did not predict sickness absences among senior level pay grade employees. It was also hypothesized that physical activity, diet, and age would all moderate the relationship between hazards and health outcomes; where greater physical activity, a healthier diet, and a lower age would help buffer the negative effects of hazards on health. The results did confirm that age moderates the relationship between hazards and sickness absence among the lower pay grade employees; however, physical activity and diet did not affect the relationship between hazards and health for both pay grades.

**Theoretical Implications**

**Workplace Hazards and BMI.** In order to discuss the theoretical implications of the findings in the current study, the relationship between workplace hazards and BMI will be reviewed. Research has found a consistent link between occupational stress and weight gain among employees (Martikainen & Marmot, 1999). Further, some studies have confirmed that both physical and psychosocial hazards in the workplace can lead to
increased stress levels and weight gain (Schulte et al., 2007). In line with previous research, the first hypothesis tested in this study was that physical hazards in the workplace would be positively related to BMI, meaning that increased exposure to physical hazards would lead to an increase in BMI. In support of hypothesis 1a, physical hazards were positively related to BMI among the lower level pay grade employees; however, for the senior level pay grade, physical hazards were negatively related to BMI, contradicting previous research. At first, the findings may seem strange that physical hazards are related to a lower BMI for senior level employees. One possible explanation is that employees in the lower pay range may have more physically demanding jobs, whereas senior level employees are more likely to be managing people, and not actually completing physically demanding tasks. Senior level employees who face more physical hazards may be getting more physical activity compared to other senior level employees. In contrast, senior level employees who are being exposed to less physical hazards may be completing less physically demanding tasks which involve some level of physical activity. Consequently, senior level employees who are more physically active throughout the workday may in turn have a lower BMI due to increased energy expenditure. This relationship may not hold true for lower level employees because these employees may all be completing equally physical tasks. Therefore, higher exposure to physical hazards may indicate a more physically active job for senior level employees, but not for lower level employees.

Hypothesis 1b predicted that psychosocial workplace hazards would be positively related to BMI, meaning that higher exposure to psychosocial hazards would lead to an
increased BMI. Much research has confirmed that occupational stress can lead to weight gain (Stansfeld & Candy, 2006) and that psychosocial hazards in the workplace are one of the leading causes of stress in the workplace (Eurofound, 2011). The results of this study confirmed hypothesis 1b, where greater exposure to psychosocial hazards were related to an increased BMI for both senior level and lower level pay employees. The results of this dissertation highlight the fact that not only are psychosocial hazards a common stressor for employees, but psychosocial hazards also have a significant impact on the physical health of employees. Additionally, this study demonstrates that psychosocial hazards impact employee health across varying pay grades, underlining the strength of the relationship between psychosocial hazards and body composition.

**Workplace Hazards and Mental Health.** A plethora of research has demonstrated that psychosocial hazards in the workplace can negatively impact mental health (Rugulie et al., 2006). The negative impact that psychosocial hazards can have on mental health range from psychiatric disorders (Stansfeld et al., 1999) to poor general mental health (Niedhammer et al., 2006). Given the abundant literature linking psychosocial hazards to mental health, future examination of this relationship may not add much new information to the scientific literature. Therefore, the current study did not examine the association between psychosocial hazards and mental health. Although it is important to review which kinds of workplace hazards impact mental health, it is also important to focus on relationships that have been investigated less often and can make the greatest contribution to the literature; the link between physical hazards and mental health.
Studies of the link between physical hazards and health have tended to focus on how physical hazards can result in bodily injury, e.g., musculoskeletal injuries (WHO, 2001) or physiological damage to the brain, e.g., brain exposure to harmful substances (Canadian Environmental Law Association, 2011). I chose to take a unique perspective and examine how exposure to physical hazards can negatively impact general mental health. Research has revealed that occupational stress can have a negative impact on mental health (Cox et al., 2000) and that physical hazards are a common stressor in the workplace for many employees (Eurofound, 2011). This suggests that occupational stress resulting from physical hazards can contribute to the worsening of mental health. I predicted that physical hazards would be related to worse mental health, meaning higher exposure to physical hazards would be related to a higher score on the GHQ-12 scale. The results of this study failed to support hypothesis 2, in that exposure to physical hazards was not related to mental health among either the senior level or lower level pay grade employees. The failure to find a significant relationship between physical hazards and mental health may be due to the fact that certain types/severities of physical hazards may cause more psychological stress than others, e.g., toxic fumes vs. a hot working environment. The complex relationship between physical hazards and mental health may make it difficult to find an effect without an improved measurement of workplace hazards.

**Workplace Hazards and Sickness Absence.** Physical working conditions may be attributable to upwards of 42% of sickness absences annually (Melchoir et al., 2005). Physical workplace hazards have also been found to be strongly associated with absences
due to physical injury (Allebeck & Mastekaasa, 2004) and illness (Haukenes et al., 2011). In line with previous research findings, hypothesis 3a of the present study predicted that physical hazards in the workplace would be positively related to sickness absence. In support of hypothesis 3a, increased exposure to physical hazards were related to increased sickness absence for the lower level pay grade; however, for the senior level pay grade, physical hazards were not related to sickness absence, failing to support hypothesis 3a. One explanation for why physical hazards impact sickness absences for lower level pay grade employees and not senior level pay employees could be differences in exposure to physical hazards. As previously mentioned, employees in the lower pay range may have more physically demanding jobs and have a greater exposure to physical hazards. In contrast, senior level employees are more likely to be managing people, and not actually completing physically demanding tasks, lowering their exposure to physical hazards. Studies have also reported that employees in lower pay grades work in less safe environments, with more workplace hazards compared to higher paid employees (Melchoir et al., 2005), possibly accounting for increased sickness absences. Finally, socioeconomic differences in morbidity and mortality have been found between pay grades (North et al., 1993). For example, lower paid employees might have less healthcare benefits to prevent or treat illnesses compared to higher paid employees, leading to more days away from work due to sickness.

In addition to physical hazards, psychosocial workplace hazards are one of the leading causes of stress in the workplace (Eurofound, 2011). Research has established that psychosocial hazards in the workplace are related to increased sickness absences
(Lund et al., 2005). Many studies have been limited to linking components of the job-demand-control model to absences (Berkamm & Goldberg, 2003); however, the current study has expanded on previous research by examining how several different kinds of psychosocial hazards can impact sickness absence. I hypothesized that psychosocial hazards in the workplace would be positively related to sickness absence. In support of this hypothesis, exposure to psychosocial hazards predicted sickness absences for the lower pay grade employees; however, psychosocial hazards were not significantly related to sickness absence among the senior pay grade employees. One explanation for the findings of this study could be that lower pay grade employees are exposed more to certain psychosocial hazards compared to senior pay grade employees. For example, lower pay grade employees have lower job control and higher job demands (North et al., 2006), which likely contributes to stress levels and sickness absences. Also, as stated earlier in the discussion section, socioeconomic differences in morbidity and mortality have been found between pay grades (North et al., 1993). Specifically, employees in lower pay grades tend to have lower perceived health (Marmot et al., 1995), and may have less resources to cope with injury and illness compared to employees in higher pay grades.

**Physical Activity.** Given the negative impact that workplace hazards can have on employee health, it is important to investigate ways to help employees cope with these hazards. Physical activity has been shown to have a wide array of health benefits, including reducing the risk of chronic diseases, improving quality of life, and stress reduction (Harvard School of Public Health, 2013). People who are more physically
active also tend to maintain a healthy body weight (Harvard School of Public Health, 2013), have better mental health and functioning (CDC, 2011), and tend to miss fewer days of work due to sicknesses and injury (Rogen et al., 2013). Physical activity can also help buffer stress people experience on a daily basis (Mayo Clinic, 2013). Despite these health benefits, few studies have investigated whether physical activity can buffer occupational stress experienced from exposure to physical and psychosocial hazards in the workplace. Further, to the best of this authors’ knowledge, few studies have examined how physical activity can buffer the negative effects of physical and psychosocial hazards upon BMI, mental health, and sickness absence. Given the fact that physical activity can improve mental and physical health (Mayo Clinic, 2013), while also acting as a stress buffer (Harvard School of Public Health, 2013), it is probable that physical activity would buffer the stress associated with exposure to physical and psychosocial hazards upon physical and mental health.

Based on the scientific literature, and the reasoning explained above, I hypothesized that physical activity would moderate the effects of physical and psychosocial hazards upon BMI, general mental health, and sickness absence. Specifically, hypotheses 4a to 6b predicted that employees who are more physically active would be better able to cope with stress from exposure to physical and psychosocial hazards. The increased ability to cope with stress would therefore result in a lower BMI, better mental health, and less sickness absences compared to employees who were not very physical active. The results of this study failed to support hypotheses 4a to 6b; physical activity did not act as a moderator between workplace hazards and BMI,
mental health, or sickness absence. An explanation for the inability of the current study to find an effect for physical activity may be explained by the differing intensity levels of physical activity and exercise. First, physical activity and exercise have different physiological effects on the human body because the intensity of physical exertion is dissimilar. Exercise results in a higher, sustained increase in heart rate, as well as a greater amount of calories consumed by the human body compared to general physical activity (Caspersen, Powell, & Christenson, 1985). General physical activity may not be at a high enough intensity to elicit a physiological response sufficient to have an impact on bodyweight, mental health, or sickness absence. This differentiation between physical activity and exercise intensity can aid in the explanation of why exercise shows more consistent effects on improving health compared to general physical activity (Driver & Taylor, 2000).

In addition, health status and health behaviors beyond physical activity likely play an important role in the health of employees (CDC, 2011). For example, an employee may be physically active, may smoke or consume large amounts of alcohol, which could negate any positive effects of physical activity on health. An employee may also suffer from chronic health conditions, such as diabetes, heart problems, or high blood pressure, which have all been linked to obesity, poor mental health and sickness absences (CDC, 2011; Rogen et al., 2013). Physically activity alone may not be enough for an individual who suffers from a chronic health condition to reduce sickness absence. Further, some employees may already suffer from psychiatric or mental health disorders, where physical activity alone may not be effective for treating a mental disorder. It is likely that
the effects of overall health status have a stronger impact on BMI, mental health, and sickness absence than physical activity alone would have.

Another possible reason why the current study did not find support that physical activity acts as a stress buffer between workplace hazards and health outcomes may be that employees choose alternative methods to cope with stress. Physical activity can help individuals cope with stress (Mayo Clinic, 2013); however, some employees may choose to cope with stress using alternative methods, such as seeking support from co-workers and friends, while other employees may practice relaxation techniques, such as meditation. Physical activity should not be viewed as the only viable method for stress reduction, rather physical activity should be viewed as one of many possible alternatives for dealing with stress.

**Diet.** In addition to exercise, eating a healthy diet can play a significant role in employee health. A healthy, well-balanced diet can help people maintain a healthy body weight, reduce obesity (Harvard School of Public Health, 2013) and help prevent or treat the onset of mental health problems and chronic diseases (Mental Health Foundation, 2013). Further, a healthy diet can help people cope with stress by means of lowering blood pressure and increasing immune system functioning (Roberts et al., 2002). Despite the clear health benefits that consuming a healthy diet boast, few studies have specifically investigated whether diet can buffer occupational stress experienced from exposure to physical and psychosocial hazards in the workplace. Further, to the best of this authors’ knowledge, few studies have examined how a healthy diet can buffer the negative effects of physical and psychosocial hazards upon BMI, mental health, and sickness absence.
Given the fact that consuming a healthy diet can improve mental and physical health (Mayo Clinic, 2013), while also acting as a stress buffer (Harvard School of Public Health, 2013), it is probable that eating a healthy diet would buffer the stress associated with exposure to physical and psychosocial hazards upon physical and mental health.

I hypothesized that diet would moderate the effects of physical and psychosocial hazards upon BMI, general mental health, and sickness absence. Specifically, hypotheses 7a to 9b predicted that employees who eat a healthier diet would be better able to cope with stress from exposure to physical and psychosocial hazards. The increased ability to cope with stress would therefore result in a lower BMI, better mental health, and less sickness absences compared to employees who do not have a healthy diet. The results of this study failed to support hypotheses 7a to 9b; diet did not act as a moderator between workplace hazards and BMI, mental health, or sickness absence. An explanation for the inability of the current study to find an effect for diet may be explained by the differentiation between chronic versus short term health benefits of a healthy diet. The health benefits of a healthy diet are largely based on how long a person has been eating healthy (Robert et al., 2000). For example, someone who has been eating healthy for several years will likely be in better health compared to someone who has just recently made healthy changes to their diet. In addition, an employee who has been eating healthy for several years will likely be in better overall health, and show healthier responses to stress via blood pressure compared to an employee who has been eating healthy for a couple of months.
Another possible explanation for why diet did not act as a moderator in the current study is that eating healthy foods are only one aspect of a healthy, well-balanced diet. For example, the quantity of food a person consumes and the timing of meals can affect how a diet will impact health (Harvard School of Public Health, 2013). For instance, an individual may eat healthy foods, but skip breakfast or not eat for hours, which cause erratic spikes in blood glucose levels (Boyne et al., 2003). In addition, someone could be eating nutritious foods, but be consuming too many calories per day, leading to weight gain and health problems (Harvard School of Public Health, 2013). Finally, a person could be eating healthy foods, but not consuming enough calories per day, leading to nutritional deficiencies (Holloszy & Fontana, 2007). Nutritional deficiencies are a major health risk because they can lead to mental and physical health problems (Wachs, 2009).

Finally, the overall health status of an individual is one of the strongest predictors of health outcomes (Mayo Clinic, 2013), including BMI, mental health, and sickness absences. In addition, health behaviors beyond eating a healthy diet can play an important role on employee health (CDC, 2011). For example, an employee may have a healthy diet but does not exercise and smokes often, both of which could negate the benefits of a healthy diet. An employee may also suffer from chronic health conditions, such as diabetes, heart problems, or high blood pressure, which have all been linked to obesity, poor mental health and sickness absences (CDC, 2011; Rogen et al., 2013). Additionally, some employees may already suffer from psychiatric or mental health disorders, where diet alone may not be effective for treating a mental disorder. It is likely that the effects
of overall health status have a stronger impact on BMI, mental health, and sickness absence than diet alone would have.

**Age.** In addition to modifiable health behaviors such as physical activity and consuming a healthy diet, factors that an individual has no control over, such as age, can impact health. For instance, it has been shown that BMI increases with age (Welon et al., 2002) and older employees also miss more days of work due to sickness and injury (Voss et al., 2008). To date, few studies have tested whether older employees have a more difficult time coping with occupational stress. Given that older employees tend to have more health problems such as chronic disease (CDC, 2011), it is probable that the lower health status of older employees would make them more susceptible to the negative effects of occupational stress on health.

I hypothesized that age would moderate the effects of physical and psychosocial hazards upon BMI and sickness absence. Specifically, hypotheses 10a to 11b predicted that older employees would be less capable of coping with stress resulting from physical and psychosocial hazards in the workplace, resulting in a higher BMI and more sickness absences compared to younger employees. The results of the present study failed to support hypotheses 10a and 10b, meaning age did not have an impact on whether physical or psychosocial workplace hazards affected BMI. The present study’s inability to find any significant effects for age on BMI could be related to the different health consequences of BMI for older versus younger individuals. For example, a higher BMI has been found to be inversely related to mortality among older people, after adjusting for waist circumference (Janssen & Katzmarzyk, 2005). Thin older people are also at a
higher risk for death (Grabowski & Ellis, 2001), indicating that there are some health
benefits for older people to maintain some body fat (Chapman, 2008). Further, BMI does
not measure fat distribution. For example, older people tend to accumulate more visceral
fat (abdominal fat) compared to younger people (Zamboni et al., 1997), and visceral fat
poses the most health threats to people (Harvard School of Public Health, 2013).
Subsequently, age can impact fat distribution; however, age may not dramatically impact
measures of BMI, which do not measure fat distribution.

In addition, the results of the current study supported hypothesis 11a, where age
moderated the relationship between physical hazards and sickness absence for the lower
level pay grade employees; however age did not moderate the relationship between
physical hazards and sickness absence for the senior level pay grade. Further, the results
supported hypothesis 11b, where age significantly moderated the relationship between
psychosocial hazards and sickness absence for the lower level pay grade employees;
however age did not act as a moderator for the senior level pay grade employees. Age
likely did not play a factor among the senior level pay grade employees because earlier
findings from the current study found that workplace hazards did not impact sickness
absences among this pay grade; therefore if no initial relationship exists between hazards
and sickness absence, it is likely that the age of the employee would not alter this
relationship. In contrast, workplace hazards did have an impact on sickness absence for
lower level pay grade employees and age played a role in how often employees exposed
to workplace hazards were absent from work due to sickness or injury.
Healthcare Differences between Europe and the United States. It is also important to note the differences in healthcare systems between Europe, specifically Northern Ireland and the United States. The sample used for this study consisted of Northern Ireland civil servant workers, who have access to universal healthcare, provided by National Health Service (NHS). In the U.K., universal healthcare is governed by the government and funded from taxes (Grosios, Gahan, & Burbidge, 2010). In contrast, the U.S. healthcare system is funded by public and private insurance, with large fees for many patients. In the U.S., many individuals who are below the poverty line can’t afford expensive insurance premiums and medical expenses that are not covered by insurance (Schoen, Osborn, Squires, & Doty, 2013). The differences in access to healthcare may explain why this study did not find that physical activity or diet buffered stress. Employees in the U.K. may have higher baseline line health status compared to American employees, who don’t have equal access to healthcare. A study examining the effects of workplace hazards on health in the U.S. may find that physical activity and diet buffer stress among a less healthy U.S. sample.

Organizational Implications

The current study has several important implications for organizations. First, this study used the Total Worker Health framework set forth by NIOSH (2013) to highlight the importance of recognizing that both work-related factors and health factors beyond the workplace jointly contribute to the health and safety of employees. NIOSH (2013) describes total worker health as a strategy integrating occupational safety and health protection with health promotion to prevent worker injury and illness and to advance
health and well-being. The present study has stressed the importance of promoting worker health and well-being while also protecting worker safety and health. This study found that exposure to workplace hazards negatively impacts employee health and that the promotion of health behaviors can improve employee health.

An important factor for organizations to consider when they are deciding how to promote worker health is which intervention level they want to focus on (primary, secondary, or tertiary). According to LaMontagne et al. (2007), the goal of primary prevention is to reduce the potential risk factors or alter the nature of the stressor before workers experience stress-related symptoms or disease. Examples of primary prevention include job redesign or workload reduction. Secondary prevention aims to help equip workers with knowledge, skills, and resources to cope with stressful conditions. Secondary prevention targets the employees’ response to stressors, and can include cognitive behavioral therapy or stress coping classes. Finally, according to LaMontagne et al. (2007), the goal of tertiary prevention is to treat, compensate, and rehabilitate workers with enduring stress-related symptoms or disease. Examples of tertiary prevention include occupational therapy or return-to-work programs.

Another important factor for organizations to consider when deciding how to go about promoting employee health is whether to promote health behaviors within the workplace, outside of the workplace, or both. Many researchers and practitioners now acknowledge that it is necessary to promote employee health both within and outside the organization, while at the same time protecting the privacy and rights of employees (NIOSH, 2013). For example, employers could promote healthy eating in the workplace
by offering healthy food choices in the cafeteria. Organizations could also go a step further, and promote physical activity outside of the workplace by offering subsidies for employee gym memberships. In order to promote total worker health employers should aim to promote worker health both inside and outside of the workplace, because both factors impact employee health. Further, in order to promote total worker health, organizations should aim for implementing preventative measures of stress and ill health, before negative health issues arise.

The current study found that both physical hazards and psychosocial hazards in the workplace can negatively impact health, as demonstrated by reliable indicators of health; specifically BMI, general mental health, and sickness absences. One of the most important ways organizations can improve the health and well-being of their employees is by reducing/removing exposure to physical and psychosocial hazards. By focusing on primary prevention, organizations can remove a stressor/hazard from the workplace, and help prevent the onset of stress and illness among employees. For example, organizations could reduce employee exposure to physical hazards by developing strict safety procedures for employees to follow when working in hazardous conditions. Further, employers could investigate whether there are safer ways for employees to complete job tasks, while minimizing exposure to potential physical hazards. With regards to psychosocial hazards, organizations can aim to improve communication among employees with conflict management skills development (LaMontagne et al., 2007). Teaching employees how to effectively communicate with each other can help reduce potential conflict in the workplace and minimize employee exposure to psychosocial
hazards (Brew & David, 2004). Although ideal, it is often difficult and time-consuming for organizations to implement primary level interventions for health promotion. For example, the nature of some jobs may make it difficult or impossible for job redesign, where exposure to certain physical or psychosocial hazards are inherent for a job. Therefore, some organizations may find it more helpful to target secondary level interventions, to help employees deal with hazards that can’t be removed from the workplace.

Organizational Implications of Physical Activity. When primary prevention is not possible, organizations can consider using secondary level interventions to improve employee health, such as promoting physical activity. Although the current study did not find that physical activity affected the relationship between workplace hazards and health outcomes, physical activity did have a direct effect on BMI for both pay grades. The results of this study confirm that physical activity is a viable method for reducing BMI, confirming previous research (Sallis et al., 2003). Further, physical activity had a direct effect on mental health and sickness absence for the lower pay grades, suggesting that physical activity is a viable method for improving the mental health of employees while also reducing sickness absences. Physical activity promotion can be considered a secondary level intervention in most cases, unless physical activity is used as a rehabilitation method for treating employees who are already sick or ill. Physical activity promotion can be used as a secondary level intervention because physical activity can be used to help employees’ cope with stress and alter their responses to stressors.
Importantly, health interventions in the workplace that target physical activity have been proven to be effective in improving employee health (Groeneveld et al., 2010).

Organizations can promote physical activity in several ways. First, employers can promote physical activity within the workplace by offering opportunities to be more physically active at work. For example, Marshal (2004) found that less organized approaches, which promote incidental physical activity with and around the workplace were most effective. For instance, initiatives set in place to promote regular walk/stress breaks at work or promoting the use of stairs versus taking the elevator have been shown to be effective for weight reduction (Yancey et al., 2008). Further, Marsh (2004) established that individually based programs, where materials were tailored to individual needs were most successful. For instance, programs should be tailored based on an individuals’ readiness for change; ranging from whether a person has no desire to practice physical activity to an individual who wants to start being physically active, but does not know how to begin (Daley & Duda, 2006). It may be optimal to give information about the health risks of being physically inactive to people who do not want to change their activity levels; however, information about what kinds of exercises to practice may be best for someone who wants to become more active, but lacks sufficient knowledge about how to incorporate physical activity into their daily routine.

Importantly, social support and workplace initiatives to increase social support for physical activity can aid in adopting a healthier lifestyle (Stokes, Henley, & Herget, 2006). For example, unstructured support from co-workers can help motivate people to get more physical activity; however, to increase the effectiveness of social support,
organizations can create a healthy culture in the workplace. For example, employers can organize friendly competitions between co-workers, where employees can track how many steps they have taken in a day using a pedometer. Notably, organizations that create a culture where physical activity is the norm may have the best chance for sustaining positive health behavior changes (Marshal, 2004).

Although this study did not find effects for physical activity on mental health and sickness absence for the senior level pay grade employees, physical activity promotion is still important. For example, it is not wise for an individual who is inactive to jump right into a demanding exercise program because this could lead to injury. Physical activity promotion can be used as an intermediate step between being inactive and participating in an exercise program, in order to prepare a person’s body for more demanding exercise. Promoting physical activity as an intermediate step to exercise for workplace initiatives is important because an employer does not want to deal with lawsuits from injured employees. For example, a corporate exercise promotion program could lead to injury among unhealthy employees who are not ready to perform vigorous exercise. Physical activity is a solution to slowly introducing employees to an exercise program, reducing the likelihood of an injury.

**Organizational Implications of Diet.** In addition to promoting physical activity in the workplace, complete health promotion programs should aim to target multiple health behaviors in order to bring about the greatest possible change in employee health (Groveneveld et al., 2010). Although the current study did not find that diet affected the relationship between workplace hazards and health, the results indicated that diet had a
direct effect on BMI for the senior pay grade and mental health for the lower pay grade. Diet can be considered a secondary level intervention because diet would be used to help employees’ cope with stress and alter their responses to stressors. Importantly, health interventions in the workplace that target eating habits have been proven to be effective in improving employee health (Groeneveld et al., 2010).

Organizations can promote a healthy diet for their employees in several ways. Research suggests that educational training in the workplace can improve an employees’ diet and health (Maes et al., 2012). For example, providing employees with information about healthy eating, especially by means of multimedia methods, have been shown to increase positive attitudes towards healthy foods and the adoption of healthier eating behaviors (Beaudoin et al., 2007). For instance, providing employees with information about healthy eating through a website, and personalizing information so employees can keep track of their diet may aid in promoting effective behavior change. Similar to physical activity interventions, promoting healthy eating by personalizing a program to an individuals’ readiness for change (Daley & Duda, 2006) may be the best option for creating lasting changes in an employees’ diet. An employees’ readiness to adopt healthy eating habits can range from whether a person has no desire to eat healthy to an individual who wants to start eating healthy, but does not know how to begin. It may be optimal to give information about health risks about an unhealthy diet to people who do not want to change their eating behaviors; however, material about how to shop for healthy foods may be best for someone who wants to eat healthy, but doesn’t possess enough knowledge about what foods to eat.
The work environment can also affect an employees’ eating habits and diet. Engbers et al. (2005) argue that an important addition to a health promotion program are environmental modifications, which can influence dietary intake. For example, environmental changes in the workplace that have been shown to increase healthy eating include the following: increasing the availability and variety of healthful food options, reducing the price of healthy foods in worksite cafeterias and vending machines, and making healthy food options more visible to employees (Story et al., 2008). In addition to the physical aspect of the work environment, social support and workplace initiatives to increase social support for healthy eating can aid in dietary changes (Kelsey, Earp, & Kirkley, 1997). For instance, unstructured support from co-workers can help motivate people to maintain a healthy diet; however, to increase the effectiveness of social support, organizations can create a healthy culture in the workplace. Further, employers can organize friendly competitions between co-workers, where employees can track the healthy foods they eat. Importantly, organizations that create a culture where eating healthy is the norm may have the best chance for sustaining positive health behavior changes (Kristal, Glanz, Tilley, & Li, 2000).

Although the current study did not find effects of diet on BMI for lower level employees, mental health for the senior level employees, or sickness absence for both pay grades, promoting a healthy diet is crucial for optimal health (Harvard School of Public Health, 2013). It is important to note that the benefits of a healthy diet are largely based on how long a person has been eating healthy (Robert et al., 2000). For example, someone who has been eating healthy for several years will likely be in better health.
compared to someone who has just recently made healthy changes to their diet. Therefore, thinking of health promotion in terms of long-term health benefits may help organizations and individuals realize that just because there may not be any immediate tangible rewards for a healthy diet, the long-term rewards may still be as valuable. For instance, healthier employees in the future can save organizations lost revenues by means of less sickness absences and lower insurance premiums (Danna & Griffin, 1999). Further, the long-term health benefits of eating a healthy diet can equate to increased quality of life and optimal health for the individual (Mayo Clinic, 2013).

Organizational Implications of the Aging Workforce. Promoting total worker health involves more than promoting modifiable health behaviors among the working population. In some instances, factors beyond an employees’ control can affect health and safety both within and outside the workplace. The current study found that age moderated the relationship between physical hazards and sickness absence and psychosocial hazards and sickness absence among the lower level pay grade employees. Additionally, although age did not moderate the relationship between workplace hazards and BMI, age did show a direct effect on BMI for both pay grades. When organizations develop health interventions for their workers, the age of their employees is an often overlooked aspect of a health intervention. Age does not fit the normal framework for health interventions because age is not a modifiable behavior. Despite age being an often overlooked variable in health intervention research, the rapidly aging workforce is forcing researcher and organizations to pay attention to the unique health needs of these individuals.
Importantly, although age is a factor that an individual has no control over, older employees can practice positive health behaviors, to slow the decline in age-related functional fitness and health. According to Kenny, Yardley, Martineau, and Jay (2008), an average decline of 20% in physical work capacity has been reported between the ages of 40 and 60, due to decreases in aerobic and musculoskeletal capacity. These declines can contribute to decreased work capacity and increase the likelihood of work-related injuries and illness. Kenny et al. (2008) argue that well-organized, management supported worksite health interventions encouraging physical activity during work hours could potentially decrease the incidence of age-related injury and illness.

Promoting both a healthy diet and physical activity among older workers may have a greater impact on health compared to younger employees (University of Iowa, 2009). In the context of older workers, the promotion of physical activity and diet may be used as a secondary or tertiary level intervention. From a secondary intervention level, increased physical activity and a healthier diet may help older employees cope with stressors in the workplace. From a tertiary intervention level, physical activity and dietary changes may be used to help rehabilitate older employees suffering from health problems. Older employees are at the greatest risk of sustaining severe injuries in the workplace and are more likely to miss more days of work per year due to sickness and injury (Wegman & McGee, 2004). Therefore, health interventions targeted towards improving the health of the highest risk group for occupational injury and sickness, e.g., older workers, should be viewed as a promising area for improving employee health and organizational productivity.
Due to a lack of attention paid to the health needs of the aging workforce, there are currently few guidelines or standard practices that organizations can use as a framework for tailoring health interventions to their older employees. Luckily, many of the same principles that are used for health interventions of younger employees can be used for older employees. For instance, Marsh (2004) established that individually based programs, where materials were tailored to individual needs were most successful. Programs should be tailored based on an individuals’ readiness for changing a health behavior. Further, less organized approaches which promote incidental physical activity or healthy eating during work hours may be most effective. For instance, initiatives set in place to promote regular walk/stress breaks at work or creating “healthy snack days” for employees may bring about behavior change. However, some aspects of health promotion should be tailored to an employee’s age. For example, it is essential that lower impact forms of physical activity are promoted for older employees. Strenuous physical activity can lead to injury among older employees, who are at an increased risk of joint and bone injuries (Cummings et al., 1993).

**Strengths of Current Study**

The current study has made several important contributions to Occupational Health Psychology. First, the present study has used total worker health as a framework for investigating occupational stress and health behaviors. Total Worker Health is a concept based on taking all aspects of a person’s health into account when promoting health (NIOSH, 2013). One strength of the current study is that the health of an employee
is examined from both within and outside the workplace, allowing for a comprehensive evaluation about what factors best predict a person’s health.

Researchers have differed in their definition of what physical and psychosocial hazards in the workplace encompass. The current study has attempted to organize a framework for what constitutes workplace hazards, and attempted to create an all-inclusive definition of physical and psychosocial hazards, which can be used as a framework for future researchers.

Thirdly, the present study is one of few to examine the effects of both physical and psychosocial workplace hazards upon employee health. For example, studies have examined how psychosocial hazards impact mental health or how physical hazards affect musculoskeletal disorders; however few studies have examined the effects of both physical and psychosocial hazards on health outcomes. Further, the current study investigated the effects of physical hazards on health outcomes, while controlling for psychosocial hazards. Additionally, the effects of psychosocial hazards on health outcomes were examined, while controlling for physical hazards. Controlling for one type of hazard allows for an examination about whether one hazard (e.g. physical) predicts a health outcome beyond and above the effects of another hazard (e.g. psychosocial). Specifically, the current study found that physical hazards can negatively impact BMI and sickness absences, above and beyond psychosocial hazards. Additionally, it was found that psychosocial hazards can negatively impact BMI, mental health, and sickness absence, above and beyond the effects of physical hazards.
Additionally, the current study noted that there are potential differences in both health outcomes and health behaviors based on an employees’ pay grade level. A strength of the present study is that it recognizes that lower paid employees have differing health needs compared to employees in the highest salary bracket. Lower paid employees may lack financial and social resources to enable them to cope with exposure to workplace hazards. The current study highlights the fact that organisations should take the divergent health needs of employees in different pay grades when designing and implementing health interventions in the workplace.

A final strength of the current study is that it recognizes new challenges that the aging workforce may face in the future. For example, aging employees are at an increased risk for chronic diseases (NIOSH, 2013) and workplace accidents compared to younger employees (Voss et al., 2008). The demographics of the workforce is changing, and aging workers are at an increased risk for health problems such as obesity and chronic diseases. The present study highlights the fact that researchers and organizations may need to tailor health promotion programs to this section of the workforce. Specifically, older employees are at an increased risk for obesity compared to younger employees. Increased obesity rates can lead to health problems for individual employees and can be a financial burden for employers, e.g., increased sickness absences and healthcare costs. The present study highlights the point that different approaches may need to be taken when promoting the health of older employees.
Weaknesses of Current Study

There are some potential problems with the current study. First, the present study does not have direct measures of the mechanisms of occupational stress, rather measures of physical and psychosocial hazards are used as proxies for occupational stress. For example, participants list what physical or psychosocial hazards are causing them unwanted stress at work; however the responses are in a yes/no format. The yes/no format may not capture whether certain workplace hazards are more severe, causing more stress than other hazards. A direct measure of the severity and frequency of hazards or a direct measure of perceived occupational stress may best capture how hazards in the workplace are creating stress.

Another weakness of the current study is that a cross-sectional design was used, where all data was collected at the same time-point. Therefore, it is difficult to determine whether the outcome is affected by predictor or the predictor is affected by the outcome. Cross-sectional studies make it difficult to interpret the sequence of events. For example, since workplace hazards, health outcomes, and physical activity were measured at the same time it is not possible to completely confirm whether physical activity can affect the relationship between workplace hazards and health.

There are also limitations to using BMI as an indicator of health and obesity. First, the current study used self-report data on height and weight to calculate participants’ BMI. Self-report measures of weight may not be reliable measures because individuals may underreport their weight, due to being self-conscious about their bodyweight. In addition, BMI does not measure fat distribution across the body. Fat
accumulation around the waist and abdomen can put people at a greater risk for chronic disease and poor health compared to fat distributed in other parts of the body (Harvard School of Public Health, 2013). Finally, BMI may not be an accurate predictor of health for individuals that are muscular, e.g., athletes, because BMI takes weight and height into account, without accounting for differences in bodyweight due to muscle. For example, the BMI of a muscular athlete may list them as obese because they are heavy for their height, not taking into account that muscle is contributing to a heavier weight (CDC, 2013). Nonetheless, BMI is a useful indicator of health, because it not only predicts chronic disease, but it is also a cost effective and easy tool to use.

Another possible limitation for the present study is the confounding factor of physically demanding work and physical activity levels. For example, employees who have more physically demanding job tasks may be getting more physical activity than employees who work primarily in an office setting. Further, employees who have physically demanding jobs may also be exposed to more physical workplace hazards. It may be the case that exposure to physical hazards is also related to greater levels of physical activity. For instance, office employees who are exposed to less physical hazards may also have less physically demanding jobs. Taking into account the nature of an employees’ job, and how it can impact health and health behaviors is a potential factor to consider for future research.

**Future Research**

There are many different avenues for future research on the topic of workplace hazards and employee health outcomes. First, it is important to consider the role that
resources have on occupational stress and employee health. Future research could examine how workplace hazards impact employee health by framing a study using the Job-Demand-Resource Model (JD-R) by Demerouti, Bakker, Nachreiner, and Schaufeli (2001). The JD-R Model by Demerouti, et al. (2001) categorizes employee working conditions into demands and resources. In the context of the current study, job demands can be characterized by physical and psychosocial hazards in the workplace. Resources can be described as factors that help employees cope with workplace stressors, and help employees attain job goals and personal growth. Resources can include job conditions which help employees deal with stress or personal characteristics e.g., coping skills (Schaufeli & Bakker, 2004). Future research could examine how healthy lifestyle factors act as resources to help buffer the negative effects that workplace hazards have on health. The current study examined how exercise and diet can act as stress buffers; however future researchers may want to examine how multiple healthy lifestyle factors grouped together can buffer stress. Healthy lifestyle factors could include exercise, diet, drinking and smoking behaviors. It is likely that a group of healthy lifestyle factors would be more likely to buffer stress compared to examining individual health behaviors. It is probable that employees who have more healthy lifestyle resources will be better able to cope with occupational stress, and have more favorable health outcomes.

Additionally, future research could incorporate ideas from positive psychology to help determine the best ways to promote total worker health. For example, positive psychology emphasises prevention across all areas of psychology, focusing on primary prevention of health problems rather than just treating a health problem (Seligman &
Csikszentmihalyi, 2000). Organizations and researchers should aim to incorporate positive psychology into worksite health interventions. For instance, future health interventions in the workplace should place a greater emphasis on primary prevention, which has been shown to be more cost-effective compared to secondary or tertiary interventions (Cecchini et al., 2010). Instead of research focusing on how to treat employees who are already suffering from health problems, researchers should investigate how organizations can do a better job of removing hazards from the workplace.

Importantly, positive psychology research indicates that positive states are more than the absence of negative states (Peters & Czapinski, 1990). Future research should examine the conceptual differences between positive and negative states, and incorporate this differentiation into total worker health promotion. For instance, “happy” is not the same as “not sad”, and each state has differing biologically based mechanisms (Russell, 2003). Applying positive psychology to the current study, the absence of physical and psychosocial hazards in the workplace does not always equate to a happier and healthier worker. Researchers should investigate the effectiveness of using both primary and secondary interventions in the workplace. Primary interventions can be the first line of defence against occupational stressors; however, using health promotion strategies as a secondary intervention level may help improve employee health above and beyond the initial removal of a stressor.

In addition, future research should incorporate direct measures of the mechanisms of occupational stress. The current study used workplace hazards as indicators of
occupational stress; however having direct measures of occupational stress may make the link between workplace hazards, stress, and health outcomes more clear. For example, in most cases, increased exposure to workplace hazards was related to more negative health outcomes; however it is plausible that not all of the workplace hazards equally contribute to occupational stress. In order to determine which kinds of workplace hazards are most stressful for employees, future researchers could group hazards by severity. It is likely that certain hazards, such as exposure to toxic chemicals will induce more stress compared to working in a hot climate. Therefore, some sort of grouping or weighing technique may be effective in making the link between workplace hazards, occupational stress, and health more clear.

Future research could also improve upon the current study by implementing a longitudinal study instead of using a cross-sectional design. A longitudinal study allows for the collection of data at different time-points, making it easier to establish whether one variable affects another variable over time. A longitudinal design can be used to establish the sequence of events among predictor and outcome variables. For example, future research could measure workplace hazards at one time-point, and measure health outcomes six months later, in order to establish if workplace hazards can impact future health.

Furthermore, other indicators of obesity and health could be used in addition to using BMI. Although BMI is easy to measure and inexpensive, it is an indirect measure of body fat, which can be prone to error. BMI is also a less accurate predictor of body fat for the elderly (Harvard School of Public Health, 2014). Alternative methods for
measuring body fat include measuring waist circumference, skinfold thickness, bioelectrical impedance, and hydrostatic weighing (Harvard School of Public Health, 2014). The most accurate method for measuring body fat is hydrostatic weighing, where individuals are weighed in air, while submerged in a tank of water. However, this method is time consuming and expensive in some instances. Measuring skin thickness with calipers or measuring waist circumference can be a more convenient and inexpensive method for measuring body fat, although these methods can be prone to measurement error. Finally, biometrical impedance can be a safe and relatively inexpensive method for measuring body fat; however an individual’s’ hydration levels can affect the accuracy of readings. Future researchers should weigh the pros and cons of each method for measuring body fat, and determine if cost, accuracy, or convenience is a priority. Ideally, research should incorporate multiple methods for measuring body fat, in order to get the most accurate and reliable measures.

One interesting factor to consider for future research is physical activity related to work tasks or pay grade. Lower pay grade employees tend to have more physically demanding jobs (Hemingway et al., 1997). For example, lower pay grade jobs may include more bending, stretching, standing, and lifting objects (Sekine et al., 2006). The main issue is whether occupational physical activity should be considered when examining the physical activity levels of employees. The distinction between occupational physical activity and leisure physical activity could be made if the goal of a future study is to examine both forms of physical activity separately. The other option would be to include both occupational and leisure physical activity into one measure of
general physical activity. Finally, if the goal was to examine the individual effects of leisure physical activity on health, occupational physical activity could be controlled for to account for varying levels of occupational physical activity among employees.

Additionally, future research could investigate how physical and psychosocial hazards in the workplace affect sleep quality. Given that the current study found that workplace hazards can negatively impact health outcomes such as BMI, mental health and sickness absence, it is also likely that workplace hazards would impact sleep quality. Previous research has linked work demands and occupational stress to reduced sleep quality (Caruso, Hitchcock, Dick, Russo, & Schmit, 2004); however few studies have directly linked exposure to both physical and psychosocial hazards to sleep quality. An individual’s ability to attain a healthy and consistent sleep schedule is vital to overall health and well-being (The National Sleep Foundation, 2009). Therefore, future research should investigate whether workplace hazards impact sleep quality, and devise ways to buffer the negative effects of workplace hazards on sleep quality.

Finally, it is often difficult to convince organizations to implement health interventions in the workplace because organizations are not convinced that these interventions will have any benefit. Studies linking or demonstrating the potential benefits to the employees and organization in terms of financial gain and improved organizational and individual health are critical for gaining organizational support for a worksite health intervention.
Conclusions

In conclusion, some novel relationships were established in this study. First, psychosocial hazards were found to predict BMI among both pay grades. Further, physical hazards predicted BMI for both pay grades; however, contrary to prediction, physical hazards were inversely related to BMI among the senior pay grade employees. Moreover, it was found that physical hazards were not related to mental health. In addition, physical and psychosocial hazards only predicted sickness absence among lower pay grade employees. The current study also found that physical activity and diet did not buffer the negative effects of workplace hazards on BMI, mental health, and sickness absence. Nevertheless, physical activity was significantly related to BMI for both pay grades and mental health and sickness absence for the lower pay grades. Additionally, diet was significantly related to BMI for the senior pay grade and mental health for the lower pay grade. Finally, age moderated the relationship between physical hazards and sickness absence and psychosocial hazards and sickness absence among the lower level pay grade employees. The results of this study show that physical and psychosocial hazards in the workplace can be detrimental to employee health. Importantly, physical activity was related to a lower BMI, improved mental health, and less sickness absences, while a healthy diet was related to a lower BMI for both pay grades. Promoting physical activity and a healthy diet are viable methods for improving employee health. Further, when organizations are designing worksite health interventions, physical activity, diet, and employee age should be factored into a plan designed to promote total worker health.


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APPENDICES
Which of the following, in your view are causing your workplace to be unsafe or unhealthy? (Tick all that apply)

1) The lighting
2) The heating
3) The air quality
4) Noise levels
5) Unsafe work area (e.g. cluttered or badly
6) Set up office area)
7) Hazardous chemicals/microbiological agents
8) Radiological hazards
9) Wiring/cabling
10) Unsafe floor surfaces
11) Water leaks
12) Inadequate seating or desk space
13) Inadequate access to staff facilities (tea/coffee, rest areas, toilets)
14) Other (please specify)___________________________________
APPENDIX B

HSE MS Psychosocial Hazards Scale

Which, if any, of the following are causing you unwanted stress in your job? (Tick all that apply)

1) Long working hours 23) How you are treated by your manager
2) New technology 24) Poor morale where you work
3) Having too much work to do 25) Poor relationships with colleagues
4) Having too little work to do 26) Feeling undervalued
5) Changes to your job 27) Being bullied in the last year
6) Boring or repetitive work 28) Sexual harassment in the last year
7) Shift work 29) Sectarian harassment in the last year
8) People you manage 30) Lack of support from management/colleagues
9) Too much responsibility 31) Poor communication
10) Dealing with the public 32) Being ignored or excluded
11) Excessive travel 33) Being criticized
12) Balancing family and work commitments 34) Lack of recognition at work
13) Working beyond your level of ability 35) Office politics
14) Unrealistic targets 36) Lack of equal opportunities
15) Unreasonable deadlines 37) Poor working conditions
16) Constant interruptions 38) Lack of career progress
17) Keeping up with emails/voicemails 39) Inadequate training
18) Performing tasks outside your job specifications 40) Lack of job security
19) Lack of consultation about decisions that affect you 41) Being understaffed
20) Lack of freedom to plan your work 42) The way work is shared
21) Disliking the work you do 43) Being unclear about what you are supposed to do
22) The lack of flexibility in your work pattern 44) None of these, I am not stressed at work
23) None of these, I am not stressed at work
45) Other (Please specify)____________
APPENDIX C

Exercise

How many times a week, on average do you do the following kinds of exercise for more than 20 minutes? (Please write the appropriate number on each line. If NONE, please write ‘0’).

a) Strenuous Exercise (Heart beats rapidly) (e.g. Running, jogging, football, squash, basketball, vigorous swimming, vigorous long distance cycling, high impact aerobics and other exercises of a similar intensity)………………………………………...times a week

b) Moderate Exercise (Not exhausting) (e.g. Fast walking, badminton, easy swimming, easy cycling, volleyball, popular dancing, heavy gardening, low impact aerobics and other exercises of a similar intensity)………………………………………...times a week

c) Mild Exercise (Minimal effort) (e.g. Yoga, golf, easy walking, bowls, light gardening and other exercises of a similar intensity)………………………………………...times a week
Which of the following, if any, do you consciously try to limit or avoid? (Tick all that apply)

Salt
Fat/fatty foods
Caffeine
Sugar
Red meat
Fast foods
Other (Please specify) __________________
APPENDIX E

General Mental Health-12 Questionnaire (GHQ-12)

Please read this before you start this section. We would like to know how your health has been in general, over the past few weeks. Please answer ALL the questions by putting a tick in the box under the answer which you think most applies to you.

Have you recently…

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<td>a)</td>
<td>Been able to concentrate on whatever you are doing?</td>
<td>Better than usual</td>
<td>Same as usual</td>
<td>Less than usual</td>
</tr>
<tr>
<td>b)</td>
<td>Lost much sleep over worry?</td>
<td>Not at all</td>
<td>No more than usual</td>
<td>Rather more than usual</td>
</tr>
<tr>
<td>c)</td>
<td>Felt that you are playing a useful part in things?</td>
<td>More so than usual</td>
<td>Same as usual</td>
<td>Less useful than usual</td>
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<td>d)</td>
<td>Felt capable of making decisions about things?</td>
<td>More so than usual</td>
<td>Same as usual</td>
<td>Less so than usual</td>
</tr>
<tr>
<td>e)</td>
<td>Felt constantly under strain?</td>
<td>Not at all</td>
<td>No more than usual</td>
<td>Rather more than usual</td>
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<tr>
<td>f)</td>
<td>Felt you couldn’t overcome your difficulties?</td>
<td>Not at all</td>
<td>No more than usual</td>
<td>Rather more than usual</td>
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<td>g) Been able to enjoy your normal day-to-day activities</td>
<td>More so than usual</td>
<td>Same as usual</td>
<td>Less so than usual</td>
<td>Much less than usual</td>
</tr>
<tr>
<td>h) Been able to face up to your problems?</td>
<td>More so than usual</td>
<td>Same as usual</td>
<td>Less so than usual</td>
<td>Much less able</td>
</tr>
<tr>
<td>i) Been feeling unhappy and depressed?</td>
<td>Not at all</td>
<td>No more than usual</td>
<td>Rather more than usual</td>
<td>Much more than usual</td>
</tr>
<tr>
<td>j) Been losing confidence in yourself?</td>
<td>Not at all</td>
<td>No more than usual</td>
<td>Rather more than usual</td>
<td>Much more than usual</td>
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<tr>
<td>k) Been thinking of yourself as a worthless person?</td>
<td>Not at all</td>
<td>No more than usual</td>
<td>Rather more than usual</td>
<td>Much more than usual</td>
</tr>
<tr>
<td>l) Been feeling reasonably happy, all things considered?</td>
<td>More so than usual</td>
<td>Same as usual</td>
<td>Less so than usual</td>
<td>Much less than usual</td>
</tr>
</tbody>
</table>
FIGURE A1
NICS Research Overview

- Securing Commitment
  - Needs Analysis
    - Action
      - Evaluation
        - NICS Workforce Health Survey
          - Reports and Recommendations
            - NICS-Wide Improvement Plans drawn up by OHS/WHC
              - Department/Agency Improvement Plans drawn up by local implementation teams
            - Delivery of service wide improvement plan
              - Delivery of department/agency improvement plans
FIGURE A2

Physical Activity as a Moderator between Physical Hazards & BMI
FIGURE A3

Physical Activity as a Moderator between Psychosocial Hazards & BMI
FIGURE A4

Physical Activity as a Moderator between Physical Hazards and GHQ-12
FIGURE A5

Physical Activity as a Moderator between Psychosocial Hazards & GHQ-12
FIGURE A6

Physical Activity as a Moderator between Physical Hazards & Sickness Absence
FIGURE A7

Physical Activity as a Moderator between Psychosocial Hazards & Sickness Absence

Senior Pay Grade

Lower Pay Grade
FIGURE A8

Diet as a Moderator between Physical Hazards & BMI
FIGURE A9

Diet as a Moderator between Psychosocial Hazards & BMI
FIGURE A10
Diet as a moderator between Physical Hazards & GHQ-12

Senior Pay Grade

Lower Pay Grade
FIGURE A11

Diet as a Moderator between Psychosocial Hazards & GHQ-12
FIGURE A12
Diet as a Moderator between Physical Hazards & Sickness Absence

Senior Pay Grade

Low Health Diet
High Health Diet

Lower Pay Grade

Low Health Diet
High Health Diet
FIGURE A13

Diet as a Moderator between Psychosocial Hazards & Sickness Absence

Senior Pay Grade

Low Psychosocial Hazards  High Psychosocial Hazards

Sickness Absence Days

Low Health Diet  High Health Diet

Lower Pay Grade

Low Psychosocial Hazards  High Psychosocial Hazards

Sickness Absence Days

Low Health Diet  High Health Diet
FIGURE A14
Age as a Moderator between Physical Hazards & BMI

Senior Pay Grade

Body Mass Index

Low Physical Hazards  High Physical Hazards

Low Age
High Age

Lower Pay Grade

Body Mass Index

Low Physical Hazards  High Physical Hazards

Low Age
High Age
FIGURE A15

Age as a Moderator between Psychosocial Hazards & BMI

Senior Pay Grade

Low Psychosocial Hazards  High Psychosocial Hazards

Lower Pay Grade

Low Psychosocial Hazards  High Psychosocial Hazards
FIGURE A16

Age as a moderator between Physical Hazards & Sickness Absence
FIGURE A17

Age as a Moderator between Psychosocial Hazards & Sickness Absence

Senior Pay Grade

Lower Pay Grade
<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrials</td>
<td>Industrial Grade Employees</td>
</tr>
<tr>
<td>AA</td>
<td>Administrative Assistants (NICS), (Northern Ireland Office-NIO)</td>
</tr>
<tr>
<td>AO</td>
<td>Administrative Officer (NICS)</td>
</tr>
<tr>
<td>EO11/EO1</td>
<td>Executive Officer Grades 2 &amp; 1 (NICS), Grade C (NIO)</td>
</tr>
<tr>
<td>SO</td>
<td>Staff Officer (NICS), Grade B2 (NIO)</td>
</tr>
<tr>
<td>DP</td>
<td>Deputy Principal (NICS), Grade B1 (NIO)</td>
</tr>
<tr>
<td>Grades 6&amp;7</td>
<td>Senior Principal &amp; Principal (NICS), Grade A (NIO)</td>
</tr>
<tr>
<td>Grades 5+</td>
<td>Senior Civil Service (Assistant Secretary, Under Secretary &amp; Permanent Secretary)</td>
</tr>
<tr>
<td>Variable</td>
<td>Mean</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>(1.98)</td>
</tr>
<tr>
<td>Psychosocial Hazards</td>
<td>5.98</td>
</tr>
<tr>
<td></td>
<td>(5.43)</td>
</tr>
<tr>
<td>BMI</td>
<td>25.53</td>
</tr>
<tr>
<td></td>
<td>(4.23)</td>
</tr>
<tr>
<td>GHQ-12</td>
<td>2.44</td>
</tr>
<tr>
<td></td>
<td>(3.48)</td>
</tr>
<tr>
<td>Sickness Absence</td>
<td>11.44</td>
</tr>
<tr>
<td></td>
<td>(28.84)</td>
</tr>
<tr>
<td>Exercise</td>
<td>7.69</td>
</tr>
<tr>
<td></td>
<td>(3.94)</td>
</tr>
<tr>
<td>Diet</td>
<td>2.61</td>
</tr>
<tr>
<td></td>
<td>(1.61)</td>
</tr>
<tr>
<td>Age</td>
<td>38.87</td>
</tr>
<tr>
<td></td>
<td>(10.13)</td>
</tr>
</tbody>
</table>

* = $p < .05$; ** = $p < .01$ (two-tailed) Standard deviations appear in parentheses below means.
TABLE B3

Comparison of Means for Measured Variables between Senior Pay Grade and Lower Pay Grade

<table>
<thead>
<tr>
<th>Variables</th>
<th>Senior Pay Grade</th>
<th>Lower Pay Grade</th>
<th>df</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample Means</td>
<td>Sample Means</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>0.74 (1.57)</td>
<td>1.38 (2.00)</td>
<td>15,896</td>
<td>-10.05***</td>
</tr>
<tr>
<td>Psychosocial Hazards</td>
<td>5.83 (4.66)</td>
<td>6.05 (5.49)</td>
<td>15,896</td>
<td>-1.27</td>
</tr>
<tr>
<td>BMI</td>
<td>25.31 (3.21)</td>
<td>25.52 (4.29)</td>
<td>14,909</td>
<td>-1.49</td>
</tr>
<tr>
<td>GHQ-12</td>
<td>2.10 (3.06)</td>
<td>2.48 (3.47)</td>
<td>15,896</td>
<td>-3.36*</td>
</tr>
<tr>
<td>Sickness Absence</td>
<td>5.57 (18.44)</td>
<td>11.81 (29.03)</td>
<td>14,736</td>
<td>-6.53**</td>
</tr>
<tr>
<td>Exercise</td>
<td>7.67 (3.64)</td>
<td>7.71 (3.96)</td>
<td>12,757</td>
<td>-0.24</td>
</tr>
<tr>
<td>Diet</td>
<td>3.05 (1.57)</td>
<td>2.59 (1.60)</td>
<td>15,896</td>
<td>8.81***</td>
</tr>
<tr>
<td>Age</td>
<td>47.59 (7.85)</td>
<td>38.18 (9.95)</td>
<td>15,735</td>
<td>29.40***</td>
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</table>

* = p < .05; ** = p < .01; *** = p < .001. Standard deviations appear in parentheses below means.
### TABLE B4

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<th>1</th>
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<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Psychosocial Hazards</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3 BMI</td>
<td>-.08*</td>
<td>.08*</td>
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<tr>
<td>4 GHQ-12</td>
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<td>.48**</td>
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<td>5 Sickness Absence</td>
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<td>.08**</td>
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<td>.04</td>
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<td>.16**</td>
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<td>-.10**</td>
<td>.15**</td>
<td>.01</td>
<td>-.01</td>
<td>-.04</td>
<td>.11**</td>
<td>1</td>
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<td>9 Gender</td>
<td>.12*</td>
<td>.07*</td>
<td>-.28*</td>
<td>.02*</td>
<td>.11**</td>
<td>-.01</td>
<td>.14**</td>
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</tr>
</tbody>
</table>

* = p < .05; ** = p < .01 (two-tailed); Gender: Males coded as 1, females coded as 2, in all Tables.
<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
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</tr>
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<td></td>
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<td>BMI</td>
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<td>.07**</td>
<td>1</td>
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<td></td>
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<td>GHQ-12</td>
<td>.16**</td>
<td>.46**</td>
<td>.05**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sickness Absence</td>
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<td>.11**</td>
<td>.03**</td>
<td>.17**</td>
<td>1</td>
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<td></td>
</tr>
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<td>-.02*</td>
<td>-.06**</td>
<td>-.10**</td>
<td>-.04**</td>
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<td>-.05**</td>
<td>.18**</td>
<td>-.01</td>
<td>.02*</td>
<td>-.09**</td>
<td>.17**</td>
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</tr>
<tr>
<td>Gender</td>
<td>.09**</td>
<td>-.02*</td>
<td>-.17**</td>
<td>.04*</td>
<td>.09**</td>
<td>-.14**</td>
<td>.13**</td>
<td>__</td>
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</table>

* = p < .05; ** = p < .01 (two-tailed)
TABLE B6

Regression Analyses: Physical & Psychosocial Hazards Predicting BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Senior Pay Grade</th>
<th></th>
<th>Lower Pay Grade</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE B</td>
<td>β</td>
<td>B</td>
</tr>
<tr>
<td>Gender</td>
<td>-2.14</td>
<td>.25</td>
<td>-.28**</td>
<td>-1.47</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>.08</td>
<td>.02</td>
<td>.12**</td>
<td>.05</td>
</tr>
<tr>
<td>Hazards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>-.17</td>
<td>.07</td>
<td>-.08*</td>
<td>.04</td>
</tr>
<tr>
<td>R²</td>
<td>.10</td>
<td></td>
<td></td>
<td>.03</td>
</tr>
<tr>
<td>F</td>
<td>31.27**</td>
<td></td>
<td></td>
<td>165.18**</td>
</tr>
</tbody>
</table>

* = p < .05; ** = p < .01 (two-tailed)
### TABLE B7

Regression Analyses: Physical Hazards Predicting GHQ-12

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<tr>
<th>Variable</th>
<th>Senior Pay Grade</th>
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<th></th>
<th>Lower Pay Grade</th>
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<td></td>
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<td>$B$</td>
<td>$SE\ B$</td>
<td>$\beta$</td>
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<td>Gender</td>
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<td>.20</td>
<td>-.01</td>
<td>.36</td>
<td>.05</td>
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</tr>
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<td>Psychosocial Hazards</td>
<td>.32</td>
<td>.02</td>
<td>.49**</td>
<td>.30</td>
<td>.01</td>
<td>.46**</td>
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<tr>
<td>Physical Hazards</td>
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<td>.06</td>
<td>-.02</td>
<td>-.03</td>
<td>.01</td>
<td>-.02</td>
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<table>
<thead>
<tr>
<th>$R^2$</th>
<th>.23</th>
<th>.21</th>
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</thead>
<tbody>
<tr>
<td>$F$</td>
<td>31.27**</td>
<td>1.33**</td>
</tr>
</tbody>
</table>

* = $p < .05$; ** = $p < .01$ (two-tailed)
<table>
<thead>
<tr>
<th>Variable</th>
<th>Senior Pay Grade</th>
<th></th>
<th>Lower Pay Grade</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE B$</td>
<td>$\beta$</td>
<td>$B$</td>
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<tr>
<td>Gender</td>
<td>4.58</td>
<td>1.44</td>
<td>.10**</td>
<td>5.11</td>
</tr>
<tr>
<td>Psychosocial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazards</td>
<td>.14</td>
<td>.13</td>
<td>.04</td>
<td>.53</td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>.28</td>
<td>.40</td>
<td>.02</td>
<td>.43</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.01</td>
<td></td>
<td></td>
<td>.02</td>
</tr>
<tr>
<td>$F$</td>
<td>4.48**</td>
<td></td>
<td></td>
<td>97.03**</td>
</tr>
</tbody>
</table>

* = $p < .05$; ** = $p < .01$ (two-tailed)
TABLE B9

Physical Activity as a Moderator between Physical Hazards & BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
<td>-2.20</td>
<td>-.28**</td>
<td>-2.15</td>
<td>-.28</td>
</tr>
<tr>
<td></td>
<td>(.27)</td>
<td></td>
<td>(.27)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.08</td>
<td>.11**</td>
<td>.08</td>
<td>.11**</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td></td>
<td>(.03)</td>
<td></td>
</tr>
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<td>-.16</td>
<td>-.08*</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td></td>
<td>(.07)</td>
<td></td>
</tr>
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<td>Physical Activity</td>
<td>-.12</td>
<td>-.14**</td>
<td>-.12</td>
<td>-.13*</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td></td>
<td>(.03)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards x Physical Activity</td>
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<td>.02</td>
<td>-.00</td>
<td>-.01</td>
</tr>
<tr>
<td></td>
<td>(.02)</td>
<td></td>
<td></td>
<td>(.01)</td>
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</tbody>
</table>

$R^2$ : .11** .11** .04** .04**
$F$ Change : 23.97** .37 122.56** .47

Note: Physical Hazards and Physical Activity were centered at their means.
*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas
Psych is abbreviation for Psychosocial Hazards in all Tables
TABLE B10

Physical Activity as a Moderator between Psychosocial Hazards & BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
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<td>-.28**</td>
<td>-2.20</td>
<td>-.28**</td>
</tr>
<tr>
<td></td>
<td>(.27)</td>
<td></td>
<td>(.27)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>-16</td>
<td>-.08*</td>
<td>-16</td>
<td>-.08*</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td></td>
<td>(.07)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.08</td>
<td>.11**</td>
<td>.08</td>
<td>.11**</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td></td>
<td>(.03)</td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td>-.12</td>
<td>-.14**</td>
<td>-.12</td>
<td>-.14**</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td></td>
<td>(.03)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards x Physical Activity</td>
<td>.00</td>
<td>.002</td>
<td>.00</td>
<td>.00</td>
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<tr>
<td></td>
<td>(.01)</td>
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</tr>
</tbody>
</table>

\[ R^2 \]
\[ .11** \]
\[ .11** \]
\[ .04** \]
\[ .04** \]

\[ F \]
\[ Change \]
\[ 23.97** \]
\[ .003 \]
\[ 122.56** \]
\[ .08 \]

*Note: Psychosocial Hazards and Physical Activity were centered at their means.*

*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas
### TABLE B11
Physical Activity as a Moderator between Physical Hazards & GHQ-12

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>( \beta )</td>
<td>B</td>
<td>( \beta )</td>
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<td>-.01</td>
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<td>(.22)</td>
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<td>(.22)</td>
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</tr>
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<td>.32</td>
<td>.49**</td>
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<td>(.02)</td>
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<td>(.06)</td>
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<td>.02</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td></td>
<td>(.03)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards x Physical Activity</td>
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<td>-0.002</td>
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<td>(.02)</td>
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<td>(.00)</td>
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</table>

| \( R^2 \)                      | .23** | .23** | .22** | .22** |
| \( F \) Change                 | 64.63** | .19  | 826.15** | .48  |

Note: Physical Hazards and Physical Activity were centered at their means.
*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas.
TABLE B12

Physical Activity as a Moderator between Psychosocial Hazards & GHQ-12

<table>
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<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
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<th>Model 2 (Lower Pay Grade)</th>
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<td>(.03)</td>
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<td>(.01)</td>
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<td>(.001)</td>
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</table>

$R^2$                      | .23** | .23** | .22* | .22* |
$F$ Change                 | 64.63** | .04 | 826.15** | 3.24 |

*Note: Psychosocial Hazards and Physical Activity were centered at their means.

*p < .05. **p < .01.

Standard errors appear in parentheses under unstandardized betas.
<table>
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<tr>
<th>Variable</th>
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<th>Model 2 (Lower Pay Grade)</th>
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<td>β</td>
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<td>4.55</td>
<td>.10**</td>
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<td></td>
<td>(1.53)</td>
<td></td>
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<td>.14</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>(.14)</td>
<td></td>
<td>(.14)</td>
<td></td>
</tr>
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<td>.02</td>
<td>.27</td>
<td>.02</td>
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<td></td>
<td>(.43)</td>
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<td>.02</td>
<td>.01</td>
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<td></td>
<td>(.19)</td>
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<td>.01</td>
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<tr>
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<td>(.12)</td>
<td></td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.01*</td>
<td>.23*</td>
<td>.02*</td>
<td>.02*</td>
</tr>
<tr>
<td>( F ) Change</td>
<td>2.99*</td>
<td>.10</td>
<td>63.72**</td>
<td>1.29</td>
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</table>

*Note: Physical Hazards and Physical Activity were centered at their means.
*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas.
## TABLE B14

Physical Activity as a Moderator between Psychosocial Hazards & Sickness Absence

<table>
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<th>Model 2 (Lower Pay Grade)</th>
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<td>( B ) ( \beta )</td>
<td>( B ) ( \beta )</td>
<td>( B ) ( \beta )</td>
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<tr>
<td>Gender</td>
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<td>4.55 (.10**)</td>
<td>4.89 (.08**)</td>
<td>4.90 (.08**)</td>
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<td>Physical Hazards</td>
<td>.28 (.42)</td>
<td>.27 (.43)</td>
<td>.42 (.14)</td>
<td>.43 (.03**)</td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.14 (.14)</td>
<td>.14 (.14)</td>
<td>.52 (.10**)</td>
<td>.52 (.10**)</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>-.003 (.17)</td>
<td>.02 (.19)</td>
<td>-.19 (.07)</td>
<td>-.19 (.03**)</td>
</tr>
<tr>
<td>Physical Hazards x Activity</td>
<td>.04 (.12)</td>
<td>.01 (.07)</td>
<td>-.04 (.07)</td>
<td>-.01 (.03)</td>
</tr>
</tbody>
</table>

\( R^2 \) | .01* | .01* | .02* | .02*  \\
\( F \) Change | 2.99* | 2.41* | 63.72** | .01  \\

*Note: Psychosocial Hazards and Physical Activity were centered at their means.*  
*p < .05. **p < .01.*  
Standard errors appear in parentheses under unstandardized betas.
TABLE B15

Diet as a Moderator between Physical Hazards & BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
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<td>B</td>
<td>β</td>
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<td>-2.07</td>
<td>-.27**</td>
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<tr>
<td></td>
<td>(.37)</td>
<td>(.25)</td>
<td>(.13)</td>
<td>(.13)</td>
</tr>
<tr>
<td>Psych Hazards</td>
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<td>.13**</td>
<td>.09</td>
<td>.013**</td>
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<td></td>
<td>(.02)</td>
<td>(.02)</td>
<td>(.01)</td>
<td>(.01)</td>
</tr>
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<td>Physical Hazards</td>
<td>-.17</td>
<td>-.08*</td>
<td>-.14</td>
<td>-.07</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td>(.08)</td>
<td>(.02)</td>
<td>(.02)</td>
</tr>
<tr>
<td>Diet</td>
<td>-.17</td>
<td>-.09**</td>
<td>-.19</td>
<td>-.10**</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td>(.07)</td>
<td>(.02)</td>
<td>(.02)</td>
</tr>
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<td>Physical Hazards</td>
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<td>-.04</td>
</tr>
<tr>
<td>x Diet</td>
<td>(.04)</td>
<td>(.04)</td>
<td>(.01)</td>
<td>(.01)</td>
</tr>
</tbody>
</table>

\[ R^2 \]  
\[ .10** \]  
\[ F \]  
\[ 25.35** \]  
\[ .91 \]  
\[ 123.95** \]  
\[ 1.85 \]

*Note: Physical Hazards and Diet were centered at their means.
*p < .05.  **p < .01.
Standard errors appear in parentheses under unstandardized betas.
TABLE B16

Diet as a Moderator between Psychosocial Hazards & BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
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<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
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<td>-.27**</td>
<td>-2.07</td>
<td>-.27**</td>
</tr>
<tr>
<td></td>
<td>(.25)</td>
<td></td>
<td>(.25)</td>
<td></td>
</tr>
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<td>-.16</td>
<td>-.08*</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td></td>
<td>(.07)</td>
<td></td>
</tr>
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<td>.09</td>
<td>.13**</td>
<td>.10</td>
<td>.14**</td>
</tr>
<tr>
<td></td>
<td>(.02)</td>
<td></td>
<td>(.02)</td>
<td></td>
</tr>
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<td>-.09**</td>
<td>-.18</td>
<td>-.09**</td>
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<td>(.07)</td>
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<td>-003</td>
<td>-01</td>
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<td></td>
<td>(.01)</td>
<td></td>
<td>(.004)</td>
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R²  | .10** | .10** | .03* | .03* |
F Change  | 25.35** | 2.46 | 123.95** | .52 |

Note: Psychosocial Hazards and Diet were centered at their means.
*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas
TABLE B17

Diet as a Moderator between Physical Hazards & GHQ-12

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
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<td>$\beta$</td>
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<td>-.01</td>
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<td>(.21)</td>
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<td>.32</td>
<td>.49**</td>
</tr>
<tr>
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<td></td>
<td>(.02)</td>
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<td>-.01</td>
<td>-.004</td>
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<td>(.06)</td>
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<td>(.06)</td>
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<tr>
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<td>(.06)</td>
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<td>-.04</td>
<td>-.04</td>
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<td>(.03)</td>
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<td>.23**</td>
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<td>$F$ Change</td>
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<td>1.75</td>
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Note: Physical Hazards and Diet were centered at their means.
*p < .05.  **p < .01.
Standard errors appear in parentheses under unstandardized betas.
TABLE B18

Diet as a Moderator between Psychosocial Hazards & GHQ-12

<table>
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<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
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<td>$B$</td>
<td>$\beta$</td>
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<td>-.01</td>
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<td></td>
<td>(.21)</td>
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<td>-.02</td>
<td>-.04</td>
<td>-.02</td>
</tr>
<tr>
<td></td>
<td>(.06)</td>
<td></td>
<td>(.06)</td>
<td></td>
</tr>
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<td>.33</td>
<td>.50**</td>
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<td>(.02)</td>
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<td>(.05)</td>
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<td>-.04</td>
<td>.00</td>
<td>-.002</td>
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</table>

$R^2$                   | .23** | .23**   | .21** | .21**   |

$F$ Change              | 77.27** | 1.76   | 1001.10** | .06 |

Note: Psychosocial Hazards and Diet were centered at their means.  
*p < .05.  **p < .01.  
Standard errors appear in parentheses under unstandardized betas.
TABLE B19

Diet as a Moderator between Physical Hazards & Sickness Absence

<table>
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<th>Model 2 (Senior Pay Grade)</th>
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<td>(.13)</td>
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<td>(.41)</td>
<td>(.15)</td>
<td>(.15)</td>
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</table>

**R^2** | .01* | .01* | .02* | .02* |

**F** | 3.36** | .52 | 72.82** | .002 |

*Note: Physical Hazards and Diet were centered at their means.*  
*p < .05. **p < .01.*  
Standard errors appear in parentheses under unstandardized betas.
TABLE B20
Diet as a Moderator between Psychosocial Hazards & Sickness Absence

<table>
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<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
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<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
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<td>4.56</td>
<td>.10*</td>
</tr>
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<td>(1.45)</td>
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<td></td>
<td>(1.45)</td>
<td></td>
</tr>
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<td>.28</td>
<td>.02</td>
<td>.29</td>
<td>.02</td>
</tr>
<tr>
<td>(.40)</td>
<td></td>
<td></td>
<td>(.40)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.14</td>
<td>.04</td>
<td>.16</td>
<td>.04</td>
</tr>
<tr>
<td>(.13)</td>
<td></td>
<td></td>
<td>(.14)</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
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<td>-.002</td>
<td>-.04</td>
<td>-.003</td>
</tr>
<tr>
<td>(.38)</td>
<td></td>
<td></td>
<td>(.39)</td>
<td></td>
</tr>
<tr>
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<td>-.01</td>
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<td>(.08)</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

$R^2$                     | .01* | .01* | .02**| .02**|

$F$ Change                | 3.36*| .11  | 72.82**| 1.64|

Note: Psychosocial Hazards and Diet were centered at their means.
*p < .05.  **p < .01.
Standard errors appear in parentheses under unstandardized betas.
### TABLE B21

<table>
<thead>
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<th>Variable</th>
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<th>Model 1 (Lower Pay Grade)</th>
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<td>B</td>
<td>β</td>
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<td>(.26)</td>
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<td>(.26)</td>
<td></td>
</tr>
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<td>.09</td>
<td>.12**</td>
<td>.09</td>
<td>.13**</td>
</tr>
<tr>
<td></td>
<td>(.02)</td>
<td></td>
<td>(.02)</td>
<td></td>
</tr>
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<td>-.09</td>
<td>-.05</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td></td>
<td>(.09)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>.02</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>(.01)</td>
<td></td>
<td>(.02)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards x Age</td>
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<td>.05</td>
<td>.001</td>
<td>.004</td>
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<tr>
<td></td>
<td>(.01)</td>
<td></td>
<td>(.002)</td>
<td></td>
</tr>
</tbody>
</table>

| $R^2$                     | .10** | .10** | .06** | .06** |
| $F$ Change                | 24.29** | 1.67 | 215.46** | .26 |

*Note: Physical Hazards and Age were centered at their means.  
*p < .05.  **p < .01.  
Standard errors appear in parentheses under unstandardized betas.*
### TABLE B22

Age as a Moderator between Psychosocial Hazards & BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
<td>-2.00</td>
<td>-.26**</td>
<td>-2.03</td>
<td>-.27**</td>
</tr>
<tr>
<td></td>
<td>(.26)</td>
<td>(.26)</td>
<td>(.07)</td>
<td>(.07)</td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>-.16</td>
<td>-.08*</td>
<td>-.16</td>
<td>-.08*</td>
</tr>
<tr>
<td></td>
<td>(.07)</td>
<td>(.07)</td>
<td>(.02)</td>
<td>(.02)</td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.09</td>
<td>.12**</td>
<td>.13</td>
<td>.18**</td>
</tr>
<tr>
<td></td>
<td>(.02)</td>
<td>(.03)</td>
<td>(.01)</td>
<td>(.01)</td>
</tr>
<tr>
<td>Age</td>
<td>.03</td>
<td>.06*</td>
<td>.02</td>
<td>.06*</td>
</tr>
<tr>
<td></td>
<td>(.01)</td>
<td>(.01)</td>
<td>(.004)</td>
<td>(.004)</td>
</tr>
<tr>
<td>Psych Hazards x Age</td>
<td>-.01</td>
<td>-.08</td>
<td>.00</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>(.003)</td>
<td>(.001)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|R²| .10** | .10** | .06** | .06** |
|F| 24.29** | 3.43* | 215.46** | .06 |

*Note: Psychosocial Hazards and Age were centered at their means.
* p < .05. ** p < .01.
Standard errors appear in parentheses under unstandardized betas.
TABLE B23

Age as a Moderator between Physical Hazards & Sickness Absence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
<td>5.01</td>
<td>.14**</td>
<td>5.15</td>
<td>.12**</td>
</tr>
<tr>
<td></td>
<td>(1.52)</td>
<td></td>
<td>(1.52)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.15</td>
<td>.04</td>
<td>.14</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>(.14)</td>
<td></td>
<td>(.14)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>.33</td>
<td>.03</td>
<td>.01</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>(.41)</td>
<td></td>
<td>(.50)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.09</td>
<td>.04</td>
<td>.11</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>(.08)</td>
<td></td>
<td>(.09)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards x Age</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>(.05)</td>
<td></td>
<td>(.05)</td>
<td></td>
</tr>
</tbody>
</table>

| R² | .02** | .02** | .02** | .02** |
| F  | 3.58** | 1.18  | 77.21** | 2.92* |

Note: Physical Hazards and Age were centered at their means.
*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas.
TABLE B24

Age as a Moderator between Psychosocial Hazards & Sickness Absence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Senior Pay Grade)</th>
<th>Model 2 (Senior Pay Grade)</th>
<th>Model 1 (Lower Pay Grade)</th>
<th>Model 2 (Lower Pay Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Gender</td>
<td>5.01</td>
<td>.14**</td>
<td>5.03</td>
<td>.11**</td>
</tr>
<tr>
<td></td>
<td>(1.52)</td>
<td></td>
<td>(1.52)</td>
<td></td>
</tr>
<tr>
<td>Physical Hazards</td>
<td>.33</td>
<td>.03</td>
<td>.33</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>(.41)</td>
<td></td>
<td>(.41)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards</td>
<td>.15</td>
<td>.04</td>
<td>.13</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>(.14)</td>
<td></td>
<td>(.19)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.09</td>
<td>.04</td>
<td>.09</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>(.08)</td>
<td></td>
<td>(.08)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazards x Age</td>
<td>.002</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.02)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*R² | .02 | .02 | .02** | .02** |

F for change in R² | 3.58** | .02 | 77.21** | 3.58* |

Note: Psychosocial Hazards and Age were centered at their means.
*p < .05. **p < .01.
Standard errors appear in parentheses under unstandardized betas.
# TABLE B25

Regression Analyses Split by Age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>IV’s</th>
<th>DV</th>
<th>DF</th>
<th>Model R square</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>Physical hazards, Psychosocial hazards, Gender</td>
<td>BMI</td>
<td>(3, 2900)</td>
<td>.03**</td>
</tr>
<tr>
<td></td>
<td>GHQ-12</td>
<td>(3, 2900)</td>
<td>.20**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sickness Absence</td>
<td>(3, 2935)</td>
<td>.02**</td>
<td></td>
</tr>
<tr>
<td>30-40</td>
<td>BMI</td>
<td>(3, 6073)</td>
<td>.04**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GHQ-12</td>
<td>(3, 6471)</td>
<td>.20**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sickness Absence</td>
<td>(3, 6036)</td>
<td>.02**</td>
<td></td>
</tr>
<tr>
<td>40-50</td>
<td>BMI</td>
<td>(3, 3996)</td>
<td>.03**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GHQ-12</td>
<td>(3, 4216)</td>
<td>.22**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sickness Absence</td>
<td>(3, 3878)</td>
<td>.03**</td>
<td></td>
</tr>
<tr>
<td>50+</td>
<td>BMI</td>
<td>(3, 2368)</td>
<td>.01**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GHQ-12</td>
<td>(3, 2511)</td>
<td>.26**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sickness Absence</td>
<td>(3, 2299)</td>
<td>.01**</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05. **p < .01.
### TABLE B26

Regression Analyses Split within Lower Pay Grade

<table>
<thead>
<tr>
<th>Pay Grade</th>
<th>IV’s</th>
<th>DV</th>
<th>DF</th>
<th>Model R square</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Physical hazards, Psychosocial hazards, Gender</td>
<td>BMI</td>
<td>(3, 2772)</td>
<td>.03**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GHQ-12</td>
<td>(3, 2932)</td>
<td>.24**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sickness Absence</td>
<td>(3, 2715)</td>
<td>.02**</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>BMI</td>
<td>(3, 4221)</td>
<td>.04**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GHQ-12</td>
<td>(3, 4460)</td>
<td>.19**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sickness Absence</td>
<td>(3, 4160)</td>
<td>.02**</td>
</tr>
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<td>D</td>
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<td>BMI</td>
<td>(3, 6140)</td>
<td>.02**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GHQ-12</td>
<td>(3, 6549)</td>
<td>.12**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sickness Absence</td>
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<td>.02**</td>
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<td>Industrial</td>
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<td>BMI</td>
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<td>.01**</td>
</tr>
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<td></td>
<td></td>
<td>GHQ-12</td>
<td>(3, 900)</td>
<td>.28**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sickness Absence</td>
<td>(3, 806)</td>
<td>.04**</td>
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</table>

*p < .05.  **p < .01.
<table>
<thead>
<tr>
<th>Var</th>
<th>Model 1 (Low Grade)</th>
<th>Model 2 (Low Grade)</th>
<th>Model 1 (Low Grade)</th>
<th>Model 2 (Low Grade)</th>
</tr>
</thead>
<tbody>
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<td>B</td>
<td>β</td>
</tr>
<tr>
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<td>.09**</td>
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<td>.45</td>
<td>.03**</td>
</tr>
<tr>
<td></td>
<td>(.13)</td>
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<td>(.13)</td>
<td></td>
</tr>
<tr>
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<td>.54</td>
<td>.10**</td>
<td>.54</td>
<td>.10**</td>
</tr>
<tr>
<td></td>
<td>(.05)</td>
<td></td>
<td>(.05)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.11</td>
<td>.04**</td>
<td>.12</td>
<td>.04**</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td></td>
<td>(.03)</td>
<td></td>
</tr>
<tr>
<td>Psych Hazard x Age</td>
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<td>.02*</td>
<td>.023</td>
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</tr>
<tr>
<td>R²</td>
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<td>.02**</td>
<td>.02**</td>
<td>.02**</td>
</tr>
<tr>
<td>F</td>
<td>77.21**</td>
<td>.2.92*</td>
<td>77.21**</td>
<td>3.58*</td>
</tr>
</tbody>
</table>

**Note:** Psychosocial Hazards, Physical Hazards, and Age were centered at their means.

*p < .05. **p < .01.

Standard errors appear in parentheses under unstandardized betas.

Phys is abbreviation for Physical Hazards, Psych is abbreviation for Psychosocial Hazards.