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PERCEIVED NEW RISKS TO CONSTRUCTION WORKERS IN KUWAIT DUE TO RISING TEMPERATURES

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by

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TITLE: PERCEIVED NEW RISKS TO CONSTRUCTION WORKERS IN KUWAIT DUE TO RISING TEMPERATURES

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This study aimed to examine the risks construction workers in Kuwait face due to increasing temperatures. The environmental conditions for construction workers include working in hot and humid environments, wearing protective clothing, and performing hard physical work. These aspects place them at an increased risk for occupational heat stress. The health impacts of occupational heat exposure for construction workers are heat-related diseases, occupational accidents/ injuries, urological diseases, dysfunctional reproductive system, reduced mental health and cognitive functioning, vision and eye problems, and death. Heat exposure affects workers' health through heat-related illnesses, including heavy sweating, dizziness, muscle pain, fatigue, skin itchiness, and headache. Heat exposure also has various direct and indirect social implications for construction workers. It leads to family problems, workplace issues with co-workers and managers, reduced income, lack of basic amenities, reduced capability, and reduced productivity. One significant preventive measure for heat stress is providing training and education to workers on identifying heat stress signs and assessing and monitoring themselves and fellow workers while working in hot environments.

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PREFACE

The Purpose of the Study:

- The study's purpose is to understand better the various risks that workers in construction sites in Kuwait experience due to high temperatures.
- Generally, the physical activities of a construction worker are high, and when the worker is working in a hot environment, they are vulnerable to increased body temperature. The construction industry is among the most significant employment sector in Kuwait, and due to industrialization, the industry has undergone rapid development. Therefore, it is vital to study the impacts of heat strain on the millions of individuals who sustain and grow this sector.

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INTRODUCTION AND LITERATURE REVIEW

The temperature of the planet Earth has increased yearly since the industrial revolution. Since then, humans have released abundant carbon dioxide into the atmosphere. As a consequence, there has been a trigger of unnatural warming that has made the Earth's temperature increase drastically over a short period (Lemordant & Gentine, 2019). In particular, the Earth's temperature has risen by 0.08°C every decade since 1840, and it is expected to continue rising in the future (Acharya et al., 2018). Extreme heat exposure due to increasing temperatures has emerged as one of the significant threats to human existence and working populations' environmental wellness, health, and socioeconomics (Lucas et al., 2014).

For this reason, there has been great emphasis on the 2030 agenda for Sustainable Development Goals (SDGs), which is a universal call to combat increasing temperatures and global warming and ultimately preserve the planet (Weiland et al., 2021). According to Lucas et al. (2014), rigorous manual work in an environment with extreme heat exposure due to temperature increasing beyond 37° is hazardous as it leads to heat- stress-related diseases and deaths. Generally, the elderly are at an increased risk of increasing temperatures as the rates of hospitalization and mortality are higher in the older population (Lu et al., 2022). This is attributed to the fact that various measures of health decline with age. Thus, there is a need for formulating defined policies that focus on enhancing housing structures for the elderly since they have minimal external activity.

Kuwait is one of the hottest countries in the world, and in the last few years, it has been experiencing sizzling temperatures. According to Kartam et al. (2000), Kuwait is ranked 71 out of 121 countries worldwide in the global climate risk index. It is expected that by 2050, the

temperatures in the country will rise by an additional 2.4°*f (*Kartam et al., 2000). One of the working populations that have been significantly affected by the rising temperatures in the country has been construction workers. The construction industry in Kuwait is one of the largest sectors, meaning many individuals earn their income by working in this sector. Besides experiencing increasing temperatures, Kuwait has poor working conditions, which places construction workers at risk of extreme heat exposure (Alahmad et al., 2020).

Many guidelines for extreme temperatures advise people to remain in cool places or sheltered areas (Lucas et al., 2014). However, this may not be possible for construction workers as they mostly work in an open environment and thus have to work amid extreme heat stress and high metabolic demands. Since construction workers are a vital component of the global economy, there is a need to pay special attention to the risks faced by the workforce due to heat stress. A lack of proper regulations put in place to protect construction workers has placed them at an increased risk of heat-related morbidity.

Since the extreme temperatures due to the changing climate and other associated factors are expected to increase in the future, this means that construction workers will continue to be vulnerable to heat stress unless this issue is properly addressed both at a national level and an international level (Hurlimann et al., 2019). Also, due to globalization, the construction industry is growing at a high rate, and therefore it is increasingly offering jobs to millions of people nationally and internationally. Greenhouse gas emissions, particularly due to human activities, are increasing dramatically, and as a consequence, hot days are expected to last longer and with increased intensity and frequency. Other factors, such as more working hours accompanied by a large volume of work, improper regulation of construction businesses, and health disparities, mainly among the expats, further worsen the susceptibility of construction workers to

occupational heat stress (Acharya et al., 2018).

The Purpose and significance of the study

The general objective of this study is to investigate the risks that construction workers face in Kuwait due to rising temperatures. The study will focus on environmental conditions in construction, health impacts, and social implications of occupational heat exposure. It will also discuss practical preventive measures for occupational heat exposure in construction, such as training the workers. The study is beneficial as it informs policies and ideal measures addressing the various risks the construction workforce faces due to extreme temperatures. The study will also benefit companies, employers, and workers in various ways to save the workers and keep the work in progress.

Research Questions

what are the perceived new risks to construction workers in Kuwait due to the rising temperatures?

Two sub-questions were generated to answer the main question, each addressing parts of the main question.

Q1. What are the established risks to construction workers due to rising temperatures?

Q2. What are the perceived new risks of construction workers due to rising temperatures?

Literature Review

Sociology of climate change

Without a doubt, climate change is one of the most significant environmental issues in the modern world. It is an example of the dialectical of society and nature, which is essential for sociology (Bhatasara, 2015). Research on sociology emphasizes that forces of climate change cannot be merely amended by technical solutions, but rather they must function with other

effects on human behavior, including social, economic, and political structures. There are predictions that global climate change will have detrimental impacts on ecosystems and human society; therefore, climate change may be regarded as a social issue. Zehr (2015) indicates that sociologists have contributed immensely to understanding the human drivers of climate change. For instance, through sociology, people have understood the impacts of social structure on greenhouse gas emissions. Sociology is equipped with mechanisms and tools to examine and give insights into the causes, implications, and solutions to climate change.

Moreover, people have become aware of the role of power and politics in policy systems and the corporate sector. Sociology has contributed significantly to climate justice studies across various stratification systems (Brulle& Dunlap, 2015). Through sociology, humans have understood the impacts of climate change on their relationship with other species. Sociology must remain connected to environmental issues and climate inequalities to realize its potential contribution to the study of climate change and the application of these contributions-world change (Brulle& Dunlap, 2015).

According to (Zehr, 2015), increasing population size and increasing consumption are some of the practices that represent how human conduct contributes to climate and environmental change. Consequently, climate change can influence all social aspects of sustainable development (Zehr, 2015). These include employment, health, income and livelihoods, housing, education, and poverty. Regarding employment, climate change affects job opportunities in various industries (Bhatasara, 2015). More specifically, climate change, including changes in weather patterns and temperatures, has a social influence on construction workers in Kuwait, resulting in reduced health and loss of income and livelihoods.

Environmental working conditions in the construction

The construction industry is one of the industries with the highest risks of working conditions in Kuwait and internationally. Construction projects are normally socio-technical systems that can take various organizational forms. The construction industry is project-based and operates in a globalized environment (Abrey& Smallwood, 2014). Various figures are involved in completing construction projects, all of which significantly affect safety, such as authorities, contractors, subcontractors, and workers. According to Hassan (2012), each project is distinct in construction, and the various types of projects are houses, railways, roads, and bridges. Likewise, each project has a unique way of working with machinery and techniques.

In their physical working conditions, construction workers often wear helmets, gloves, earplugs, or safety goggles, depending on their work (Abrey& Smallwood, 2014). Most construction workers usually work outdoors and in an open environment. The most significant risk that construction workers face when working in outdoors is heat stress (Acharya et al., 2018). Other risks they may be exposed to include contaminants (fumes from paints), hazardous equipment, bright or dim lighting, and whole-body vibration (e.g., when using a jackhammer).

According to Horie (2013), heat stress in the workplace is likely to happen under four primary conditions: hot and humid environments, clothing with less air permeability, heavy workloads, and inadequate break periods. Environmental conditions that prevent occupational heat stress are indicated by the values on the WBGT while taking into account the intensity of work, break frequency, and clothing type (Horie, 2013). The American Conference of Government Industrial Hygienists (ACGIH) recommends limited threshold values (TVLS). The TLVs values represent the maximum level a worker can be exposed to while working without adverse effects (Smith &Perfetti, 2018).

The TLV values suggest that the upper limit for physically demanding work such as sawing, and hand drilling is 27.5°C. This should be followed even if more than 25% is allocated to breaks and rest. In addition, the action limit employers can begin discussions to improve working conditions is 24.0°C (Horie, 2013). If an employer is acclimatized to a hot working environment and uses their hands and the upper arms, the upper limit is 30°C, and if they use the whole body, the upper limit is 28°C. By following these measures, working in an environment where WBGT is more than 28°C, work requiring engaging the whole body must not exceed one hour (Horie, 2013).

Health impacts of occupational heat exposure

According to Dutta et al. (2015), deterioration in health is a significant risk factor for occupational heat stress. Exposure to extremely high temperatures puts construction workers at risk of developing heat-related illnesses and injuries, particularly those working outdoors. These risk factors include the usage of machinery and powered equipment, heavy workload, working in elevated areas, and poor accommodation conditions near construction sites (Dutta et al., 2015). Other factors include temporary employment through sub-contracting and constant and direct exposure to solar radiation. In this study, the health impacts of heat exposure on construction workers have been categorized in the following ways:

- Heat-related diseases.
- Occupational accidents or injuries.
- Impact on the urinary and reproductive health systems
- Impact on mental health.
- Death
- Other health impacts of heat exposure.

- Social relations of occupational heat exposure.
- Educating the construction workers on heat stress.

Heat-related diseases

Heat-related illnesses account for most of the health impacts of heat exposure. Many researchers agree that exposure to unusual heat and humidity without proper rest or sufficient fluid intake can lead to various heat stress-related illnesses (Xiang et al., 2014; Dutta et al., 2015). Especially the rates of hospital visits and hospitalizations due to heat-related illnesses are increasing steadily. For example, a study by Riley et al. (2018) showed that emergency department visits due to occupational heat-related illness were highest among male workers and workers from minority communities. This suggests that significant factors that increase the risk of heat-related diseases are gender and ethnicity. The study also showed that the hospitalization rate due to heat-related disease was 1.5 times higher among black people compared to white. In addition, as the number of construction workers increased, the number of emergency department visits due to heat-related diseases increased by 8.1%, while the hospitalization rate increased by 10.9%. Furthermore, the highest incidence of heat-related diseases was observed among men and individuals living in rural areas (Riley et al., 2018).

Arcury et al. (2015) found that about 35% of the workers reported heat-related illnesses while working outdoors, while about 13% reported heat-related illnesses while working indoors. Factors associated with heat-related illnesses while working in the open environment included wet shoes and wet clothing. The participants reported various heat illness symptoms, and variables such as body hotness, urination frequency, and body mass index were utilized for regression analysis. El-Shafei et al. (2018) stated that construction workers' most reported heat stress symptoms were sweating, dizziness, muscle pain, headache, and skin itchiness. Moreover,

the majority of the construction workers showed signs of average dehydration. Dutta et al. (2015) reported that the workers' most symptoms of heat illness were excessive sweating, dark-colored urine, and colored mouth. Kakamu et al. (2021) explored factors associated with heat-related illness risk among construction workers. The researchers found that inadequate sleep is a risk factor for heat-related illness. Inadequate sleep has a strong relation to fatigue. Besides, fatigue due to insufficient sleep may lead to a rise in heat rate (Kakamu et al., 2021). Thus, heart rate after a simple exercise may be an excellent index for heat-related illness risk assessment.

Contrary to the conventional wisdom that aging increases the risk of heat-related illness. Kakamu et al. (2021) found that younger construction workers were at a higher risk for heat-related illness. This is supported by Riley et al. (2015), who found that the highest incidence of heat-related diseases was higher in people aged between 15 to 35 years old. According to Hifumi et al. (2018), exertional heat-related illness is more common in healthy young individuals, while classical heat-related illness is more common in the older population. One explanation for this is that younger age groups have a tendency to pay less attention to heat-related illness prevention measures. Furthermore, younger people tend to engage more in physical work that requires high intensity, while older people tend to engage in physical work that requires less intensity (Hifumi et al., 2018). However, older workers might feel higher physical strains than younger workers because the risk of heat-related illness in the elderly increases even when they engage in light workloads.

Kakamu et al. (2021) also reported that construction experience reduced the risk of heat-related illness. That means that construction workers with more experience doing physical work outdoors have a reduced risk of heat-related illness than workers with no or less experience. This is because experienced workers are more acclimatized to heat and exertion per job requirements.

Another factor associated with the risk of heat-related illness is maximum skin temperature (Kakamu et al., 2021). Notably, heavy sweating as a major symptom of heat-related illness has been emphasized in several studies (El-Shafei et al., 2018; Dutta et al., 2015). One of the major minerals lost in sweat is sodium. However, when sweating excessively, the sweat glands are unable to reabsorb enough sodium. This causes an increased sodium concentration, leading to high osmotic pressure in the blood (Horie, 2013). This can cause distress and discomfort for the worker. Moreover, some symptoms of heat illness, such as dark-colored urine, happen when a person is sweating excessively and without consuming enough fluids (El-Shafei et al., 2018).

Occupational accidents or injuries

Occupational accident refers to an unexpected event that has a connection with work and results in injuries to workers, disease, or even death. In addition to contributing to the global economic and health burden, accidents or injuries in occupational settings leads to a significant burden for the workers, their families, and co-workers (Shah, 2011). Estimates from the International Labor Organization (ILO) show that 317 million occupational accidents occur globally every year, which means that 153 accidents happen every 15 seconds (McInnes et al., 2017). For most countries, economic costs for occupational-health issues, including injuries, are projected to equate to 4 to 6 % of the gross domestic product (McInnes et al., 2017). ILO (2017) classifies the severity of occupational injuries into two: occupational injuries that lead to the absence of the injured employee from work for a period of fewer than four days and occupational injuries that lead to the absence of the injured employee from work for a period of more than four days.

In Kuwait, the labor law requires a worker to report to the public authority of the workforce about occupational-related accidents in the company (Shah, 2011). This is to assess

why accidents have occurred and take appropriate steps to minimize the risks of accidents in the future. Moreover, national statistics are produced annually to track the incidences of occupational-related accidents in Kuwait and compare yielded prevalence with other countries (Shah, 2011). A study by Al Fajjam S.M. & Samir A.M (2018) found that occupational injuries were more prevalent among younger workers in Kuwait. One possible reason for this is that younger people work in departments that require them to do more physical work, which increases the risk of exposure to risky situations. Al Fajjam S.M. & Samir A.M (2018) also reported that many expat Indian workers had more injuries than workers from other ethnicities. The higher prevalence of work-related injuries among the younger workers and the Indian workers could be explained by a lack of minimal experience, expertise, negligence of safety precautions, and lack of training in safety rules (Al-Thani et al., 2014).

Increasing temperatures have been identified as a significant risk factor for occupational-related injury. Understanding the relationship between occupational heat exposure and injuries is crucial in the context of a warming climate. Osborne & Vernon (1922) were the first researchers to identify the association between occupational injury and heat exposure. The researchers found fewer accidents occurred in the British factories when the temperatures were around 20°C, while many accidents occurred when temperatures were lower and higher. Since then, there have been various studies and reports on work-related accidents/injuries as a result of high temperatures. Page & Sheppard (2016) reported estimates of occupational accidents due to ambient temperatures in the U.S. from industries such as construction, forestry, and agriculture. The reports indicate that on those days when temperatures were between 32°C and 37°C, there were an 8.2% increase in the accident rates and a 30 % increase in accident rates when temperatures were above 37°C. Likewise, it was reported that when temperatures were between

21°C and 27°C, injury rates increased by 4%, and when temperatures were above 37 °C, the rates increased by 30% (Page & Sheppard., 2016).

Some specific types of occupational injuries sustained while working in hot conditions include slips/falls, burns, cuts, getting hit by objects, wounds, amputations, and exposure to harmful substances (Spector et al., 2019). Such injuries may occur due to the influence of increasing temperatures on cognitive and physiological changes such as fatigue, physical discomfort, a decline in psychomotor performance, reduced concentration, and reduced focus (Spector et al., 2019). According to Varghese et al. (2018), there is a significant difference between increasing temperatures and heat waves. Heat waves have more hazardous impacts, as they are prolonged periods of excessively high temperatures. Heat waves lead to more severe injuries such as wounds, burns, amputations, and lacerations (Xiang et al., 2014).

Factors that increase the vulnerability to occupational injuries due to heat exposure include being male and young. For instance, McInnes et al. (2017) found that young male workers in Australia had a higher risk of injury on hot days. Likewise, other subgroups of workers had increased vulnerability to occupational injuries and accidents following a warm night. Varghese et al. (2018) indicate that factors that make a worker susceptible to work-related injuries in hot environmental conditions include sweaty palms, lack of expertise and training, physically intensive work, accidental contact with hot surfaces, foggy safety glasses, poor hydration, too heavy PPEs, and negative behavior and attitudes to work.

Varghese et al. (2018) further illustrate that the physiological factors that make an individual vulnerable to physical injury correlate with the capability of the thermoregulatory system in the body to respond to and deal with extreme temperatures. Higher surrounding temperature than skin temperature results in changes in blood circulation due to the skin's

inability to lose excess heat. Consequently, there is less blood supply to vital organs such as the brain, resulting in problems such as dizziness and fainting, which can result in injuries (Varghese et al., 2018).

Khanzode et al. (2012) illustrate that the nature of physical work plays a role in causing injury. This is because metabolic rate is directly related to muscular work. Most construction workers perform physically demanding work, such as carrying heavy loads, creating trenches, and operating machinery (Kakamu et al., 2021). Such activities are associated with significant muscle fatigue, which can occur if the blood P.H. levels reduce because of increased glycogen degradation in skeletal muscle. Additionally, there could be an increase of highly reactive molecules in the skeletal muscles. Consequently, muscle strength significantly declines, affecting the worker's performance, and as a result, the worker could be more vulnerable to physical injuries (Varghese et al., 2018).

Impact on the urinary and the reproductive health systems

Evidence shows that heat exposure in occupational settings influences the urinary system leading to various urological diseases or conditions. The urinary system comprises the kidneys, ureters, bladder, and urethra (Lu et al., 2022). The purpose of the urinary system is to filter toxins and wastes from the blood through urine. According to Simmering et al. (2021), prolonged exposure to excessively higher temperatures increases fluid loss from sweating, reducing extracellular fluid and leading to dehydration. Consequently, reduced urine output reduces the clearance of bacteria from the urinary tract, resulting in urinary tract infections. Luo et al. (2014) reported a close relationship between ambient heat exposure and urolithiasis in their study. Laborers working in the hot conditions outdoors were more likely to have urolithiasis than workers working indoors. Dehydration resulting from excessively sweating under heat exposure

is one of the mechanisms stimulating urolithiasis. Thus, increased water intake is a significant preventive measure for urinary conditions (Luo et al., 2014). However, the nature of work may not always allow construction workers enough breaks to rehydrate, increasing their risk of developing urinary conditions.

Nerbass et al. (2017) further emphasize that occupational heat stress significantly affects kidney health. In particular, heat stress increases the risk of kidney stones. Kidney stones are tiny crystals in the kidneys or the urinary tract. Extreme hot environments trigger dehydration, which causes the formation of kidney stones. Likewise, people with kidney stones are more likely to develop chronic kidney disease (Simmering et al., 2021). Furthermore, daily excessive heat exposure and repeated dehydration may stimulate rhabdomyolysis and hypoperfusion related to exertion and can increase the risk of chronic kidney disease (Luo et al., 2014). Health safety procedures and adaptation strategies in occupational settings should always be considered and implemented to deal with heat stress's health impacts.

Heat stress can also significantly affect most aspects of the reproductive function by comprising hormonal imbalance and the physiology of the reproductive tract. For instance, excessive heat exposure in males affects the quality and motility of the sperm. According to Xiang et al. (2014), male workers working in hot conditions are likely to have impaired motility through scrotal insulation, which can affect sperm quality. Lee et al. (2022) indicate that majority of men with azoospermia and oligozoospermia have high testicular epididymal temperature because of occupational heat exposure.

Impact on mental health

A close association exists between heat stress and psychological conditions and cognitive problems. The strongest evidence is found in a study by Burke et al. (2015), who found that in

the U.S, the suicide rates increased by 0.7%, and in Mexico, the suicide rates increased by 2.1% due to an increase in average monthly temperatures. It is estimated that by 2050, there will be an estimated number of around 40,000 additional suicides in the U.S and Mexico due to climate change and global warming (Burke et al., 2015). These rates are almost equal to suicide incidences due to social-economic aspects such as unemployment and poverty.

People working in hot conditions are likely to exhibit suicidality or use depressive language, indicating a decrease in mental wellness (Nunfam et al., 2018). The biological and physiologic mechanisms of serotonin are presumed to play a role in such behaviors. Increasing temperatures are likely to trigger anxiety and cause an increase in levels of the stress hormone known as cortisol, which aggravates anxiety symptoms (Luo et al., 2014). Research indicates that risks of hospital admission and emergency department visits for psychiatric conditions have increased in hot seasons (Thompson et al., 2018). This suggests that mental health impacts should be incorporated into policies for public health response to increasing temperatures.

Excess heat has also been shown to impair the cognitive functioning of workers. Varghese et al. (2018) indicate that workers working in air-conditioned environments are likely to have improved cognitive function than those working in non-conditioned environments. Complex cognitive processes are highly likely to be impaired due to heat stress. Mazloumi et al. (2014) evaluate the impacts of heat stress on cognitive functioning in a sample of 70 workers working in a hot industry. The researchers confirmed that there was an impairment of cognitive processes such as reaction time, selective attention, working memory, and processing speed under heat-stress conditions. Lack of comfort, disturbances, unconsciousness and cognitive fatigue that occur due to heat stress cause the cognitive performance of the worker to undergo various changes. This suggests that thermal stressors adversely affect an individual's

psychomotor capacities and information processing (Gaoua et al., 2011).

The increased heat contributes to insomnia, a sleep disorder associated with difficulty falling asleep (Luo et al., 2014). Sleep is a critical function of an individual's overall health and well-being. Therefore, sleep deprivation can adversely affect depression, mood, cognition, and overall quality of life. The core body temperature drops during the nighttime sleep phase and increases during the wake phase (Okamoto-Mizuno & Mizuno, 2012). That means a decreased core body temperature triggers normal sleep onset and maintenance. Heat stress and increased humidity can make an individual have trouble falling asleep and staying asleep, potentially worsening all psychological difficulties and coping abilities. This has implications for construction workers as they tend to work in temperature-sensitive environments and have limited access to air-conditioning or cool places.

On top of that, increased temperatures are likely to worsen the psychiatric symptoms in workers with already existing severe mental illnesses. For instance, people with schizophrenia may have altered thermoregulation (a feature distinct to the condition). Thus, when they get exposed to intense heat, they can significantly lose their delicate ability to make good plans and efficiently take care of themselves (Ota et al., 2014). These people are at an increased risk of having heat stroke and other heat-related illnesses. Furthermore, individuals working in hot conditions and taking psychiatric medications such as antidepressants are likely to have reduced mental health (Luo et al., 2014). Psychiatric medications can alter the body's heat regulation and put an individual at greater risk for hazardous toxicity during heat waves.

Death

Excessive occupational heat exposure at the workplace has been associated with increased deaths. The relationships between heat exposure and mortality risk have been

interpreted in several study designs, such as case-crossover studies, register-based cohorts, and time-series analyses (Alahmad et al., 2019). Yoon et al. (2021) indicate that the dose-response model has further shown the casual association between heat exposure and risk of mortality. Such significant associations have been tested in various parts of the world. Therefore, the relationship between heat waves and the risk of death has been accepted as a common phenomenon in various geographical regions.

For instance, a study by Alahmad et al. (2020) showed that in Kuwait, males were at an increased risk of death due to extreme temperatures compared to women. These gender differences could be explained by the gendered-social structures that require women in many Arab countries to stay indoors to take care of the family. Therefore, cultural and social norms could be key determiners of outdoor heat exposure. Alahmad et al. (2020) also reported that the working population (aged between 15- 64 years old) was at an increased risk of death due to the increasing temperatures. Al-Kandari& Crews (2014) indicate that adults in Kuwait tend to receive more social support and frequent visits from family members, friends, and the religious community. Such aspects could play an important role in minimizing exposure to extreme heat and ultimately enhancing overall health.

Alahmad et al. (2020) reported that the non-Kuwait population was more vulnerable to heat exposure mortality than the Kuwait population. According to the Ministry of Health (2015), the non-Kuwait population comprises about 65% of males who are in the working-age group. That means these people are more likely to take up physical work and have more heat exposure than the Kuwait population. This interpretation is in line with Achilleos et al. (2013), who found that the mortality rate is higher among non-Kuwaiti males as they spend extra time outdoors. A similar study by Alahmad et al. (2019) found that extremely high temperatures were associated

with increased mortality risk in Kuwait. These findings provide various insights into the climate vulnerability and environmental issues in hot and arid regions. Air-conditioners have been recommended as a protective measure against heat-related deaths. Kuwait is a prosperous country, and air conditioners are likely to be used throughout the year, particularly in indoor environments. In spite of the increasing temperatures in Kuwait than in other regions, the degree of health impacts may be explained by the use of air-conditioners, acclimatization, and other adaptive behaviors such as staying indoors (Alahmad et al., 2019).

Pradhan et al. (2019) examined whether heat exposure resulted in deaths among Nepali expat workers in Qatar. The researchers found that the annual mortality rate for Nepali expat workers was 150 deaths per 100,000 workers. The leading cause of these deaths was cardiovascular diseases. Notably, these deaths due to cardiovascular diseases were poorly labeled as cardiac arrest. On average, the risk of heat mortality increases by 0.2%-5.5 % for every 1 °C rise in temperature (*Heat and health)*. The study findings by Pradhan et al. (2019) also showed that there was a strong association between average afternoon heat levels and cardiovascular disease mortality. This implies that these deaths could have occurred during the hot months due to increased heat strain. Therefore, there is a need to implement adequate heat protection as a part of health and safety programs.

In the United States, data between 2000 and 2010 showed that the yearly average fatality rate due to heat exposure was 0.22 per one million workers (Gubernot et al., 2015). The fatality data further showed that the highest heat-related mortality rates were identified among the construction, agriculture, Hispanic, and men workers and owners of small businesses. This suggests that factors that might increase the risk of heat-related mortality are occupation, ethnicity, and gender. According to Acharya et al. (2018), in the U.S., the rate of heat-related

mortality was 13 times higher in the construction industry compared to other sectors. In their study, Yoon et al. (2021) reported that over 13 years, there were over 4.5 million deaths among Korean workers due to heat exposure, and 17% of these deaths occurred outdoors. Maximum daily temperature (MAXT) was increasingly associated with a higher risk of death and outdoor deaths (Yoon et al., 2021). In the U.S., more than 1,300 deaths every year are associated with hot temperatures (Bobb et al., 2014). It is worth noting that this indicator is likely to underestimate the deaths that occur due to heat exposure because the stress of a hot environment can elevate the risk of dying from heart and respiratory conditions. Such causes of death are more prevalent than heat-related illnesses.

Other health impacts of heat exposure

Extreme heat exposure has also been associated with other health issues, such as eye problems and dyslipidemia (Luo et al., 2014). Thermal cataracts have been regarded as an occupational affliction in relation to eye problems. A study by Yasmin et al. (2013) show that workers exposed to increased temperatures reported having an inflammation of the conjunctiva (the tissues lining the eyelid). Ultraviolet radiation in occupational settings also causes eye problems in workers. Eye problems and decreased vision may make workers vulnerable to occupational accidents and injuries. In their study, Sahu et al. (2013) found that workers exposed to heat had an increased risk of dyslipidemia, which refers to unhealthy cholesterol and lipids levels in the blood. The abnormal cholesterol level is related to the production of cortisol, which increases under heat stress states. Likewise, under heat exposure, cardiovascular strain is linked with the production of cortisol (Luo et al., 2014). Thus, it is crucial to regularly screen the lipid profile of the workers exposed to heat.

Social implications of occupational heat exposure

Given that occupational heat stress significantly affects the health of construction workers, there is the expectation that it may have social implications for all workers. Heat stress aggravates the existing workplace and settlement issues for construction workers, leading to direct and indirect social effects (Nunfam et al., 2018). The construction industry is not a well-structured sector as, most of the time, many workers are hired by intermediaries on a daily basis. According to Kakamu et al. (2021), many construction sites have continuous heavy physical workloads with no organized breaks. Besides the ambient temperatures, workers suffer from physically demanding work and poor working and accommodation conditions, and all these aspects cause social disruptions. Venugopal et al. (2016) reported that many construction workers stated that working conditions such as occupational heat stress significantly affected their normal living and social lives. Explanations of the social implications may include fatigue and tiredness that influence normal functioning and work capability. Likewise, heat-related illness could result in poverty through the disability or the death of the breadwinner due to the disease and high medical expenses associated with disease treatment.

This phenomenon typically creates issues with the supervisors and managers, which affect the job opportunities for the workers, thus sinking them further into poverty (Venugopal et al., 2016). Many workers report experiencing workplace frustrations and stress due to heat-related fatigue and illness, which can influence social behaviors such as alcohol consumption, substance use, and smoking (Nunfam et al., 2018). Research indicates that extremely high temperatures increase interpersonal violence by 4% and group violence by 14% (Hsiang et al., 2013). This significantly impacts the workplace and domestic violence against women, men, and children. Since construction workers are hired daily, many have insecurities and worries about

the availability of jobs, and getting jobs depends on the nature of the worker's relationship with the intermediaries.

Due to the construction job's travel demands, some construction workers' children are unable to get formal education (Nunfam, 2021). The lack of supervision when parents are out working forces children, especially girls, to take up parenting roles and care for their younger siblings. This also may deny them opportunities to get formal education. Many migrant construction workers lack social identity cards and permanent addresses, limiting their access to government subsidies and benefits such as medical insurance and free education (Nunfam et al., 2018).

According to Nunfam et al. (2018), fatigue interferes with family life for many workers working in hot environments as they lack leisure time to spend with family members. This may result in negative child development, low family fitness, and a lack of trust and communication in the family. On top of that, occupational injuries and other heat-related illnesses affect the social well-being and cohesion of the workers with their families (Venugopal et al., 2016). For example, a worker who has had their legs amputated due to the effects of heat waves may be unable to spend time outdoors with family members and friends.

Medical expenses due to treating heat-related illnesses erode income, which affects family education (Nunfam et al., 2018). As a consequence, many workers may be unable to pay for the educational fees for their children and provide for other basic needs. Increased irritation, reduced focus, and exhaustion of workers due to occupational heat exposure increase the risk of poor interrelations with co-workers, managers/supervisors, family members, and community members (Nunfam, 2021). It is vital that workers get along with their co-workers and supervisors to make the workplace more comfortable and healthier.

The social wellness effects of occupational heat stress are also associated with productivity issues (Nunfam et al., 2018). Productivity highly depends on thermal conditions, particularly during physically demanding work. When a worker is working in environments characterized by extreme heat, the natural body response is to slow down to minimize metabolic heat production. This defense mechanism results in decline in work capability and subsequently reduced worker productivity (Venugopal et al., 2016). Productivity losses will significantly affect workers from poor backgrounds and their ability to earn due to health decline and add a further burden of medical costs to their already limited income (Venugopal et al., 2016). In addition, productivity losses affect the work progress at the construction sites, which directly affects the outcomes of the projects and indirectly affects the economy.

Due to heat-related symptoms and illnesses, many workers take frequent day-offs, which lowers productivity. As a result, they may be unable to complete their work and targets on the scheduled time (Nunfam, 2021). Work productivity is lowest in the afternoon. The rising temperatures may explain this during the afternoon sessions, which translates to more heat stress (Nunfam, 2021). Since heat stress leads to impairment of cognitive processes such as short-term memory, visual-motor tracking, arithmetic efficiency, and attention, it can potentially minimize the capability and productivity of the workers and resulting work output (Nunfam et al., 2018).

Educating the construction workers on heat stress

Since heat stress can significantly affect workers' health, social wellness, work capability, and productivity, construction companies in Kuwait should take preventative measures for heat stress. More specifically, significant stakeholders such as health and safety managers, regulatory authorities, and public interest groups are at the frontline of occupational health and safety in the construction industry in Kuwait. Such stakeholders are responsible for safeguarding and

protecting the workers' health, safety, social well-being, and productive capacity (Jacklitsch et al., 2018). In addition, they have the mandate of determining, assessing, and controlling work-associated and environmental hazards.

According to Rowlinson et al. (2014), creating awareness and providing education through training interventions are employers' first steps to protect their workers in construction against extreme heat exposure. Jacklitsch et al. (2018) indicate that when workers lack training and knowledge about preventative controls, they are at an elevated risk for heat-related illness. Therefore, it is crucial to ensure that workers are aware of the dangers and potential outcomes of heat stress (McCarthy et al., 2019). This enables workers to protect themselves and have an idea of how to protect their co-workers.

The training should cover heat hazards, signs and symptoms, risk factors, and first aid. More importantly, heat stroke, as the most severe heat-related illness (Jacklitsch et al., 2018), should be discussed in detail since it varies between individuals, types of activity, and symptoms. Furthermore, if it is not treated promptly, it usually leads to death. Educational interventions and training should include the impacts of alcohol, tobacco, caffeine, and medications that may minimize heat tolerance and ultimately increase the risk of heat stress (McCarthy et al., 2019). Construction workers should be educated on the importance of immediately reporting any signs of heat stress-related illness to the supervisors at the work sites. There should also be training on the workers' procedures to respond to symptoms of potential heat-related illness and how to contact emergency services (Stoecklin-Marois et al., 2013). It is crucial that these procedures are easy and clear to follow such that all workers understand them. Construction companies should offer frequent refresher training to the construction workers to review fundamentals they may have forgotten, particularly regarding signs and symptoms of heat stress (Rowlinson et al.,

2014).

Workers working in hot environments should be educated on the importance of taking frequent medical evaluations to determine the possibility of underlying conditions that may result from heat stress (Jacklitsch et al., 2018). During training, printed materials such as brochures containing proper heat stress-related illness information, such as symptoms and first aid, should be distributed to the workers (Stoecklin-Marois et al., 2013). Additionally, construction workers should be invited to participate in discussions about cultural beliefs and attitudes toward heat stress. For instance, some workers may have the perceived belief that by becoming dehydrated before work, a person becomes "hardened" and thus may not necessarily require fluids when working (Jacklitsch et al., 2018). Likewise, regarding signs of heat-related illness, some workers believe that if an individual is sweating, they are not experiencing heat stress. Educating the workers against such misinformation is essential by replacing them with facts.

Besides training, construction companies can also hold brief safety meetings a couple of times a week (McCarthy et al., 2019). During safety meetings, employers can highlight the significance of sufficient hydration and cool-down areas. Through such brief meetings, construction workers can learn how to identify heat stress signs and the appropriate steps they should take. Due to the increased technology usage, there has also been a growing interest in training for heat stress available in digital forms such as phone applications and online training (Jacklitsch et al., 2018). Construction companies and individual workers can use portable electronic devices at work sites. An excellent example of a successful app is the OSHA-NIOSH heat safety tool app, which is useful in planning outdoor work activities based on the hotness of the day (Jacklitsch et al., 2018). Besides training the construction workers, it is crucial to train the supervisors to monitor weather reports and respond to warning systems for increasing

temperatures (McCarthy et al., 2019).

Furthermore, the worksite supervisors should also be trained on the procedures they should follow, such as emergency response procedures when a worker has symptoms of heat-related illness. Exertion is a risk factor for heat-related illness, and work in the construction industry involves heavy manual work (Varghese et al., 2020). This may imply that construction workers should be educated on the importance of taking adequate time for recovery and sufficient hydration when working in hot conditions.

Heat stress in the construction industry may be prevented or minimized by developing and implementing work practice controls or engineering controls. For example, health and safety managers can identify the various environmental conditions when planning work activities to be done during increasing temperatures (Horie, 2013). In addition, companies and employers can schedule physically demanding activities during the low-sunlight hours, such as morning hours, to protect workers from heat-related illnesses (Rowlinson et al., 2014). In addition, employers can post safety signage and send electronic information about heat stress to remind workers to assess and monitor themselves while working in hot conditions. Companies and employers can provide enough cooling gear to the construction workers, such as helmets, cooling vests, misting systems, sleeves, and towels (Horie, 2013). It is important that when working in hot conditions, the clothing should be light-colored and loose-fitting. Construction workers should be trained on how to properly use heat-protective equipment and clothing (Jacklitsch et al., 2018).

Providing mineral water as a method of hydration can help the workers stay properly hydrated throughout the day. Educating workers on the importance of self-hydration is also crucial to minimize the risk of increased heat stress (Smith et al., 2021). Construction companies should also set a period for acclimatization to heat, which is a period to improve tolerance to

heat. According to Jacklitsch et al. (2018), many companies lack an acclimatization plan which is highly linked to the deaths of workers when health and safety authorities are examining cases of heat-related illness. Acclimatization comprises the physiological adaptations that occur during successful and repeated exposure to a hot environment (Jacklitsch et al., 2018). As a result, an individual is able to work more efficiently with a reduced likelihood of heat-related illness.

This implies that when construction workers are not acclimatized to the heat and are exposed to heat, they are more likely to exhibit signs of heat stress-related illness. Likewise, they have challenges in replacing the water lost during sweat (Smith et al., 2021). During training for heat stress, there should be an emphasis on the importance of acclimatization and the various ways construction workers can achieve acclimatization (Jacklitsch et al., 2018). For instance, workers can gradually acclimate themselves to heat by increasing the workload performed in hot conditions (Horie, 2013). Construction companies could also implement the buddy system (Jacklitsch et al., 2018), where workers educate their co-workers about the dangers of heat stress and the preventative measures they should follow.

Occupational heat strain theory

The present study is based on the occupational heat strain theory. The occupational heat strain theory is directly associated with the idea that heat stress threatens the capability of workers to work and lead meaningful and healthy lives (Flouris et al., 2018). Occupational heat strain has significant productivity and health outcomes; thus, it should be identified as a public health concern (Flouris et al., 2018). Occupational heat strain consists of changes in temperature, heartbeat, and sweating. The occupational heat strain theory is critical for this study as it helps in understanding how extreme temperatures influence workers.

Heat strain is a body response due to the overall load of heat stress. Heat stress can be a

combination of external environmental heat and internal body heat due to metabolic processes (Hurlimann et al., 2019). Therefore, there are two types of heat exposure sources in an occupational setting: weather-related and human-made heat exposure. According to Acharya et al. (2018), heat stress is dependent on various factors such as humidity, wind, air movement, temperature, clothing, and physical activities. These variables differ significantly in regard to occupation, environment, and individual workers.

Research indicates that workers find more comfort while working in a hot and humid environment than while working in a hot and dry environment (Zhang & Schwartz, 2014). The conditions that come with working in hot and dry environments and the heavy physical, work, and protective equipment (PPE) further exacerbate heat stress. Thus, various metrics have been utilized to characterize heat stress, such as simple temperature metrics, composite indices for temperature and humidity, skin temperature, and core body temperature. This is attributed to the fact that heat strain is the total heat load caused by various variables such as environmental conditions, body metabolic heat, thermal impacts of clothing, and physical activities. The Wet Bulb Globe Temperature (WBGT) has been commonly used to measure air temperature, radiant heat, humidity, and wind speed, particularly in occupational settings (Morris et al., 2019).

According to Parsons (2006), WBGT has limitations in measuring the impact of wind speed and impacts of metabolic rate. Despite this, WBGT is still a crucial index for measuring heat effects. The thermal Work Limit (TWL) is another heat stress index that has relevance for the construction workforce working outdoors (Acharya et al., 2018). TWL is used in occupational environments that incorporate weather variables into a single index as the equivalent body metabolic rate. Notably, though skin temperature and core body temperatures are better indicators of heat exposure than other measures, they are not commonly used due to

safety precautions and logistics concerns. This is because, in order to measure the skin temperature, people are required to attach or ingest a sensor that measures the temperature (Acharya et al., 2018).

Gender differences in healthcare use

The construction industry is one of the most male-dominated industries globally. Regarding gender, it has been observed that many men are unwilling and lack the motivation to take care of their health in everyday life during stressful life events, including heat stress hazards (Novak et al., 2019). In addition, it has been noted that men tend to be less active in seeking health-related information because of the social constructs of masculinity (Novak et al., 2019). Therefore, even when information about the prevention of heat stress is readily available on construction sites, men have inadequate competency to engage with such information because of pure ignorance or reluctance. As mentioned earlier, the symptoms of heat-related illnesses tend to be worse in men as compared to women (Achilleos et al., 2013). When men fall ill due to heat-related illness or any other type of illness, they largely avoid seeking medical attention (Lee et al., 2015). Several reasons explain this, including discomfort or embarrassment with discussing specific issues and dislike of being told that they should change their routines or lifestyle (Vaidya et al., 2012). Thus, adhering to behavioral choices associated with masculine beliefs significantly contribute to higher rates of diseases and lower quality of life among men.

Social dynamics in managing heat stress in the construction industries

Although it is in the long-term interest of employers and government regulators of the construction industry to promote occupational health and safety, in reality, some of them do not invest in a culture of health and safety (Sánchez et al., 2017). Some of these employers and policymakers look at workers' health and safety as nothing more than a checklist, as they do this

just to meet workplace standards and avoid penalties (Shea et al., 2016). This is particularly seen in how ethnic minority groups are treated worldwide in the construction industry. In western cultures, particularly among young people, construction work has a reputation for being hard, dirty, and mentally draining, and thus many shy away from working in such environments (Venugopal et al., 2016). Because of race-based discrimination and lower socioeconomic status, migrant/ethnic minorities take such positions in construction (Wrench, 2016). For instance, in developed countries, including the Middle East, many migrant construction workers originate from South Asia and Africa. According to Abdul-Aziz et al. (2018), such migrant/ethnic minorities are considered because they make few demands, are easier to segregate and lay off, and can accept low payments. However, these ethnic minorities endure labor abuse and exploitation in addition to working in dangerous and unhealthy construction conditions (Abdul-Aziz et al., 2018).

Labor abuse in the construction sector may entail no rest hours or holidays, unpaid wages, unpaid overtime work, and contract substitution. For instance, when working in hot conditions, the ethnic groups may be denied protective clothing, taking breaks, or practicing sufficient hydration practices, and may be allocated longer work periods. In addition, migrants/ethnic minorities in construction companies live in unsanitary and overcrowded housing (Abdul-Aziz et al., 2018). Also, they become vulnerable to exploitation by construction employers because they have low education levels, limited financial resources, and lack alternative job opportunities (Wrench, 2016). These systemic barriers, including labor abuse and exploitation, place unequal value on minority groups. In addition, they exacerbate the health impact of heat-related illness (Venugopal et al., 2016). Consequently, improving occupational safety and health in the construction industry becomes challenging. In a nutshell, in order to properly manage heat

stress among all construction workers, employers and government regulators need to genuinely care about the health and safety of workers (Sánchez et al., 2017). Declaring safety and health as a priority is insufficient. However, it needs to be reflected in how construction employers treat workers and how the entire business processes and practices are conducted.

CHAPTER 2

METHODOLOGY

Introduction

This chapter discusses the methodology of the paper. This study used entirely qualitative data collected via interviews and observations. This is because qualitative data is detailed and all-inclusive; offers more than a snapshot; focuses on lived experience and places in its context (Tracy, 2019, pp. 56), which is essential to assessing the risks to construction workers in Kuwait due to rising temperature.

This chapter starts by revisiting the research questions of the paper and the data used to answer the question. After that, the data collection procedure is explained. This includes the process of the collection of the interview data is documented. Furthermore, the process of the conduct of observation and collection of the observation data is also documented. The data analysis procedure adopted is also detailed. For the data analysis, issues related to the research quality and ethical consideration for the data were also highlighted.

Research question

The main research question of this study states: what are the perceived new risks to construction workers in Kuwait due to the rising temperatures? There are two significant issues in the research question. The first is to examine the established risks to construction workers in Kuwait due to rising temperature, and the second is to explain whether there are new risks or not. Most construction workers in Kuwait are affected by increasing workplace temperature, and these effects can be categorized into health and social effects. Two sub-questions were generated to answer the main question, each addressing parts of the main question:

Q1. What are the established risks to construction workers due to rising temperatures?

Q2. What are the perceived new risks of construction workers due to rising temperatures?

To answer these questions, data were collected on environmental working conditions, risks associated with the working conditions, and effects of the working condition on the health and relationship of construction site workers.

Study Design

This study is qualitative and adopts a phenomenological research design in determining the new risks to construction workers as a result of environmental conditions on the construction site. Phenomenology research design focuses on studying an individual's lived experiences within the world (Neubauer, Witkop, & Varpio, 2019, pp 90). The phenomenological approach helps to describe best what the experiences mean to the individual (Grossoehme,2014). Matua and Van Der Wal (2015) described phenomenology as a discipline that investigates people's experiences to reveal what lies 'hidden' in them. (Neubauer, Witkop, & Varpio,(- 2019, pp 90) described phenomenology as a powerful research strategy that is well-suited for exploring challenging problems experienced by individuals.

Phenomenology is inductive qualitative research that can be either descriptive or interpretive (Reiners, 2012). While descriptive phenomenology emphasizes the 'pure' description of people's experiences, interpretative phenomenology emphasizes researchers' interpretation of lived experiences (Matua and Van Der Wal, 2015). This study adopts descriptive phenomenology as it focuses on bracketing the researchers' past experiences and biases. Instead, it focuses on the participants and amplifies their experience to understand new risks associated with working on a construction site in Kuwait.

The phenomenological approach was adopted to understand the lived experiences of construction workers regarding the impact of high temperatures on workers on construction sites.

The goal is to gather descriptions of construction workers' experiences which are rich in detail and imagery, as well as reflect their meaning (Grossoehme, 2014). I adopted phenomenological research because the study seeks to have an in-depth understanding of how construction workers experience heat stress and the new risks associated with heat stress (Williams, 2021).

Sampling technique and the sample

There are two common sampling methods in qualitative research: theoretical sampling and purposive sampling (Campbell, Greenwood, Prior, Shearer, Walkem, Young, S., ... & Walker, K 2020). Theoretical sampling is based on grounded theory and emphasizes the importance of combining data collection with analysis. Data is repeatedly collected and analyzed for new information until saturation (Foley et al., 2021). On the other hand, purposive sampling allows me to choose a population sample because it fits the case of his studying (Campbell et al., 2020). Purposive sampling also allows me to get the targeted group to provide the relevant information for a study that probes to elicit a particular experience common to a particular group of participants (Grossoehme, 2014). Silverman (2010) states that purposive sampling is more cost-effective but requires in-depth planning. Purposive sampling is also cost-effective and time effective.

I adopt purposive sampling due to its appropriateness to a target population, construction workers in Kuwait. Kuwait was chosen because of its more accessible access to the research participant and its environmental conditions. South Abdullah Al-Mubarak, block two, was chosen because it is a new area with many construction activities. The construction site was chosen because this was where I got consent to observe construction site workers. To do so, I had to travel to Kuwait in the summer 2022, between May and June. The time was totally perfect for doing the observations, and the temperatures were around 45 to 53 Celsius (113 to 128 Fahrenheit). A ticket was given from the Kuwait Cultural Office. Kuwait Cultural office gives an allowance ticket yearly

for students who study abroad. Hence, I decided to go home to do the observations and find participants to interview face-to-face.

The interview data was collected with a snowball sampling strategy. These participants were selected because they had in-depth experiences and knowledge of the research topic, having worked in the construction industry in Kuwait for a minimum of 5 years. The sampling technique was chosen because it was most appropriate as the construction site workers are mostly not online and mostly have just elementary school certificates. Snowballing was also chosen, given the time constraints of the research and how busy construction workers are.

Table 1.1: Demographic data of the participants

	Age (Year)	Nationality	Marital status	Salary/wages	Educational Qualification	Job duration (Year)
Abdelhamid	42	Egypt	Married	300KD	Elementary school	16
Abo Mohamad	53	Egypt	Married	250-300KD	Elementary school	35
Ayman	35	Egypt	Single		Secondary school	7
Hadi	27	Syria	Single		Secondary school	5
Hesham	44	Egypt	Married	200-300KD	No-formal education	20

Ismael	35	Egypt	Married	250KD	No-formal education	18
Jassem	36	Syria	Single		Secondary school	9
Mohamad	31	Syria	Single		Secondary school	8
Rashed	25	Syria	Single		Secondary school	7
Riza	26	Egypt	Single	250KD	Diploma	7
Salman		Egypt	Married	200KD	No-formal education	5
Yaqoub	30	Egypt	Married	350KD	Middle school	12

Data Collection Method

I collected interview data and observation data. Kvale (1983, pp174) defines phenomenological interviews as data collected to gather a description of the lifeworld of the interviewee in order to report described phenomena" The interview data collection technique was chosen because it helps get information that cannot be obtained using data collection techniques such as questionnaires and observations (Blaxter, Hughes, and Tight, 2006). Observation includes using and integrating direct observation and participant discussion, including online observation (Reeves, Kuper, and Hodges, 2008). Observation can be participatory or non-participatory. I used nonparticipant observation as the workload of the construction worker is quite strenuous and heavy. As a nonparticipant, it was also more manageable to take notes while work was going on.

Also, I was able to see the natural environmental working condition as the researcher was physically present on site but did not just participate in the physical workload.

I conducted 12 interviews in two phases. At first, I conducted four online interviews as they were scheduled at a time when I could not travel to Kuwait. I subsequently conducted eight face-to-face interviews. The juxtaposing of these online as well as face-to-face interviews was done to overcome the limitations of online interviews where not all the non-verbal cues can be observed, reduced attention, and network disruptions. (Parvaresh-Masoud and Varaei, 2018).

The twenty hours of nonparticipant observation was also done in Kuwait, more specifically in a new area called (South Abdullah Al-Mubarak, block 2), where there were plenty of construction activities. I received permission from the house's owner before starting the observation. The workers numbered about nine, including a site manager and a supervisor. I divided the observation into three houses per day, which made seven days in total, between 11 am and 2 pm. The time was chosen because it was in the middle of the day, and I could observe the workers at the right temperature, ranging between 45 to 53 Celsius (113 to 128 Fahrenheit). The observation allowed me to see and feel the observed group experience from the inside (Grossoehme, 2014).

Instrument

I adopted a semi-structured interview guide for the interviews. This interview guide was chosen because of its flexibility. Although its questions are predetermined, a semi-structured guide allows me to ask probing questions for clarification while ensuring that the interview is done in a way that answers research questions (Griffee, 2005). SIU Institutional Review Board (IRB) reviewed the semi-structured interviews for this work before administering them to the respondents. This was to ensure that questionnaire's content was not offensive and could not cause

harm to the subjects after obtaining approval from the IRB. The study used face-to-face and online interviews (Zoom). The interview lasted between 45 and 120 minutes, and various questions were asked in this process to meet the study's objectives. The First four interviews were recorded online via Zoom, beginning between March and April, and the face-to-face interviews started between May and June and were recorded by a digital voice recorder. All interviews were conducted in the Arabic language and then translated to English.

Moreover, I took verbal consent and sent the consent form paper to the participant. Some of them signed the consent paper online with help from me, especially during the online interviews. However, face-to-face interviews were convenient for us both to sign the form. For the online interviews, it was challenging to find workers. However, with help from my brother and friend, I was able to get their initial approval and numbers. I gave all participants 30 KD (30 USD) as appreciation for their time.

All the participants in this research are construction workers who have worked for at least five years in the industry. There was also a site observation for firsthand information on the construction site workplace. Questions asked from the participants were based on the following categories: socio-demographic information, environmental working conditions (its risks, etc.), health-related questions, and relationships (family, friends, etc.).

The participants were very friendly and helpful in providing information for the research. They freely expressed themselves and sometimes provided additional information. Where this was experienced, I followed up on the additional points to get more information from that angle. The interview questions are grouped and asked of the respondents as follows:

Environmental working conditions (its risks, etc.)

- How do you feel about the air temperature in your workplace?
- Do you think the temperature gets worse yearly?

- What is the average time you spend in hot environments every day?
- Do you work in an inside or outside environment or in both?
- How often do you get fresh air at your workplace?
- How do you feel about humidity levels in the workplace?
- Do you get thirsty minutes after drinking water while working at high temperatures?
- How many times do you get fresh water at your workplace?
- When the temperature rises during the day, do you feel more tired in the workplace?

Health-related questions

- How often do you take reasonable breaks to rest and hydrate the body?
- Do you sweat a lot in the workplace, especially in the summer?
- How do you describe your heart rate at work?
- How often do you have headaches at work?
- How often do you feel dizzy at work?
- How often do you have shortness of breath at work?
- How often do you get a rash or sunburn on your skin at work?
- How often do you have muscle contractions in your body at work?
- What is your level of concentration at work?
- How often do you visit your healthcare provider for heat-related diseases?
- When working in direct sunlight, how can you describe your vision?
- How often do you take medications without a prescription to treat heat-related diseases?
- How do you build your endurance to work when working?
- How often do you call emergency services because of severe symptoms of heat-related diseases that require immediate medical attention while in the workplace?

Relationships (family and friends) questions

- Do you think high temperatures affect your relationship with others in the workplace?
- How often do you discuss and blame the extreme heat waves with your co-workers?
- How often do you discuss the signs and symptoms of heat-related diseases with other people, such as skin irritation?
- Do you get angry when interacting with co-workers in the summer?
- Do you answer family or friends' calls when you work at a high temperature?

- How often do you eat or drink with your co-workers?

Validity and Reliability of Data

The data triangulation method was used because it allows for the use of a variety of data, such as we used in this study (interview guide and observation method), including time, space, and persons in the study. The strength of the project allows for including a variety of people, not just a single person. The weakness may be traced to the data's quantity and quality, such that having little data may undermine the result. More so, the choice of just one construction site in Kuwait may not allow for generalizing from the data.

Data analysis Process

Thematic analysis based on descriptive phenomenology is the chosen analytical method for the research as it investigates and describes the lived experience of individuals (Sundler, Lindberg, Nilsson & Palmer, 2019). This method was chosen because it can identify new patterns from the qualitative data on the effect of rising heat on construction workers (Braun and Clarke, 2013). I used thematic analysis because it helped identify shared meanings and random patterns from the qualitative data on the impact of heat on construction workers in Kuwait (Braun and Clarke, 2013). I followed the six steps of thematic analysis, which include:

1. I got familiar with the data by reading the interview transcripts and observation data multiple times. I also became familiar with the data when transcribing from the interviews. After transcribing and re-reading the interviews and observation data, I wrote memos on the most prevalent and exciting themes remembered. This gave the participant an insight into the themes that stayed in my memory or that must have caught my attention based on their repetitiveness in the data or the fact that it gave me a new insight. I gave new names to the participants while transcribing to conceal their identities.

2. Generate initial codes – This stage involves giving labels to the words of the participants. I imported the interview and observation data into NVIVO and started assigning labels to the participant's words. These labels are words or phrases that summarize or capture the essence of what the participant has said. For the interviews, the codes were primarily descriptive and semantic, while the codes for the observation were mainly latent and descriptive.

3. Search for themes – I categorized similar codes together in this stage.

4. Reviewing themes- this stage involves splitting and merging categories based on the research purpose

5. Defining and Naming themes – this stage involves naming and defining or describing each theme's themes and boundaries. This definition clarifies a theme's description and sets boundaries regarding what code can fit into the theme.

6. Writing a report involves writing the result and would include data excerpts, words, or quotations of the participants to give it validity.

CHAPTER 3

RESULTS

This section presents Four themes and eight sub-themes constructed from the analysis of twelve interviews and 20 hours of direct observation.

3.1 Theme one - Environmental Working Condition

The work environment theme consists of four sub-themes: effects of environmental variables on work, managing environmental variables, the role of managers and supervisors, work conditions, and work location.

3.1.1 Effect of Work Environment Variables:

Effect of Sandstorm, Debris and Dust in the Eyes, and Reduces Visibility

Effects of environmental variables consist of five sub-themes and eleven codes: effects of sandstorms, effects of humidity, effects of sunlight, effects of temperature, and effects of season on work variability. These describe how each of the variables affects workers on the construction site.

I observed that the participants were bombarded with sandstorms, filling their eyes, nose, and mouths with fine grits. "*As we fumble to make our way back inside for cover, our eyes, noses, and mouths are full of fine gritty stuff."* Effects of sandstorms include debris and dust in the eyes and reduced visibility.

Dust and debris from sandstorms harm workers' comfort and performance on the site. For example, I observed that workers had to run away from the oncoming sandstorm to safety, stopping them from proceeding with their activities.

I observed that "*those on the upper floor seem to be affected the most as they are faced with the occasional dust and debris blown by the wind*." This sandstorm prevents the workers

from concentrating on their work as they have to look away from time to time to avoid dust particles from entering their mouths, nose, and eyes. "*The winds are blowing, carrying sand and dust particles covering the entire place. The laborers are forced to look in the opposite direction from time to time to avoid the sand particles from getting into their eyes*". All of these point to the challenge of sandstorms as an environmental condition affecting construction workers.

I observed that "*the wind also increases the particle content in the air, which reduces visibility and decreases the quality of the working environment for the employees.*" I added that reduced visibility in the work environment is especially dangerous for workers in high places. "*Due to the reduced visibility and high winds during sandstorms, working at height is extremely dangerous as there is an increased risk of falling through voids and openings that are not visible. All work at height activities should be suspended until the storm has cleared".*

Effects of Humidity: Breathing Difficulty, Humidity is an Uncomfortable Work Environment, Humidity Makes Me Feel Sweaty, and Work Stops at High Humidity.

The effects of humidity as an environmental variable on the workers include breathing difficulty, humidity as an uncomfortable work environment, humidity causing sweatiness, and stopping work at high humidity.

I observed that the workers were having breathing difficulties due to high humidity. "*They are breathing hard, courtesy of the hot and humid a.".*

From the interviewer's responses, it is obvious that high humidity makes it difficult for the workers to work and function properly.

Participants also feel that high humidity has a negative impact on the work environment. For example, Mohamad stated, "*humidity is difficult; sometimes, we do not work. It is the worst time ever*". Ismael added that workers do not like humid environments as they get exhausted

easily. "*The humid weather will exhaust them so fast. They will not be able to breathe. People in other professions cannot even walk a distance, let alone work in the humidity*". In the same manner, Salman stated that he does not like humidity as it makes it difficult for him to breathe. "*I do not like humidity. I cannot breathe in humid weather*".

Participants do not feel comfortable with high humidity at the workplace as it makes them sweat profusely. Hadi said that he sweats a lot during high humidity. "*Of course, [I sweat a lot] sometimes in humidity, your clothes get wet. It is like the sky is raining*." Humidity makes Jassem sick from sweating a lot due to high humidity. "*I always get sick because of the humidity and sweating a lot. It is like it is raining. The humidity is very high*". Similarly, Mohamad stated that he sweats a lot, as if taking a shower. "*I sweat a lot, and my clothes are wet. It is like I took a shower while I was working. It is difficult*". When asked if he considered taking a shower and changing into new clothes, he responded, "*no, to be honest, I cannot because the new clothes will get wet so fast due to humidity."*. Moreover, finally, Rashed gave the conditions driving the degree of humidity, "*If the facility is close to the sea, the humidity is very high, but the humidity is low in desert areas*."

As mentioned above, humidity makes the work environment uncomfortable. Sometimes, it leads to outright stoppage of work for workers' health. Eight participants stated they had to stop work at high humidity. Abdelhamid stated, "…*the humidity is high in areas close to the beach. It is difficult to work in it. Sometimes, we stop working in humid weather. I do not like it… We do not work these days. We always try not to work in dusty and humid weather*". This indicates that proximity to the coast determines the humidity level, and work stops at high humidity.

In agreement, Mohamad stated that they avoid working in high humidity not to endanger

the lives of workers who cannot tolerate it. "*Because some workers are quite weak and can barely stay in this weather. We do not take a risk to save our health, especially in July and August. We do not like to work close to the beach due to the humidity*". Ayman clearly showed that they did not work in high humidity when he said, "*when the humidity is high, we usually stop working. Even if we work in the humidity, productivity will be low. We do not work that much because we cannot do more*". There are even more justifications for stopping work at high humidity as workers' efficiency is minimal during this period. In support of this, Hadi stated that "if the humidity level is high, the work stops completely." Riza, like Mohamad, added that it is risky to continue to work in high humidity. "*I cannot [work in high humidity]. I do want to take a risk*". Salman emphasized the health risks of working in high humidity. "Sometimes I stop working in humid weather, especially in August. Humidity might stop your heart from working, and you cannot breathe enough to support your body". From there, it can be concluded that veritably work stops in high humidity.

Effects of Sunlight: Sunlight Causes Dizziness, and Sunlight Makes my Vision Weak.

Sunlight in the workplace has adverse effects, such as making workers feel dizzy and affecting worker's vision. All of these are experienced by the workers at the construction site.

Working under the sun during construction activities has been said to cause dizziness among workers. For example, five of the participants testified to this phenomenon. Abdelhamid, one of the participants, stated that he felt dizzy working under the sun for hours. "*If I work outside directly under the sunlight, yes, I feel dizzy. Like if I work 3 hours continuously outside. I always avoid working outside for this reason".* His response showed how much he wanted to avoid working under the sun. Jassem also shares the same opinion as above, stating, "*I am always exposed to the sunlight. Sometimes I feel dizzy due to the intense heat coming from the*

sun".

More so, Hadi suggested that there are other contributing factors to feeling dizzy under the sun. "*Depending on the atmosphere's heat, I often feel dizzy while working under the sun*." Furthermore, in response to the number of times a week he felt dizzy, Mohammed said that he felt it "*about twice a week. I try to work inside the facility, in the interior environment [away from sunlight]*". However, Hadi attributed his feeling of dizziness under the sunlight to inexperience in protecting himself. "*At the beginning of my working years, I was suffering a lot from dizziness from the sunlight due to lack of experience, but over time, I gained experience in dealing with vertigo and maintaining my health and protecting myself from the sun*."

Five participants complained that the sun affects their vision because of the consequences of working under the sun. Hadi stated that the sun hurts his eyes whenever he works under the sun and that any form of protective glasses does not help. "*The vision is weak because the sun hurts the eye due to sunlight, but my vision is better in the internal environment… Sometimes, I wear sunglasses because they protect my eyes from the sun. Yet, the focus is low, and attention distracts me*". Similarly, Hesham revealed that he could not see properly under the sun when asked about the effect of the sun on his vision. "*It is not good under the sun's rays. When the rays hit my eyes, I feel blind*". In addition to that, Jassem stated that the sunlight makes him feel dizzy and blind.

> "*I am always exposed to the sunlight. Sometimes I feel dizzy due to the intense heat coming from the sun… I'm tired because I carry a lot of stuff from the bottom to up from the first floor to the third one. Sometimes, I feel like I do not see anything in front of me at all… I do not wear sunglasses, sometimes I do not see the person in front of me because of the sun's intensity, but in winter, it's very typical.*"

Mohamad expressed the impact of working under the sunlight on his sight over time which has been a negative one. "*At the beginning of the day, my vision is normal, but in the middle of the work or before the break, it is weak. Sometimes, I lose some things because of poor concentration and poor vision*". Salman, who claimed his vision is perfect, confessed that it reduces after working under the sun. "*My vision is perfect, but when I work for a long time under the sunlight, it makes me feel lose concentration and get low vision*."

Effects of Workplace Temperature: Being Constantly Thirsty, Heat Makes Me Feel Bad, and Temperature Affects Concentration, and Effect of Season on Work Availability.

From the participants, some of the effects of workplace temperature on construction workers are constant thirst, bad feelings, and affecting concentration.

Eight participants said they feel thirsty after drinking water due to high workplace temperature, which makes them lose body fluid through sweating. I observed that workers were dehydrated and sweaty under very high temperatures. "*The temperatures are extremely high, around 122 Fahrenheit. The laborers look weak and are very dehydrated as their clothes are covered with sweat*". Abo Mohamad stated that feeling thirsty after drinking is a common experience for him. "*It happens a lot. I drink, and then I feel thirsty after two or three minutes. What we drink gets out from our bodies when sweating*". In support of this, Ayman stated he did experience insatiable thirst, and that is the reason he carried a bottle of water along at work. "*It happens a lot. The bottle is always with me. I sweat a lot. I have to drink a lot of water to compensate for what I have lost while working*". Hadi, Hesham, Ismael, Mohamad, and Riza all constantly experienced insatiable thirst due to high temperature, and like Ayman, Hesham and Ismael carried water bottles with them to work. In fact, Ismael fills his water five times a day to cope with the workplace temperature-induced thirst.

Regarding how the participants feel about workplace temperature, they said that heat made them feel bad and uncomfortable at work. Only participants said they felt bad about workplace temperature. Abdelhamid said, "*not at all*." Hadi responded, "oh, it feels bad." These showed that the workers find the workplace temperature unbearable.

Eight participants revealed that increased workplace temperature affects their concentration at work. Abdelhamid stated that his temperature reduces with increasing workplace temperature. "*In the morning, my focus is higher than in the afternoon. The focus gets lower as time passes. If [I] eat and sleep well after the break, my focus is better, even after I eat. Working in the summer makes us feel less focused*". Just like the above participant, Hadi stated that morning temperature supports concentration which reduces as temperature increases.

> "*In the morning, the concentration is high because the temperature is good for some time, but as soon as the afternoon comes, the concentration is lower, and the productivity is lower due to fatigue. But in the winter period, the focus is much better in general because the atmosphere is a contributing factor to work. Inhalation of cold air is much better, and psychological is very good*".

Just like Hadi, Jassem also emphasized the effect of temperature on concentration in the workplace. He stated that concentration is higher in the morning and decreases as the day heats up in the afternoon.

> "*In the morning, I feel much better on the torrent. I start working at 6 am with high concentration. However, after 11 am, the concentration is very noticeable, and my energy decreases, but every four hours, I rest for only an hour to refresh and focus; taking into account that summer is very different from winter because it is much higher in winter there is not much fatigue compared to summer… [Temperature] has a tremendous*

effect [on concentration.".

The negative impact of temperature concentration is explained by better work conditions and the degree of concentration experienced during the winter. Furthermore, Ismael mentioned that there is a decrease in concentration at work after working for a long time in a hot environment. "… *The focus will be quite low because we have worked a long time, and the heat affects our ability to keep focus*". All Mohamad, Rashed, Riza, Salman, and Yaquob believed that increasing workplace temperature reduces workers' focus and concentration. In conclusion, Abo Mohamad emphasized the importance of focus and concentration at work, irrespective of workplace temperature. "*We have to focus all the time. Our focus must be high because if something goes wrong, we have to fix it again, which will cost us money and time*".

There are more job opportunities in the summer due to longer daylight for longer person-hours, suggesting a relationship between seasons and job availability. According to Abo Mahammad, people prefer to work in the summer than in the winter.

> "*Because the payment is based on the day, not hours [clients prefer to give out their projects in the summer during which] the days are longer than in the winter. So [those workers] can achieve more in the summer. My colleagues and I prefer the winter. Some people look that our productivity is short in the winter because we come to work at 7 am and leave at 3 or 4. If the day is long, I will do more, and people's building will finish early*". However, Yaquob said that job availability depends on areas and needs and not necessarily on seasons. "*It depends on the new areas, now the work is available, and there is a need for more workers*."

3.1.2 Environmental Working conditions:

Managing Work Environment: Day Offs, Drinking Water to Manage Temperature, Use of Weather Applications, Using a Fan to Manage Hot Temperature, Allowed to Take a Nap during Work, Sunglasses to Manage the Effects of Temperature, and Wearing a Hat to Endure Temperature.

In this study, participants identified environmental variables, including humidity, sunlight, and high temperature. These variables significantly affected their productivity. Management of work environment refers to various practices employed to improve the effects of environmental variables on construction workers and their activities. These are seven codes: day offs, drinking water to manage thirst, use of weather application, using fans to deal with hot temperatures, taking a nap during work, taking a break and through apparel, wearing sunglasses, and wearing a hat, respectively.

Another way of managing environmental variables is by taking days off from work when necessary. Four participants said they always take off on Fridays to rest from the environmental conditions. Abo Mohamad stated that they take days off from work, especially when tired. "…*If we are exhausted, we take Friday a day off. During the week, there is no break. We work seven days ... Sometimes the company forces us to work*…." In accordance with that, Ayman stated that "*we have a day off on Friday*" and added, "*in July, we take a lot of days off. We do not do too much because of the heat*." Hesham and Riza also said that they took off on Fridays.

Part of the management methods by the participants in handling workplace temperature is drinking water. I observed that the heat made the workers drink water early into work. "*Twenty minutes into the exercise, the heat is already sweltering, prompting occasional water drinking*." The presence of ice water and drinks sellers in the workplace indicates the workers' patronage to

manage body temperature. I iterated that:

> "*Traders mill around the site hawking ice cubes and water. Nearly all the participants scramble for the earliest opportunity to have a drink across the various service stations. A participant in charge of general security opines that the construction company contracts a few hawkers to supply food and drinks remotely*".

I also observed some workers drinking from a water bottle to quench their thirst and manage their body temperature. "*The bottled water in his hand is seemingly empty or at least carrying the last drop. He gulped the last drop of water and threw the bottle inside a litter bin as he headed out*". He further observed the workers sharing a liter of water in turns. "*They share a one-liter bottle of drinking water in turns. The urge to quench thirst overcomes the taste buds in these high temperatures. The salty water tastes sweet. In no time, they deplete the water*."

Two participants said that they used digital applications to monitor weather conditions, probably to know when to take a break or stop working. Abdelhamid stated that *he sees the weather application, and he can feel it*". Yaqoub stated that he uses weather applications to see the limit. "*Yes, I use it; just curious to see the highest point*."

The participants claimed that fans and portable air conditioners were used to manage workplace temperature**. "**Ayman stated that they used fans to control body temperature. "*Yes, it is. It makes the body cold. Sometimes we use portable A/C*". Similarly, Hadi also used a fan. "*We use fans."*

Two participants said that they were allowed to take a nap at work. Mohammed said, "*yes, I can take it after the lunch break* when asked if they were allowed to take a nap. "*I eat and sleep [for] 30 minutes*, he added. Rashed emphasized the importance of sleep by stating that "*adequate sleep and healthy eating significantly affect endurance, taking reasonable breaks to*

build endurance at work."

Due to the dust generated by construction activities, it is crucial to have a break to breathe fresh air. I observed that "*the supervisor and the manager possibly retreat to a makeshift site office to consult and develop interventions. A participant indicated that routine and periodic meetings are a culture we have seen during the projects. Besides, it gets hot that naturally, one needs a break to take a breather*". Abdelhamid explained that "*because of the cement and dust, it is hard to find fresh air. Maybe in the break time, we can go and breathe good air*". In accordance with this, Hadi said that they go on breaks to get fresh air since the air in the workplace is polluted.

> "*At work, the air is a little serious as a result of pollution from hardware machines and dust, but at break time, I go inhale the fresh air, if possible, for about 30 minutes and then go back to work. Almost 30 minutes every two hours. Yes, we're looking for a break to get the rest and breathe fresh air".*

Hesham added that he goes to the air-conditioned office for fresh air during break time "*I breathe fresh air when I take a break. We stay in the office, and we have A/C. It is only 3 times*". Mohamad stated further that he moved away from machines and equipment during the break to get fresh air.

> "*In the workplace, I try to breathe fresh air away from the mechanisms, for example, during lunch break, almost at break times, but at work times, it is not easy to get fresh air… Yes, during work, it is challenging to leave equipment and materials to inhale the fresh air, but in extreme fatigue, it is possible*".

This break for fresh air is needed to prevent dizziness, fatigue, etc., at the workplace.

Wearing sunglasses could be a solution to handle the effect of temperature. In this regard,

Yaquob stated that he wears protective glasses to protect himself from the sun. "*In the sun, I wear sunglass. [Though] it is not a good one, it does something. My vision is good. It is not that bad"*. However, Abdelhamid and others do not use it. When asked about the use of glasses, Abdelhamid stated that he does not use one. "*Because of the cost, it is expensive. I cannot offer it. It might get broken so easily... Of course, I [rather] feed my children better than pay for sunglass and break them*". Besides the cost of glasses, Abo Mohamad also gave discomfort with glasses as another reason why he does not use one. "*It is too expensive, and I am not comfortable with that. I left another company just because they forced workers to wear glasses protection. I do not know how to work with sunglasses or protection*". Salman shares this opinion. Hesham and Ayman also said they do not use glasses because of the cost. While Ismael claimed that he does not use glasses because it gets dirty very quickly. "*To be honest, the sunglasses do not work because they get dirty and dusty. I feel I do not work. You should clean it frequently. Some companies force their workers to wear goggles*". He probably does not have the time to clean it regularly at work.

Three participants said they wear hats or helmets for temperature management and safety precautions. Hadi stated that he wears a hat for temperature management. Ismael stated that a hat or helmet could only do a little when it comes to intense temperature management. "Even if I wear a hat or helmet, the heat is intense. When I worked with a good company, I wore a helmet. But now I do not because this company does not care about our safety. I get headaches often when working outside". Furthermore, Riza revealed that he only occasionally wears a hat. "*Yes, I wear a hat to protect myself from the sunlight, but not always, [and] I do not use a helmet."*

3.1.3 Environmental Work Conditions:

The Role of Managers: Ensuring Safety, Issuing Instructions, and Safety Education.

This sub-theme describes the role of managers and supervisors in ensuring project smooth and efficient execution. These roles are coded in three designations: ensuring safety, issuing instructions, and safety education,

I observed that the site managers monitor the work's progress and ensure the workers' safety by picking up dangerous materials.

> "*The site manager is at the other end of the site. He is monitoring the progress of the project. The site manager has already covered the site's perimeter, where he spotted some loopholes. While patrolling the site, he also came across pieces of timber and binding wires, some with nails lying dangerously. He proceeded to pick them up and put them in a pile. After this, he heads to the building where the actual construction is ongoing and enquires with the laborers about how they are faring*".

I saw the manager giving instructions to the workers, reminding them, especially about the instructions and conduct at the workplace. "*The manager is in charge of issuing instructions to workers. The instructions follow a continual pattern. They seem to suggest either hastening of craft or slight variations to the execution of duty*". The supervisor also prepared shift duties for workers. "*The supervisor is outside the office preparing shift duties for the workers…The supervisor continues as he reassigns duties to the workers on the site"*.

Due to the risky nature of the work environment and the need for everyone to remain safe, the supervisor and the site manager ensure that workers have safety reminders.

> "*The supervisor … then ushers in the site manager, who reiterates the importance of looking over each other's back. He also emphasizes the importance of having an eye in*

case a similar event occurs. After highlighting this, he requests a minute to remind them about the dangers of a sandstorm and emphasize the control measures"

3.1.4 - Work Location: High Demand for Outdoor Work, Preference for Indoor Work, Work both Indoor and Outdoor.

Work location refers to whether the duty is indoor or outdoor to the participants. Work location varies and depends on the nature of the work.

Hadi, a participant, said that his work is mainly in the outdoor environment. "*I work a lot abroad in construction and cement; mostly, this is an external job, and there is high demand"* and involved carrying the materials and installation.

I observed that despite the high temperature in the indoor working environment, a worker working there preferred it. "*The worker is working under the shade of the building as he is within the house. Despite the high temperatures outside the building, the inside is a little bit better, a characteristic of new buildings. He does not feel the direct impact of the sun's rays*". Three participants said they preferred indoor work. For example, Hesham said that indoor work is more comfortable. "*I prefer working inside because it is comfortable. There is no sun inside the building, wind, dust*". Yaqoub also said that the temperature inside is better. "*Because inside the building, it is colder a little bit. Outside is also fine if I cover my head with a hat*".

Twelve participants stated that they work in both indoor and indoor environments. Abdelhamid said that he works in both work environments.

"*I do them both. It depends on the type of work I am doing. I carry bricks, cement, and other stuff like helping my colleagues*". In agreement with that, Abo Mohamad said, "*I work outside and inside. It depends on the company. For me, I can do them all*".

Ayman also said, "*If the work is available; it does not matter whether it is outside or*

inside the building. I do everything".

Similarly, Hadi said he "worked both internally and externally, but mostly externally because there is a high demand for external work. Hesham also revealed that he works in both environments. "*I work inside and outside. I do them both. I build and paint. I almost do everything"*. Ismael, Jassem, Rashed, Riza, Salman, Yaquob, and Mohamad share this sentiment of working both indoors and outdoors.

3.2 Theme Two - Health and Workplace

This theme discusses the health of workers and how they operate in the workplace. Here the two sub-themes, health issues arising from the workplace and managing health issues, are reported in this theme.

3.2.1 - Health Issues Arising from Workplace:

Burns and skin rashes, Dizziness, Eye defects, Fatigue, work pressure, Muscle Contraction, and Shortness of breath.

Participants reported that some health issues arose during their work. Some were mild, while others were relatively serious to life-threatening. These are coded as becoming burns and skin rashes, dizziness, eye defects, fatiguing work pressure, heat stress, muscle contraction, shortness of breath, experiencing pain, and health risks.

Participants experience a lot of sunburns and skin infections resulting from their occupational activities. I observed a participant with a painful skin condition expressing himself as quoted below:

> "*It started by noticing lumps that were not exactly painful at the onset. As is observable, it degenerated, became tender, and painful both at once. My colleagues constantly pushed me to pursue medical checkups, but I was hesitant. Skin is certainly the*

most exposed organ of the human body. With the increasingly hot climate change here, it is probable and almost obvious that skin conditions emerge".

Continuous exposure of the skin to extreme heat and direct sun rays could have unpleasant consequences on the skin. I observed a participant with "*red lumps that were observable.* The observed participant stated that keeping oneself away from the sun and carrying out the duties can be challenging. "*It does get confusing, considering the need to protect our skin and at the same time secure a comfortable breathing space in the course of our duty*." participants were inexperienced with sunburns at the outset of the work. A participant was observed to have symptoms such as "*red hot, and dry skin."*. Abdelhamid stated that his rashes are not exactly related to the workplace and that the weather is responsible. "*I have rashes, but it's not from working in the heat or under the sunlight. Bad weather can trigger rashes. Even if you feel you are fine, when you go out, you might get itchy skin for staying outside more than usual*".

In line with this, Jassem stated that he had experienced sunburns that changed his skin color. "*Yes, there are some sunburn and other skin symptoms due to heat, all because of work. Before I worked, my skin health was perfect, but after doing this job for several years, my skin has become itchy and darker. I can feel that more in the summer season and less in winter".* This is an indication of adaptation to unpleasant weather conditions by the participant.

When asked if he had experienced sunburns and skin rashes, Mohamad said he has not, but others had experienced it. "*I have not [experienced skin burns and rashes], but I know some people have these issues. Some of them have an allergy, and in the summer, they cannot cope with it. For me, I am good*". Sunburn is observable "*among construction workers [and] the manifestation of skin burns is clear on their faces*." I also reported visible blisters and sunburns

from workers. "*The sun's intensity keeps getting hotter and hotter each passing day. The effects of the blistering sun are visible on the workers' skin turned red*".

Ayman stated that he had had sunburns resulting from exposure. "*Yes, I have sunburns on my body and face."* Riza also said that he had experienced sunburns and rashes before. "*I have experienced either rashes or sunburns, but my skin changed…Now I look darker. I do not like to stay outside too much*". In addition to these, I observed that irritation from cement and concrete could also lead to skin diseases. "*Exposure to wet concrete predisposes one to irritant skin dermatitis. I spot some symptoms of irritant skin dermatitis on their arms and backs - blistered, dry, and cracked. From time to time, they scratch their skins because their skin is itchy*".

Many participants also indicated that they were inexperienced with sunburns at the outset of the work. Some participants presented symptoms such as "red hot and dry skin,", itchy and darker skin, and tender and painful lumps. Two participants mentioned that protective clothing had offered some level of safety from sunburns, while another stated that sun cream was effective, although it caused discomfort while working.

Seven participants revealed that they experienced dizziness from working under the sunlight at work. I observed that some participants were "…*often caught in the dizziness."* I also observed a participant saying that "*it is common to feel nausea and dizziness*." According to the participants, this situation is "*worsened by the smell of fuel from the machines, especially along the arms of the cranes*" and "*sleep deprivation."* Some participants explained that the sleep deprivation they experience contributes to feeling dizzy. One of the observed participants stated that "*the nights are brutally hot. He said I am old enough to realize this is a problem that is increasing in intensity and consequence as well*". Therefore, "*it is understandable when we become dizzier during the short morning break. Generally, we are sleep-starved*".

Difficulty breathing also leads to dizziness. Participant Ismael stated, "*during the humidity period, it is difficult to breathe, the heat is intense, and with the pressure of the job, I am likely to get dizzy*." Most of the participants attributed dizziness to working under the sun. I observed a participant saying, "*there was also a bit of confusion, dizziness, and irritability*." In support of this, Hadi stated he "*often feels dizzy while working under the sun*." Hesham gave reasons why he may feel dizzy. "*It happens when you do not sleep well and even eat well…You will get dizzy if you stay outside when the sun is vertical*". In the same vein, Ismael stated that he only feels dizzy when working "*If I work all day outside, I will feel dizzy and have a headache at the same time."*

Rashed attributed his feeling of dizziness to inexperience in the early part of his career as a construction worker. "*At the beginning of my working years, I was suffering a lot from dizziness due to the sun, [and] lack of experience, but over time, I gained experience in dealing with vertigo and maintaining my health and protecting myself from the sun*." This implied that the occurrence of dizziness among construction workers could reduce over time.

High temperatures and sunlight were reported to cause eye defects or visual impairment among workers. Hesham stated that increased temperature and sunlight make the eyes red.

> "*The warm temperatures combined with the sun's scorching rays increase their pain and discomfort. This greatly reduces the productivity of the workers. Some of the laborers got red eyes. From my understanding, staying in this harsh weather will promote allergies and dry eyes*". Another participant who wears glasses stated that his glasses are not for cosmetics but rather for medical purposes. "*I wear my glasses, not for fashion or cosmetic purposes. I have had an eye defect for three years now. It started as instantaneous pain and graduated to something complex over time. I am supposed to*

undertake periodic checkups, something I have not quite followed through".

Participants also mentioned that poor working conditions contributed to eye defects or poor vision. I observed that the dust makes it difficult for workers to see the other end of the highway.

> "*Forty minutes into the exercise, the air is filled with dust, thus becoming increasingly difficult to observe the opposite end of the highway. Oncoming vehicles operate with headlights. Notably, they speed down as they approach the site area with constant motioning by the persons in charge*".

In support of this, Ayman stated that the heat affects his vision and that he cannot see clearly in high temperatures. "*No, the heat makes the vision blurry and tired. The temperature is high, and I work on the roof. Of course, I will not see very well*". Similarly, Jassem said that he, "*sometimes, I feel like I do not see anything in front of me at all… sometimes I do not see the person in front of me because of the sun's intensity, but in winter, it's very typical".* Mohamad describes how the time of the day influenced his vision by saying that "*at the beginning of the day, my vision is normal, but in the middle of the work or before the break, it is weak. Sometimes, I lose some things because of poor concentration and poor vision".*

All the participants speak passionately about the fatigue they experience during their work. A common denominator in their observation is that working in the summertime is especially physically tiring due to the intense heat, dehydration, and exhaustion. One participant said, "*Sometimes I'm tired, I cannot carry the machine (the drilling machine),*" while another participant said he "*cannot work at all...*" because of the "*heat and continuous work*." He described the fatigue as "*very deadly*" because "*sometimes I fall to the ground."*

Abdelhamid revealed that the sun is the major factor that makes them feel very tired. "*I*

feel really tired. The sun makes us feel tired". In his case, Hadi stated, "*I feel fatigued, and work pressure causes fatigue and dizziness*." Similarly, Hesham said, "*I always feel tired in the heat*." Jassem added, "*I feel very tired because of the heat, and continuous work or I cannot work at all. Fatigue is very deadly… Sometimes I fall to the ground, but there is an arrangement between my colleagues and me. If you feel tired, go inside, and if a colleague feels tired, there is a change between us".*

I observed that the participants experienced so much fatigue that they took turns in retreating to rest in a "*service station*" and "*a pillar supporting the footbridge*." I also observed, "*A visibly fatigued participant retreats to the station office hardly thirty minutes into intense activity. His tall body is now hunched over, revealing just how overwhelmed he has become*". In addition to that, decreasing activity in the workplace late in the morning is an indication of tiredness. "*Across the participants, the level of activeness decreases as the day wears on*."

Furthermore, the workers offloading wires from the lorry exhibited tiredness by retreating to rest after some time before completion of the work. "*Before all the wires could be offloaded from the lorry, two participants retreat to rest behind the pillar supporting the footbridge*." Another observed participant said, "*I wish there could be more rest time. Working continuously under the intense heat can be unsettling. I guess everyone feels that way, just that being overly expressive can be costly*". Another set of workers was obviously tired as they carried out their duties without talking to one another.

> "*The two workers responsible for setting up the concrete columns are finalizing the penultimate column. Judging by the look of things, the builders are worn out. There is not much communication going on between them. It looks like they have decided to dedicate all their remaining energy to the demands of the construction site, meeting the*

day's target on the stipulated time".

The tired workers appeared to be conserving their energy to complete the work. Moreover, the workplace temperature is unpleasant to work without getting tired. Due to the "*extremely high [temperature] of around 122 Fahrenheit, the laborers look weak and are very dehydrated as their clothes are covered with sweat*". The workers also experience pressure from work as they continue their work even when they are tired.

> "*They push the wheelbarrows on timber logs to avoid the resistance that might be caused by the rebars used to construct the beams. They are well-built, but the harsh weather seems to have taken a toll on them. The two men are panting as they push their load across the floor, starting from the point that is further away from the hoist crane*".
>
> "*The two builders are sweating heavily, with one completely removing his t-shirt due to the heat*."

They had no choice other than to continue with the work until completion.

Participants experienced intense heat, and some activities were put on hold when this happened. For example, "*the sweepers are delayed to clear the runway. The sun overhead is terrible. There has been increased heat stress among participants*". A participant added, "*this heat can burn; I wish there were more intermittent breaks*." Working very hard under intense heat is not healthy for construction workers. "*Construction workers are at an elevated risk of heat stress due to the strenuous nature of the work*." In describing the intense heat experienced, one participant, the binder, stated that "*as I move the binding wire, I develop an intense body heat that is not easily cooled off by simply drinking water*." The intensity of this heat is reflected in the fact that it cannot be efficiently cooled off by drinking water.

Muscle contraction was experienced by ten of the participants and related to engagement

in physically demanding activities. For example, Mohamad stated that he felt muscle contraction during humidity. "*In humility, sometimes I feel muscle spasms. My legs become solid*". Similarly, Hadi and Hesham respectively stated that muscle contraction depends on how they exert their body. "*Based on how I carry the materials, I rely a lot on machines to help me carry materials*," "*It depends on the work. We work, but not every day*". Similarly, Ismael stated that because he worked very hard, he experienced muscle contractions every day. "*I suffer from my muscles daily because some companies pay you on a daily basis and want to see you are working all the time. They will make you hate yourself*".

In support of this, Jassem stated that "*muscle contractions are always present because normal work requires physical effort, I believe two or three times a month, but in summer, they increase to five or six times because of trying to finish work quickly*." This shows that environmental conditions also play roles in muscle contraction.

Ten participants revealed that they experienced environmentally influenced shortness of breath. According to them, this was usually experienced during high humidity in the summer. For example, Abdelhamid stated that he experienced shortness of breath, "*I do not breathe well. We do not work these days*". This also revealed that we have to stop work for this purpose temporarily. Mohamad added that his shortness of breath happens during high temperatures. "*It happens in the summer, but it is not that much*." Similarly, Ayman stated that he did experience shortness of breath in humid weather where there is not enough air to breathe. "*In humid weather, I work in the basement because there is not enough air to breathe. I personally like to work inside the building when the weather is humid. We cannot work full time, only 3 to 4 hours in the early morning*".

In the same manner, Hadi said he finds it difficult to breathe during high humidity. "*It*

feels bad because, during the humidity period, it is difficult to breathe, the heat is intense, and with the pressure of the job, I likely get dizzy… Yes, I feel sweating and shortness of breath due to the heat." According to the participant, this shortness of breath is compounded by the atmosphere filled with dust and fumes and worse in the summer. "*If there is a lot of work, a dusty atmosphere, and plenty of dust and fumes from machines and trucks, I feel shortness of breath. The situation is much better in winter, with relatively clean air, unlike in summer*". Similarly, Hesham stated, "*if the weather is dusty or from the cement. I also do not breathe when it is humid because of the lack of oxygen when the weather is highly humid*".

Seven of the participants said that they experienced pain working as construction workers. These have experienced varying degrees of pain in different parts of the body, mainly due to carrying heavy loads. Abdelhamid stated that he experienced pains in his muscles after taking heavy loads. "*If I work a lot or carry something heavy. I feel pain in my muscles after work. You know, as construction workers, we rely on our physical ability a lot. My body is my job. Even if you are not a good worker, they use you to carry cement and tools*". Ayman stated that going up and down the stairs makes him feel a lot of pain in his muscles and bones. "*When I go up, and down the upstairs at noon, I feel my bones and muscles hurt. It is stronger when I am home*".

The degree of pain experienced is expressed by Jassem, who stated that "s*ometimes I cannot eat with friends because of severe pain. I would rather eat alone and then take a nap… In both seasons, I feel pain, but the psychological situation is better in the winter, so I do not feel tired. Pain is the same*". The participant revealed that pains are more manageable in the winter than in the summer due to reduced heat.

Rashed stated that where one feels pain depends on how a heavy load is carried. "There is

[pain], but it depends on how you have the materials. I saw a worker experiencing pain from blisters forming on his hand.

> "*One of the new workers tasked with transferring the building blocks to the proximity of the building being constructed is painfully holding his hand. His hand has formed blisters. The blisters have been caused by the skin being damaged by friction injury. His hand's damaged upper layer of skin has torn away from the layers beneath, and serum has collected in the space, creating a blister*".

Part of the pain construction workers face is headaches. Ayman stated that he always feels headaches when he works outside. "*Because of the sun's rays …. And I felt a headache. The headache started at 11:30 am. The sun is very hot*". Hadi revealed that the time of the day and temperature determines when he experiences headache. "*In the morning, there is no headache, but during the afternoon, I feel headaches. I think 2 times a week, and we take a break to relieve the pressure*".

Furthermore, Jassem stated that there is a seasonal factor in feeling headaches. "*In winter, there is no psychological pressure. On the contrary, I like to work in winter, unlike the summer season; I feel a lot of headaches, and the atmosphere in the winter is undoubtedly better*". Rashed added that machine noise contributes to his headache. "*I do not think I have many headaches, but it depends on the noise at work, primarily if the machines work long every day*."

I observed that their shirts were "*soaked in sweat" as their foreheads were also "full of sweat bubbles," which "do not seem to burst anytime soon*." Construction gear and metal bars were also covered with sweat which increased in the afternoon and lasted for hours. A participant stated, "*I still experience profuse sweating and a host of others not possible to mention now*." I also observed that "*a laborer carries a bag of cement on his back while sweating heavily due to*

the sun's heat. He is from the store heading towards a concrete mixing station where a mixer is rolling in full swing". Furthermore, I noticed that "*the worker operating the immersible concrete vibrators is sweating profusely under the blistering sun as he compacts each layer of concrete poured by his colleague*."

Eleven of the participants stated that they sweat a lot in the process of carrying out their activities. Abdelhamid said that he sweats a lot and has to drink plenty of water to compensate for the fluid being lost. "*Yes, I drink after 20 minutes in the summer. It happens a lot. I get thirsty a lot. I sweat a lot, so I have to drink a lot to compensate for the water in my body… I sweat a lot in the summer.*" Riza also mentioned that he sweats a lot and that he had to take off his clothes. It can safely be concluded that all the workers on the construction site sweat profusely.

3.2.2 Managing Health Issues:

Self-medication, Difficulty in seeing a doctor, Going to the Doctor is Costly, Emergency Medical Services, and Rehydrating the Body.

Strategies were adopted by participants and their employers in managing health issues when they arose. Self-medication, visiting the doctor, emergency medical services, and rehydrating the body are some of the ways to manage health issues at work.

Many participants occasionally resorted to self-medication. Hadi said he took medications for "*headaches, dry eyes, burn cream, and this type of medication, do not need to ask the doctor. We can find them almost everywhere,*" as well as for "*body pains*." They did not need to have a doctor's prescription to purchase these medications, and they were purchased with personal money. Jassem said that he does take pills for headaches and body pains. "*Sometimes I take pain pills for headaches and such body pain… without a prescription because they do not need it*".

Furthermore, Mohamad stated that "s*ome medications are available at the facility, and we use them permanently, sometimes as a result of extreme air, and as you know, I have a headache, in this case, take some medicine available in the facility."* In conclusion, Rashed said that there is first aid for workers where they can easily get medication. "*At work, we have a first aid bag for primary diseases such as headaches, dry eyes, and burn creams, held twice a month*."

As part of the approach to managing health issues, especially those related to sunburns, six participants said they took heat-related medication once a month. For example, Abdelhamid stated, "*I use creams but not that much… I buy tables for the headache, eyedrops, and cream. These medicines do not require any prescription, and you can find them in the supermarkets".* Hesham also claimed that he only takes heat-related medicine when needed. "*I think only one time or when I need it*." These medicines "*include Aspirin for headache, eyes drop, and sometimes cream*."

I observed that while a worker acknowledged the health issues associated with the work environment, he thought it was difficult to see a doctor.

> "*With the increasing climate change here, it is probable and almost obvious that skin conditions emerge. I guess the danger lurks everywhere—for construction workers and everyone else. Abounding challenges have made it difficult to see a doctor, but I hope there will be some sort of solution soon enough*".

Another worker said that he had not followed through on his appointment with the doctor concerning his eye defect. "*I have had an eye defect for three years now. It started as instantaneous pain and graduated to something complex over time. I am supposed to undertake periodic checkups, something I have not quite followed through*". Another worker said that it is

difficult for him to access healthcare resources due to his status as an expat. "*Vulnerabilities due to an expat worker status that limits access to healthcare resources further worsen construction workers' vulnerability to heat stress, that way exacerbating an already dire situation*."

Abdelhamid stated that going to the doctor is costly, which is especially challenging as the money is difficult to earn as a construction worker. "*If you go to the hospital or clinic, you will pay money, which is hard to make*."

Three participants said that they had been admitted to or called for a medical emergency, while the others had only heard the medical emergency call for their colleagues. Abdelhamid stated that he fell down, and his colleagues had to call an ambulance for him. "*I remember my colleague fell down, and my co-workers called the ambulance to take me to the hospital*." Similarly, Jassem was taken to the emergency when he suffered from shortness of breath. "*Yes, I remember the weather was too dusty, and I could not breathe, so a colleague called the ambulance and went to the hospital to do the crisis and sat there for five hours*."

On the other hand, Ismael and others called for an ambulance when a worker fell down in his previous place of work. "*I remember I fell down, and my co-workers called the ambulance to take me to the hospital*." Rashed and Riza also had a similar experience as Ismael. Others, such as Ayman, Hadi, Hesham, Salman, and Yaqoub, all have heard stories of ambulances being called for a sick or wounded worker.

Participants drink a lot of water and tea to rehydrate their bodies due to the loss of body fluid in profuse sweat. I observed workers requesting *mint-flavored tea*. "*Few request mint-flavored tea during the midday*." Abdelhamid stated that he "*drinks water and a cup of tea*," while Mohamad drinks water and "*drinks water to compensate for the water going out of my body."*

3.3 Theme three - Relationship with colleagues

This theme looks at the way construction workers interact and connect. It also looks at the effect of heat on relationships with each other at the tin workplace. This theme consists of two sub-themes: high temperature has a negative effect on the working relationship and cordial relationships with colleagues.

3.3.1 - Relationship with colleagues:

High temperature has a negative effect on the working relationship

Working in a hot environment that causes heat exhaustion could lead to aggressiveness, discomfort, inconvenience, or even make coworkers frustrated with one another. In Abdelhamid's opinion, the summertime is not a preferred season to work as coworkers tend always to fight "*...I see some people do not bear the summer or always want to fight. I am not angry, but if there is something important. I get frustrated. No one like to work in the summer. The heat affects their relationship. This is my opinion"* Unlike working in the winter season, the summer season makes the construction workers irritable towards their colleagues. As Ismael said, "*I always get angry in the summer, but not for any reason. I feel angry if someone takes my tools without telling me in advance,"* which will, in turn, create less cooperation among the coworkers in the summertime as fights or quarrels may be easily sparked. Mohamad agreed that coworkers are quick to anger in the summertime "*yes, anger exists with all colleagues, and cooperation is very little, unlike winter."* Ayman also supported that the high temperature makes coworkers agitated. *"Sure, one can get angry and always nervous because of the heat."*

The construction workers had a better psychological state in the winter than in the summertime. Rashed said, "*I do not think there is anger in winter because of the cold weather and its effect on mental health,"* but the high temperature during summer caused a poor

emotional and mental state of mind. Hadi spoke on how heat affects the general relationships at work, saying.

> *"Yes, relationships are not good because of poor psychological state due to fatigue or unhappiness"* Jassem, in this case, stated, *"In the summer, the psychological situation is very bad this season, and sometimes I become nervous because of the pressure, which affects my relationship with others."*

3.3.2 - Cordial relationship with colleagues:

Temperature discussion among workers, Eating with colleagues, and Discussing diseases with colleagues.

This sub-theme discusses the cordial relationship among the construction site workers. This includes the various discussions they have and how they spend their lunchtime.

While some of the workers discussed and blamed extreme temperatures at work, some did not blame the extreme temperature at work. For example, Yaqoub said they do not blame the weather as they monitor the weather app always. *"We talk about it, but not that much. We see the weather application almost every day. We do not blame the weather every day".* Abo Mohamed also said, *"No, when the heat is too high. We follow weather apps and also feel it"*. While Abdelhamid said, *"I blame the heat because we adapt to work with that…*" He also said they discussed weather conditions between countries *"…We talk about the temperature at the workplace and sometimes make comparisons between Kuwait and Egypt".* Ismael also stated that in their daily discussions, they always blamed the heat *"We talk about it daily and blame the heat daily. We always talk about the weather".* Hesham, one of the construction workers, said, *"I always blame the heat,"* He came up with an idea to avoid the heat while discussing it with his colleagues. *"I always talk to my colleagues to work at 2 AM to avoid the heat. A few of them*

agree more".

According to three construction workers, Ayman, Jassem, and Riza, June, July, and August are said to be the time or months with the highest temperature in Kuwait. As construction workers, their job may sometime be done outdoors. Ayman said they blame the hot weather in July and August. *"We talk about the heat when we work outside the building. We blame it on July and August because these two months are very hot and humid*". In the same manner, Jassem mentioned, "*We talked about July and August and the extreme heat in Kuwait"* Riza also agrees that they blame extreme temperatures at work "*Yes, we talk about the weather and blame the heat too much, especially in June, July, and August."*

The construction workers had a daily discussion about the temperature at work during summer than winter. Mohamad said, *"Daily in summer but the winter, we do not talk about these things much because they do not exist, but they are a lot in summer."* Similarly, Hadi said, *"In summer, we talk a lot about heat, especially during rest, and we always blame the temperature daily"* Jassem also agreed that they had daily discussions on temperature. *"Yes, daily because of the heat, especially afternoon. We always complain about working conditions."*

The majority of the workers ate and drank together. They spent their break times together, breakfast and lunchtime. Ismael stated that he and his colleagues did everything together as teammates. *"I eat with my colleagues twice, in the morning and at lunchtime. We work together. We eat together. We do everything together as a team"* Abdelhamid similarly said, *"We eat breakfast and lunch. We drink tea together. We eat every day together."*

Furthermore, coworkers mentioned they were not forced to eat together and preferred eating together. *"No, but I prefer to eat with my colleagues. I think group food is better because we work collectively" (Hadi). Mohammed mentioned eating together as a pattern "No, I am not,*

but it is routine. We work together and eat together."

The discussion of diseases arises when one of the construction workers is ill or infected. According to Hesham, *"We talk about when one of us gets sick, not always"* Abdelhamid also mentioned that discussions on diseases were done outside the work environment *"When someone gets sick, we discuss it. We do not talk when we are working. We talk about our diseases, whether related to the heat or not, outside the workplace.* The construction workers also talked about how to treat the diseases they discussed among themselves *"When someone has a disease, whether related to the heat or not, we discuss it, and it is implications on the body, how to treat it"* (Yaqoub). Ismael said, *"When someone gets ill, we talk about it. We always discuss the diseases and what is the cheapest and good medicine to take"* Riza then added that they discuss how to save one another's health. "*We always talk about when I feel tired or sick. Or it could be anyone gets sick. We try to help and find a solution to the diseases. We talk about saving our health".*

Meanwhile, Rashed said, "…*Sometimes, we discuss how to avoid these diseases",* and Jassem said they discussed the diseases out of fear of them being transmitted. *"Yes, we discuss the symptoms between us because sometimes we are afraid of transmission, but some do not care."* Construction workers with better knowledge or exposure to some of the diseases discussed may be in the best position to recommend treatment. *"When anyone gets sick, we discuss how to treat it. Some old workers have a good experience…"* (Ayman).

3.4 Theme Four - Motives and Motivation

This theme highlights the motives and what motivates workers in their workplace. It entails what participants do in their workplace, encouraging them to do their best while working. Participants in this theme reported some activities in the workplace that boost morale in the course of their

work. These motivating factors include the choice of the job based on qualifications and skills, encouragement from co-workers, how family motivates them, and financial motivation, Jokes with colleagues increase productivity, and listening to songs or singing motivates them to work.

3.4.1 - Motivate and Motivation:

Choice of the job based on qualifications and skills, Encouragement from Co-Workers, Family motivates me, Financial provision for my family, Jokes with colleagues increase productivity, and Listening to Songs or Singing Motivate Me to Work.

Workers at the construction site chose the job since it did not require a degree or a skill. Abdelhamid stated, "*This is the only job available for me because I do not have a degree."* Furthermore, Ayman stated, "*I have no degree. I cannot do anything else. Construction is tiring, but you can make good money*." When asked why he chose to be a construction worker because of no degree? Hesham indicated, "*Yes*." Furthermore, Jassem said, "*I do not have the qualifications to do something else*." In construction sites, skills and qualifications are not necessarily a baseline of entry. Mohammed indicated that "*My friends work in this job, and we talk a lot about it, such as building materials, so I have experience, and this work does not need any certificate or previous experience. I mean, it needs essential experiences*". To further illustrate, Rasheed expressed that "*It is a simple job that does not require significant scientific expertise but depends on physical strength*." To confirm that qualification and skill are not a stringent requirement to work as construction worker Riza indicated that "*because I do not read and write very well. This job does not necessarily need these skills".* This implied that construction workers did not require high certifications, qualifications, and skills. Workers received assuring words from their co-workers that kept them working on the construction site. During a direct observation in South Abdullah Al-Mubarak between (11 am -2 pm), I observed

that workers received encouraging words from one another. "*When working at heights, one needs to be cautious. For personal safety, a worker needs to fasten his fall prevention safety laces to stationery and stable object. Helmets are also important as they prevent head injuries that are normally fatal. Many people who have passed on after falling did not have helmets*." I also observed a worker who was speaking with his co-worker. *"I like to see your work faster. If you continue, you will climb the ladder faster to superior positions. Keep it up, young man," he tells him. The laborers have already laid four layers of building blocks on each side of the building."* I also observed a worker who helped an injured worker to bind a wound and encouraged the co-worker to continue. "*His colleague helps tie a rag around his hand and then encourages him to continue. Judging from the laborer's facial expressions, he is in pain and discomfort. Despite that, he continues with the work. He is wearing a pair of protective gloves that would have prevented this challenge."*

Meeting the needs of family members makes the worker remain in the construction work even though it poses threats to their health. During twenty hours of observation at a particular site location in South Abdullah Al-Mubarak between (11 am -2 pm), I observed that "*we are caught between considering our health in the long term and securing immediate present comfort. This is important, both to our families and us.* In the same vein, I observed that workers expressed that "*we risk the possibility of impoverishing our entire households. We have wives, kids, and families to support."* Furthermore, I observed, "*It is powerfully rewarding to support family and put children through school and contribute to this phenomenal growth."* In an interview with Jassem," *they expressed that I receive it from my family because sometimes they need me a lot, but from my friends, I do not; I call them after work to focus on it. On the contrary, contacting the family motivates me to work to renew my energy.*

Financing the family motivates the construction worker to continue with the job. one participant indicated that "*we risk the possibility of impoverishing our entire households. We have wives, kids, and families to support."* Abdelhamid expressed that the only thing that motivates him to work on a construction site is that it " *encourages me to support my family*." *During a direct observation at a particular construction site (11 am -2 pm).* I observed *that "I left my family in India. They depend on me for everything. If I do not work, my children will go hungry, and they will not gain access to education as I will not be able to afford their school fees. My family might even be kicked out," one of the builders begins. "Despite these tough conditions, which I am not used to, I have to keep working as I do not have any other source of income."* In an interview with Hesham, when he was asked if he has a family or not, he indicated that "*I do. I have to work to support my family*." Furthermore, Salman: stated the reason why he chooses construction work "*Sometimes, I work the week entirely to make money for my kids. I work all time."* This implied that the worker's financial needs depended on the construction site.

Workers on the construction site are financially motivated. Abdelhamid stated, "*it is also a well-paid job compared to my education."* Furthermore, Ismael indicated that financial stimulus comes first. In addition, Rasheed stated that "*Yes, of course, money is a fundamental catalyst. Without the money, I do not work".* To substantiate that financial benefit motivates workers on the construction site, Riza expressed that "*My daily wage encourages me to work hard. For example, if I did not finish this part today, I would not get paid*." In addition, Yaqoub stated that "*The need for money is stimulating me to work hard."* Workers at the construction site are motivated by the financial benefits received after working which comes as wages or salaries. Workers create conversations; these conversations cheer the workers up as they go about their duties. During a direct observation at a location from (11 am-2 pm), I observed, "*The laborers*

working on the cement and ballast heaps interact as they do their work. Their social relationship seems to be top-notch as the harsh working conditions cannot deter them from having some fun moments together, teasing each other. It was also observed that. "*At the mixing station, the operator, and his assistant, who is tasked with adding cement and water into the mixer, have minimal interactions because of the loud noise emanating from the mixer. However, the minimal interactions seem enjoyable as some laugh between the two colleagues."* Furthermore, I also observed that "*The former teases the latter. "Hey, are you guys doing your work," one of the workers tasked with ferrying sand to the mixing section asks cunningly. The others ignore him, prompting a burst of loud laughter from the workers dealing with the sand".* I also stated that "*On the other hand, the supervisor interacts with the laborers in the mixing section. He teases one of the workers, who seem to be too exhausted. "This work is not for the faint of hearts. It is for strong men," he says as the other laborers join in the laughter."* Construction worker jokes with a colleague at every opportunity so they can be motivated for the task. Listening to good music builds endurance and motivates workers to work in hot weather. Abo Mohamad said," *I listen to music and talk to my co-workers and say something funny."* During a direct observation at a location from (11 am-2 pm), I observed that "*one of the workers is singing a melodious song to motivate himself to keep going. He seems to enjoy his work as well."*

On the order hand, Ayman expressed that they do not, but another worker listens to music. "*No, I do not. Some of the builders do enjoy it. They buy headphones and listen to anything they like."* To state further, Ismael said, "*I do not listen to music but talk to my colleagues. If we do not talk, we will not enjoy the work".* To acknowledge the role of good music in motivating workers, Rashed stated that "*Yes, I listen to songs to motivate me to work at work time."* The words of Riza also support the role of music in motivating workers." *Usually, I*

listen to music in the workplace. I enjoy listening to music while I am working. It makes me happy." Furthermore, Salman indicated that "I listen to music to keep me entertained when working." This means that workers listen to music during work to be motivated to do the job.

CHAPTER 4

DISCUSSION

Impact of Heat of Heat Stress on Construction Workers in Kuwait

Earth's surface and atmospheric temperature have increased since the 1750s in Europe. It characterizes the beginning of the industrial revolution and has been implicated as the cause of global warming by releasing greenhouse gases (Acharya et al., 2008). Increasing global temperature affects people everywhere, with more effects in tropical and subtropical countries like Kuwait (Karta et al., 2000). Construction workers are especially vulnerable to the effects of high temperatures as they have to work in the open and often informal manner in which the construction industry organizes itself and its importance to developed and developing economies (Rawlinson et al., 2014). In this chapter, findings on the effect of heat on construction workers in Kuwait are discussed under four themes: environmental working conditions, health and workplace, relationship with colleagues, and motives and motivation.

Worker's Socio-Demographic Profile

The participants were construction workers by occupation and demography; their ages ranged from 25 to 53 years old. Their monthly wages and salaries ranged from 200KD to 350KD. Their educational qualification is from no qualification to an industrial diploma. Seventy percent of the participants are from Egypt, with the remaining from Syria. Sixty percent of them are married, with 90% having children. The individuals have been on the job between 5 to 35 years, and the medical history of one showed that he has low vision and has been using glasses for more than six years. Construction work demands great physical abilities, which may be why all the construction workers in this study are male and largely from the same countries.

In western cultures, people view construction work as hard, dirty, and mentally draining;

thus, many shy away from working in such environments (Venugopal et al., 2016). Because of race-based discrimination and lower socioeconomic status, migrant/ethnic minorities such as the ones in this study take positions in construction (Wrench, 2016). For instance, in developing countries, including the Middle East, many migrant construction workers originate from South Asia and Africa. According to Abdul-Aziz et al. (2018), such migrants/ethnic minorities are considered because they make few demands, are easier to segregate and lay off, and can accept low payments. However, these ethnic minorities endure labor abuse and exploitation and work in dangerous and unhealthy construction conditions (Abdul-Aziz et al., 2018).

(Riley et al.,2018) reveal a correlation between an increase in the number of construction workers and the number of emergency department visits due to heat-related diseases. Heat-related illness was the highest among male workers and workers from minority communities (Riley et al., 2018). This suggests that significant factors that increase the risk of heat-related diseases are gender and ethnicity. Alahmad et al. (2020) report an increased risk of death due to extreme temperatures in males compared to women emphasizing gender as a risk factor for illness and death due to occupational heat stress.

Men have been observed to be unwilling to care for their health during stressful events, including occupational heat stress (Novak et al., 2019). According to the same study, men are not forthcoming when it comes to seeking health-related information because of the masculinity social construct (Novak et al., 2019). This information may include preventing heat stress due to rising workplace temperatures. According to Achilleos et al. (2013), symptoms of heat-related illness tend to be worse in men than women. Lee et al. (2015) added that men largely avoid seeking medical attention when they fall ill. Reasons for this may include discomfort or embarrassment in discussing specific health issues and not wanting to be told to change their

routine or lifestyles (Vaidya et al., 2012). This implies that behavioral choices associated with masculinity and beliefs may contribute to higher rates of diseases and lower quality of life among men.

Environmental working conditions

The working environment of the workers refers to the physical and psychosocial conditions surrounding the worker, and this varies from trade to trade with a significant effect on the workers' productivity and health (Boschman et al., 2013; Meegahapola and Prabodanie, 2018). Given this, the work environment includes the effects of environmental variables on work, managing environmental variables, the role of managers and supervisors, work conditions, and work location. The effects of these work environments are discussed in this section.

Effects of Environmental Variables on Work

Environmental variables such as sandstorms, temperature, sunlight, and humidity hurt construction workers in this study. Participants reported that sandstorms blow dust particles into their mouths, eyes, and nose. This prevents them from concentrating on the construction work as their visibility is impaired when this is experienced. Sandstorms pose a significant health risk to workers, especially those with respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD) (Samarkandi et al., 2017). Increasing temperature has been reported to cause heat stress, increased cardiovascular activities, dizziness, fatigue, etc., and fatality in some extreme cases (El-Shafei et al., 2018). Construction workers stated that high humidity made them experience shortness of breath, excessive sweating, and other health conditions. Excess heat has been shown to impair the cognitive functioning of workers. Varghese et al. (2018) indicate that workers in an air-conditioned environment are likely to have improved cognitive function than those working in non-conditioned environments. Mazloumi (et al. (2014)

also report the impact of heat-induced cognitive decline in 70 workers in a hot industry.

A close association exists between heat stress and psychological conditions and cognitive problems. The most substantial evidence is found in a study by Burke et al. (2015), who found that in the U.S, the suicide rates increased by 0.7%, and in Mexico, the suicide rates increased by 2.1% due to an increase in average monthly temperatures. It is estimated that by 2050, there will be an estimated number of around 40,000 additional suicides in the U.S and Mexico due to climate change and global warming (Burke et al., 2015). This emphasized the need for good temperature management in construction work to avoid such consequences.

Increasing temperatures are likely to trigger anxiety and cause an increase in levels of the stress hormone known as cortisol, which aggravates anxiety symptoms (Luo et al., 2021). Research indicates that risks of hospital admission and emergency department visits for psychiatric conditions have increased in hot seasons (Thompson et al., 2018). This suggests that mental health impacts should be incorporated into policies for public health response to increasing temperatures.

Extreme heat exposure has also been associated with other health issues, such as eye problems and dyslipidemia (Luo et al., 2021). Thermal cataracts have been regarded as an occupational affliction with eye problems. Eye problems and decreased vision may make workers vulnerable to occupational accidents and injuries. In their study, Sahu et al. (2013) found that workers exposed to heat had an increased risk of dyslipidemia, which refers to unhealthy cholesterol and lipids levels in the blood. The abnormal cholesterol level is related to the production of cortisol, which increases under heat stress states. Workers in this study may also be producing heat-induced cholesterol and lipids that hurt their sight.

Moohialdin et al. (2019) report low productivity among workers in a hot and humid

environment to be a consequence of the poor environmental condition resulting from high humidity. Workers in this research stated that they devised various methods, such as stopping work at high temperatures, humidity, and when there is a sandstorm. They added that they took much water to rehydrate their body against excessive sweating that characterized these conditions. Many researchers agree that exposure to unusual heat and humidity without proper rest or sufficient fluid intake can lead to various heat stress-related illnesses (Xiang et al., 2014; Dutta et al., 2015). This emphasized the need to provide adequate and clean water for workers at the site.

Furthermore, workers need to be educated on the importance of self-rehydrating to minimize the effect of heat stress (Smith et al., 2021). It is also essential that the workers and site supervisors should be trained on the procedures they should follow, such as emergency response procedures when a worker has symptoms of heat-related illness. Moreover, this brought to the need for managing the work environment and increasing productivity to help maintain their health conditions.

Heat stress can also significantly affect most aspects of the reproductive function by comprising hormonal imbalance and the physiology of the reproductive tract. For instance, excessive heat exposure in males affects the quality and motility of the sperm. According to Xiang et al. (2014), male workers working in hot conditions are likely to have impaired motility through scrotal insulation, which can affect sperm quality. Lee et al. (2022) indicate that majority of men with azoospermia and oligozoospermia have high testicular epididymal temperature because of occupational heat exposure. These conditions disrupt workers' reproductive abilities.

Managing Work Environment

Managing an uncomfortable work environment in this study refers to the various

approaches and devices employed by the management or individual to reduce the effect of environmental conditions on the workers and their activities. These include adapting to the hot environment, taking days offs, rehydration, using weather applications, sprinkling water to reduce dust on the site, using fans and cooling systems, and using PPE.

The ability of workers to cope better with extreme heat in the workplace following the number of years spent is an indication to adapt to high temperatures. A worker said his first three years at work were very stressful due to the heat, but he appeared to cope better. Jacklitsch et al. (2018) suggest a period of adaptation for workers to cope with extreme weather conditions, especially when they are foreigners. Acclimatization comprises the physiological adaptations that occur during successful and repeated exposure to a hot environment (Jacklitsch et al., 2018). As a result, an individual can work more efficiently with a reduced likelihood of heat-related illness.

During training for heat stress, there should be an emphasis on the importance of acclimatization and the various ways construction workers can achieve acclimatization (Jacklitsch et al., 2018). For instance, workers can gradually acclimate themselves to heat by increasing the workload in hot conditions (Horie, 2013). Kakamu et al. (2021) also report that construction experience reduced the risk of heat-related illness. That means that construction workers with more experience doing physical work outdoors have a reduced risk of heat-related illness than workers with no or less experience. Experienced workers are more acclimatized to heat and exertion per job requirements.

Taking a day off allows workers to recover from stress and avoid stressful environmental conditions. Participants also used mobile applications to monitor weather conditions to know when to take time off or reduce their activities. Workers also said that they drink a lot of water to

compensate for excessive sweating and to manage extreme heat at the workplace. This agrees with workers elsewhere who rehydrate themselves following excessive sweating, characterized as hot (Smith et al., 2021). Dust control and management is another measure taken by construction workers and management. According to the participants, spraying water on the construction ground helps to reduce dust formation and distribution in the atmosphere. According to Nij et al. (2003), dust particles, especially those from quartz, are carcinogenic. When not controlled, they are in constant contact with the skin, eyes, and noses, where they have deleterious effects. A common way to reduce dust on the construction site is by spraying water on the construction ground, especially in the afternoon helps to manage dust together with the use of PPE (Nij et al., 2003).

Using fans and air conditioners can help control the indoor temperature effectively. Hence when workers operate indoors, these can help them cope with the high temperature, whether environmental or internally induced by machines. According to (Horie, 2013), companies and employers can provide enough cooling gear to the construction workers, such as helmets, cooling vests, misting systems, sleeves, towels, fans, and air conditioners. Workers also take breaks as a way to manage unfavorable environmental conditions, refresh, drink water and sometimes eat. Elsewhere, construction workers proposed a need to have 'heat relief' breaks. This may be an effective strategy as it would force workers to take breaks regardless of whether they feel they are needed or not (Lao et al., 2016).

Furthermore, using PPE to protect against environmental conditions and chemicals from construction activities has been advocated. These include helmets, gloves, earplugs, or safety goggles, depending on the work they are engaged in (Abrey and Smallwood, 2014). PPE, like helmets and safety shoes, protects the head and foot from harmful materials. Others, such as

aprons, glasses, and gloves, protect from chemical irritants and abrasion. It must be stated, however, that sometimes PPE may not be comfortable to use under extreme heat conditions.

Although it is in the long-term interest of employers and government regulators of the construction industries to promote occupational health and safety, in reality, some of them do not invest in a culture of health and safety (Sánchez et al., 2017). Some of these employers and policymakers look at workers' health and safety as nothing more than a checklist they do just to meet workplace standards and avoid penalties (Shea et al., 2016).

Role of Managers

The roles of managers and supervisors in ensuring operations' effective and smooth running constitute a substantial part of the work environment. In this study, these roles include briefing, consultation, and developing interventions, ensuring safety, issuing instructions, observing the execution of duties and monitoring work progress, and providing safety education to workers. The approach to which a manager carries out his duties can contribute the conduciveness in the workplace. Furthermore, strongly depend on the ability of the manager or supervisor to carry every worker along in the safety philosophy of the management (Yule and Flin, 2007). In this study, the manager has been observed briefing and consulting with workers on safety education, which is one way of carrying everyone along in the company's safety philosophy. They were also observed taking practical steps to ensure the safety of others by picking up a carelessly placed dangerous tool or object. Besides training, construction companies can also hold brief safety meetings a couple of times a week (McCarthy et al., 2019). During safety meetings, employers can highlight the significance of sufficient hydration and cool-down areas. Through such brief meetings, construction workers can learn how to identify heat stress signs and the appropriate steps they should take.

The overall aim of the manager is to reduce the number of injuries to personnel and operatives in the workplace through the prevention and control of workplace hazards, minimizing the risk of major accidents, controlling workplace risks, improving morale and enhancing productivity, minimizing production interruptions and reducing material and equipment damage, reducing the cost of insurance as well as the cost of employee absences, minimizing legal costs of accident litigation, fines, reducing expenditures on emergency supplies, reducing accident investigation time, supervisors' time diverted, clerical efforts, and the loss of expertise and experiences (Choudhry et al., 2008).

Work Location

Work location, from the context of work conditions in this study, refers to the nature of the work environment, whether indoor or outdoor. Participants in this study worked in both environments. Most participants preferred an indoor work environment to protect them from the direct sun’s rays and probably from high temperatures. They perceive working indoors as a better work location and condition than working outdoors. However, there is a higher demand for outdoor work than indoor work. This is so as building and road constructions are fundamentally outdoor works. Similar to this finding is the work by De Dear et al. (1998), where they report construction workers' preference for indoor work compared to outdoor work. Arcury et al. (2015) found that about 35% of the workers reported heat-related illnesses while working outdoors, while about 13% reported heat-related illnesses while working indoors. Most construction workers usually work outdoors and in an open environment. The most significant risk that construction workers face when working in outdoors is heat stress (Acharya et al., 2018).

Health and Workplace: Health Issues Arising from Workplace

Participants suffered various heat-related health conditions in their workplaces, making

them vulnerable. These heat-related health conditions include emaciation, sunburns, skin rashes, sweating, dizziness, eye defect, fatigue, heat stress, heat stroke, increased heart rate, insistent cough, muscle contraction, respiratory infections, shortness of breath, and other health risks. These types of health effects have been reported among construction workers (El-Shafei et al., 2018). Some workers reported that they have become emaciated and now a shadow of their form selves. This could mean they find the work very stressful and have not been adequately cared for themselves. (Xiang et al. (2013) point out fatigue, irritability, lethargy, impaired judgment, loss of coordination, etc., as effects of extreme workplace temperature in construction workers.

Burns and skin rashes were also reported among construction workers, and these have been attributed to contact with irritants and other sensitive materials (Purani and Shah). In addition to that, skin cancer, allergic diseases, and cardiovascular disease have been listed as effects of extreme workplace temperature (Yasmeen et al., 2020). As all participants emphasized, sweating is an observable effect of heat-related health effects on workers. Heavy sweating can lead to discomfort, and loss of body fluid has been reported as a significant symptom of heat-related illness in several studies (Dutta et al., 2015; El-Shafei et al., 2018).

In this study, workers reported that they experienced increased heart rates resulting from workplace temperature. They especially experienced increased heart rate with increasing temperature or as the day progressed. Increased heart rate could be the underlying factor of fatigue or tiredness. This has been reported to be associated with increased workplace temperature. Xiang et al. (2013) reported heart disease as one of the adverse health effects of cardiovascular disease. It is safe, therefore, to conclude that irregular heart rate resulting from workplace heat stress is such. Similarly, musculoskeletal pains attributed to carrying heavy loads, such as those observed in this study, have been reported among construction workers

(Purani and Shah, 2019; Carvajal-Arango et al., 2021).

Respiratory infections and other symptoms, such as insistent cough, are reported in this study and may result from inhalation of sand and dust particles prevalent in the workplace atmosphere. Respiratory infection is often characterized by difficulty breathing and shortness of breath that may result in anemic conditions. Purani and Shah (2019) illustrate that respiratory infection among construction workers in India and identify the activities that can lead to the development of respiratory infections, such as emptying bags of cement.

Managing Health Effects

From the responses from the participants, it is clear that the construction workers devised various means to adapt and cope with the adverse health effects experienced in the workplace. These adaptation approaches include using emergency medical services, rehydrating the body, self-medication where practicable, and visiting the doctor. Construction workers avoid energy drinks containing caffeine to manage the health effects resulting from their occupation. Construction workers naturally want to drink energy drinks for the strength to carry out their physically demanding activities. However, caffeinated drinks' ability to increase heart rate and blood osmotic pressure means that they should be avoided entirely (Rauh et al., 2006).

Emergency and medical services available to workers are also explored when it comes to taking care of their health. In this study, some workers reported being assisted with emergency medical services such as the ambulance and first aid. Others have called for an ambulance for a colleague or know of a colleague who has used ambulance services. Zwerling et al. (1996) show emergency services such as ambulances among construction workers. This indicates that workers requiring emergency services are vital for managing health effects due to occupational hazards. In addition, as the number of construction workers increased, the number of emergency

department visits due to heat-related diseases increased by 8.1%, while the hospitalization rate increased by 10.9%. The highest incidence of heat-related diseases was observed among men and individuals living in rural areas (Riley et al., 2018).

Furthermore, construction workers revealed that they get over-the-counter medication to take care of their heat-related occupational health challenges. They said they occasionally took heat-related medication, such as burnt cream, etc., to manage their health. Others took analgesics for body pains and headaches. Construction workers in this study added that these medications do not require a doctor's prescription, making them easily accessible. Tustin et al. (2018) reported using analgesics (self-medication) for work-related illnesses among construction workers.

Most importantly, as a health management procedure, construction workers visit the doctor when for heat-related illnesses when it is necessary to do so. Workers have been to the doctor for various medical conditions such as skin rashes, to get eye drops, wounds, shortness of breath, headaches, chest inflammation, etc. Adhikary et al. (2011) mention that hospital visits among construction workers in the Middle East.

Relationship with Colleagues

Construction projects are normally socio-technical systems that can take various organizational forms. Construction workers revealed that they have cordial relations with one another, but that high temperature negatively affects concentration.

High temperature has a Negative Effect on Work Relationships.

Occupational heat stress significantly affects the health of construction workers; there is the expectation that it may have social implications for the workers. Heat stress aggravates the existing workplace and settlement issues for construction workers, leading to direct and indirect

social effects (Nunfam et al., 2018). The construction industry is not a well-structured sector; most of the time, many workers are hired by intermediaries daily. Venugopal et al. (2016) reported that many construction workers stated that working conditions such as occupational heat stress significantly affected their everyday living and social lives. Increased irritation, reduced focus, and exhaustion of workers due to occupational heat exposure increase the risk of poor interrelations with co-workers, managers/supervisors, family members, and community members (Nunfam, 2021).

In this paper, workers revealed that increased temperature adversely affects their relationships with others. Examples given include the high tendency for anger during high temperatures in the summer, an experience that is not common in the winter. A worker said this phenomenon results from a poor psychological state due to fatigue or unhappiness due to increased temperature. This agrees with Xiang et al. (2013), who state that increased temperature and dehydration had been associated with negative behavioral effects on workers. Similarly, Yi et al. (2017) reported that exposure to excessive heat and humidity could reduce workers' enthusiasm and concentration.

Cordial Relationship

Construction workers are more socially vulnerable than in other industries because of their long work hours, sometimes under extreme temperatures (Carvajal-Arango et al., 2021). However, workers said they have a cordial relationship with one another as described in their responses, such as discussing climate change with colleagues, discussing diseases with colleagues, eating with colleagues, and discussing temperature. These conversations are always expressed during break time, lunchtime, etc. This is also seen when they call the ambulance for an injured or sick colleague or when they encourage one another. A cordial relationship is also

observed among construction workers in a study by Carvajal-Arango et al. (2021).

Motives and Motivation

Kakamu et al. (2021) show that construction work is physically demanding, and the workers in this study agree with that. On this premise, it is important, therefore, to discuss the workers' motive for this choice of occupation and the motivation going forward. Motivation in this context refers to the personal drive that makes one work and remains as a construction worker and has been a top concept in personnel management (Parkin et al., 2009). The participants stated that they picked the job because they are foreigners and because it is the only job they can do based on their qualifications. Construction industries in Kuwait hire many foreign workers who are primarily without high educational qualifications. Because of their limited economic opportunities, the foreigners end up working as construction workers (Adhikary et al., 2011).

The motivation of these individuals to remain on the job is influenced by the attitude of their supervisor, encouragement from co-workers, family responsibilities, financial motivation, listening to songs or singing, personal motivation, and commendations from the manager. The results showed that many participants stated that they remained on the job due to financial incentives enabling them to care for their families and those who depend on them. While many workers may not naturally choose construction work as a choice occupation, financial incentives remain a major factor in being dedicated to it (Carvajal-Arango et al., 2021). Aiyetan and Olotuah (2006) state that construction workers had been motivated financially, and these financial incentives may include extra pay for shift work and working in an uncomfortable environment. Financial motivation for workers in this study simply means their monthly salaries and wages with which they care for their families, mostly in their home countries. This is also in

agreement with Carvajal-Arango et al. (2021), who note that salary is an important motivation for workers in the construction industry.

It was observed that workers felt charged and highly motivated for the day's job when they arrived in the morning. This suggests that the workers are full of energy after a period of night rest and in line with another motivating factor, taking a break. As discussed later in this chapter, taking a break to refresh, eat and breathe fresh air is described as a relief break (Lao et al., 2016). Workers also derived motivation from colleague encouragement and focused on meeting the daily target.

In conclusion, improving occupational safety and health in the construction industry becomes challenging. However, It is crucial to manage heat stress among all construction workers properly. Employers and government regulators need to genuinely care about the health and safety of workers (Sánchez et al., 2017). Safety and health as a priority must be reflected in how construction employers treat workers and how the entire business processes and practices are conducted.

CHAPTER 5

SUMMARY, CONCLUSION, LIMITATIONS, AND RECOMMENDATION

The earth's increasing temperature affects people everywhere, especially construction workers working in the open and under the sun. The study aims to investigate the effect of heat stress on working conditions, health, and relationship among co-workers. This section includes a summary of the findings, theoretical, policy, and practical implications of the result, study limitation, and conclusion.

Work Environment: Effects of Environmental Variables

The workers' work environment is characterized by high temperatures, high humidity, sandstorms, and intense sunlight. These adverse workplace environmental variables lead to loss of concentration, respiratory infections, heat stress, shortness of breath, sweating, and impairment of cognitive functions, which may trigger anxiety and reduced productivity. It was projected that extreme temperatures could lead to reproductive impairment among workers. These adverse health effects of workplace temperature are a concern that needs to be put into consideration as a concern in occupational health.

Managing Work Environment

Workers were able to cope with the adverse effects of environmental variables by adapting to the high temperature, taking a break, rehydration, spraying water to reduce dust, using fans and air conditioners, and using PPE. Because of their long duration of work at the construction company, some of the workers appeared to have acclimated to the extreme workplace temperature. This also helps in coping with the adverse workplace environment.

Role of Managers

Managers and supervisors also provide workers with the necessary support and assistance to cope with the workplace environment. These include having safety meetings with workers in the management's safety philosophy to ensure minimal injuries and accidents.

A managerial approach to helping construction workers to cope with challenging environmental conditions, injury, and accident reductions constitute a positive social environment for the workers. A good relationship is enhanced when the supervisors carry everyone in briefings and meetings like the ones mentioned above. Workers are more cooperative when they know why certain things are required or why certain tasks have to be done in a particular way within the industry.

Health and Workplace: Health Issues Arising from Workplace

An unfavorable workplace environment resulting from environmental variables has adverse health effects on construction workers in Kuwait. These effects include emaciation, sunburns, skin rashes, sweating profusely, dizziness, increased heart rate, musculoskeletal pains, and headache, among others. These are due to the impact of rising workplace temperatures and humidity. They hurt their productivity, relationship with colleagues, and their economy. Furthermore, workers may risk making poor judgments, getting involved in an accident, and impaired reproductive ability.

Managing Health effects

Workers can manage the effect of heat through behavioral changes such as (rehydrating the body, etc.) and medical services (using emergency medical services and over-the-counter medications). The workers visit the doctors for health issues (skin rashes, eye defects, chest inflammation, etc.) arising from the workplace. Although they sometimes say that it is difficult

or expensive to see the doctor. Furthermore, the workers sometimes buy medications such as sun cream over the counter without a doctor's prescription as they claim that it is not required.

Workers have personally used the emergency services, seen others use it, or heard about it. From the research, emergency services have been called for workers. For instance, one (or some) experienced shortness of breath, while another was reported to have fallen from a considerable height while working. It was also observed that some workers who suffered strain were attended to using a first aid kit.

Relationship with Colleagues: High temperature hurts the relationship

It was seen that high workplace temperatures harmed workers' relationships. Workers tend to be angrier during high summer temperatures. On the other hand, workers revealed that they are happier during the winter. There is a lowered rate of fatigue, confusion, pressure, and aggressiveness as the temperature cooled. This phenomenon has been attributed to poor psychological state due to fatigue or unhappiness due to increased temperature. And this suggests that a cooler environment, mainly observed during the winter, positively affects workers' productivity, state of mind, and relationship with others. Extra measures need to be taken to care for the mental health of construction workers during the summer for their effectiveness and good relationship with colleagues and management.

Cordial Relationship

Workers had a very cordial relationship with one another. This is reflected in the number of things they do together apart from just working on projects. These other things include discussing climate, temperature, and diseases and eating together during their lunch break. These discussions may focus on how to cope with and manage unpleasant experiences. There were reports of workers calling the ambulance for colleagues when needed.

Conclusion

Findings from this study showed that the extreme temperatures experienced by workers resulted in adverse health and social effects on them as well as their work. Heat stress leading to the various health effects mentioned above has economic implications on the workers based on the cost of caring for themselves when not feeling well and loss to the company when they are away due to sickness. The cost of their health effects due to the workplace environment can lead to tradeoffs in financial commitment to families for the health of the individuals. The financial stress on the family during the period can also exacerbate worker anxiety about the inability to discharge his duties as the breadwinner.

Increased aggressiveness, anxiety, loss of focus or concentration, reduced productivity, and poor interpersonal relationships are observed due to increased workplace temperature, especially during the summer. This revealed the social implication of the environmental condition, with its negative effect on productivity and healthy relationships. To maintain workers' productivity and interpersonal relationship, it is important to make the environment more conducive. This will help to improve the relationship among them with socioeconomic implications for the industry. The absence of workers due to sickness or injury may lead to delays in project completion and extra cost to companies related to bringing a project to completion.

It has also been observed how certain socio-demographic factors, including immigration status, ethnicity, and poverty, increase the vulnerability of construction workers to high temperatures at the workplace. Immigrants, essentially those with educational qualifications, may take up riskier jobs involving hard labor since they may have fewer alternatives. The fear of being deported compels them to work in extreme conditions for lower wages than the natives.

The ethnicity of the construction workers is also connected to susceptibility to increased temperatures. Minority ethnic groups in Kuwait are usually less educated and more likely to be socially disadvantaged to work in risky occupations, including the construction industry. Members of ethnic groups can also be doubly susceptible to extreme heat and the associated health outcomes as they may be excluded from accessing media-based health messages due to language barriers. Arabic is the main language in Kuwait, and workers who do not speak this language may be unable to follow weather reports and information from construction companies to increase awareness and reduce the impact of increased temperatures. Lastly, poverty-stricken workers usually have limited financial, material, and social resources to cope with rising temperatures.

Occupational heat strain theory: Theoretical Implications

Existing literature suggests that environmental heat stress affects workers' ability to lead productive and healthy lives. The occupational heat strains comprise changes in heartbeat, temperature, and sweating. The heat strain is determined by environmental conditions, body metabolic rate, and clothing (discussed on page 25). This can be very different from one workplace to another. Moreover, this study's approaches to managing health effects appeared to be ingenious and behavioral, with little reference to a standard of working conditions that should apply to the construction site. This means the study only focuses on the working conditions from the perspective of the workers – an inductive focus – rather than a deductive focus from the literature perspective.

This study's findings align with the occupational heat strain theory. It was revealed that workplace environmental variables such as high temperature and humidity have various health effects on the workers. These effects include sweating, increased heartbeat, musculoskeletal

pains and headaches, dizziness, confusion, fatigue, sunburns, skin rashes, and shortness of breath. Socially, these environmental variables hurt the relationship between workers as well.

More so, social support in managing adverse health and social effects of the workplace environment from the company was limited but observed among fellow workers. Construction workers belong to lower socioeconomic status groups and are unable to afford health care mainly because of the lack of governmental and organizational support. Most construction workers tend to have limited access to good health care.

These findings are significant and should be a public health concern. Hence, the implication is that a good socio-physical work environment has positive health effects for workers and socioeconomic benefits for the workers and the management. As a growing county, the Kuwaiti government must pay attention to this vital segment of society.

Practical Implications of Research

The findings showed that construction workers suffered various adverse health and social effects from unfavorable workplace environmental conditions. The practical implication is that workers do not have adequate protection from possible workplace accidents. Workers are not adequately protected from injuries and accidents. This is revealed by the incidence of injury reported in the research. They lack adequate PPE.

In most cases, sick workers were left to take care of their health issues alone, except for serious injuries, where they were accepted for medical attention by the management. Workers responsible for their care may be inadequate and indicate poor personal health management due to cost and poor socioeconomic status. This further exposed them to significantly worse health conditions.

Policy Implications of the Research

The findings and conclusion of this research have several policy implications. In line with existing literature focused on other countries, this research has established that construction workers in Kuwait operate under extreme and unfavorable environmental conditions, such as extreme temperatures. These conditions have led to adverse health and socioeconomic effects on workers. What is more, there are little to no effective management practices that prioritize workers' safety to ensure that they are adequately protected from the impacts of environmental conditions. Stakeholders in construction companies have not made it a priority that the safety of workers is guaranteed. A specified percentage of funds should be mandatorily budgeted for safety-related expenditures. Safety policies should provide incentives for implementation and penalties for non-compliance. This will make non-implementation more costly to construction companies. More importantly, construction companies must be rated and considered for safety compliance when they bid for a contract. The government should state safety regulation standards clearly and communicate them to all construction companies in Kuwait. This will go a long way in protecting construction workers from all forms of harm resulting from the workplace.

A policy is needed to ensure all construction workers' health and medical access, irrespective of their national affiliation. There is also the need for a compensation scheme for construction workers to ameliorate the effects of severe health conditions and injuries. A maximum temperature threshold (after which health effects start to manifest) should be established for construction workers. Furthermore, minimum standard PPE use among workers in construction companies must be determined to protect the workers from injuries and reduce the impact of accidents. Finally, there is a need for minimum health, safety, and environmental

requirements for all prospective employees of construction companies. Regular retraining of construction workers is equally recommended.

When incorporated into policies, these measures will minimize the effect on the workplace environment as well as reduce the degree of accidents among construction workers. Other benefits of the policy implementation include the improved relationship between workers and the management, improved relationships within families of workers, and conservation of funds that would otherwise be spent on managing health (buying medications, visiting the hospitals, etc.) by the workers and the companies.

Limitations of This Study and Recommendations for Further Research

In this research, the findings are based on qualitative data collected from construction workers of companies in Kuwait. I managed four online and eight in-person interviews and twenty hours of observations on a new area called Abdullah Al-Mubarak construction site. There are both strengths and limitations to the qualitative approach. The qualitative data can provide detailed information on how individual worker is affected by and react to workplace environmental variables. This is particularly useful for understanding how construction workers can be protected from harmful workplace environmental conditions. However, an intrinsic limitation of qualitative data collected via in-depth interviews lies in its small sample size. Some of the findings may not be generalized to other companies in Kuwait because the sampling is based on purposive sampling rather than representative sampling. The sample size may not be large enough to discuss some particular issues (e.g., the effects of workplace environmental variables on workers' interpersonal relationships with them). In addition, there is so much emphasis on the health effects of environmental conditions on workers rather than on the impact of the workplace environment on their social well-being.

Furthermore, the choice of participants who are long-term workers in the company may be a bias in getting a skewed response from them due to acclimation to the workplace environment. There is a need to consider new entrants to the job to provide another perspective to the research. The construction work in a new area and probably out of government radar may affect the company's compliance with providing standard safety and protection frameworks. This can also affect the tendency to generalize the findings of this research.

The limitations relating to the generalization of research findings could be overcome by pursuing further research on the same topic but considering areas not covered. Future research might focus on the effects of the workplace on workers social well-being of foreign workers in Kuwait.

There is a lack of a standardized scale for measuring social and environmental conditions as perceived by the workers. This made it difficult for workers to describe the workplace social environment or welfare as good or bad. There is also no minimum standard to explain whether a worker used PPE or not.

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APPENDIX A

Sample Solicitation Request

My name is Ahmad M Alharbi. I am a graduate student in the Sociology department at Southern Illinois University Carbondale, IL. I am asking you to participate in my research study. My study aims to provide more understanding of the diverse risks that work on construction sites in Kuwait experience because of high temperatures. Participation is voluntary. If you choose to participate in the study, it will take approximately45- 120 minutes of your time. You will answer various questions to meet the study's objective. For instance, I will ask you about the temperature in the workplace and Kuwait in general, what health issues they face during summer, and your relationships with others. The minimum age to participate is 18/19 years (18 if Illinois alone and 19 if this is a national sample). You were selected to participate in this study because you have worked in Kuwait's construction industry for over five years.

There is no penalty for not participating or for withdrawing from the study. (if applicable, there will be no effect on grades/class standing/services rendered if you choose not to participate or to withdraw.)

If you have any questions or concerns about the study, please contact me. (or my advisor, if applicable) (Ahmad Alharbi. Email: ahmad.alharbi@siu.edu (Dr. Darren Sherkat, Southern Illinois University, darrensherkat@gmail.com, and 618-###-####.)

To participate in this study, please email me(ahmad.alharbi@siu.edu, or No +96599932099).Thank you for taking the time to assist me in this research.

APPENDIX B

Consent Form

My name is Ahmad M A S Alharbi. I am a graduate student in the Sociology department at Southern Illinois University Carbondale. I am asking you to participate in my research study. My study aims to provide more understanding of the diverse risks that work on construction sites in Kuwait experience because of high temperatures. Participation is voluntary. If you choose to participate in the study, it will take approximately 45- 120 minutes of your time. You will answer various questions to meet the study's objective. For instance, I will ask you about the temperature in the workplace and Kuwait in general, what health issues they face during summer, and your relationships with others. The minimum age to participate is 18/19 years of age.

There is no penalty for not participating or for withdrawing from the study. (if applicable, there will be no effect on grades/class standing/services rendered if you choose not to participate or to withdraw.) If you want to withdraw, you should tell the interviewers that. Any information submitted prior to your withdrawal will be destroyed.

Your responses will be audio/video recorded. If you choose not to have your responses recorded, I will provide audio/video recorded. These recordings will be transcribed/stored and kept for (3 years) in (Sothern Illinois University). Afterwards, these recordings will be destroyed, and any retained data will be de-identified. Please do not use individual names or locations in your responses to protect the privacy of nonparticipants. All your responses will be kept confidential within reasonable limits. Only those directly involved with this project will have access to the data. I will take all reasonable steps to protect your identity. (State that responses are anonymous, if applicable)

You may skip any question that you would prefer not to answer.

The anticipated risks of this study are psychological and privacy harm. The anticipated benefits are finding a healthy environment and enacting new rules to prevent construction workers from working in harsh summers.

Compensation in the amount of 10 KD/ 30 USD will be offered if you successfully complete this study. (If compensation is offered. If it is not, you may omit this sentence, or

you may state that thereis no compensation offered.) (If there will be a drawing [do not use the word raffle], please indicate how many items will be drawn for and how many participants are anticipated.)

If you have any questions about the study, please contact me. (or my advisor, if applicable) (Ahmad Alharbi. Email: ahmad.alharbi@siu.edu (Dr. Darren Sherkat, Southern Illinois University, darrensherkat@gmail.com, and 618-###-####.)

I have read the information above, and any questions I asked have been answered to my satisfaction. I agree to participate in this activity and know my responses will be tape-recorded. Iunderstand a copy of this form will be made available to me for the relevant information and phone numbers.

"I agree_____I disagree____to have my responses audio/video recorded."

"I agree_____I disagree____that (Ahmad Alharbi) may quote me directly, but anonymously/with a pseudonym in their paper."

Participant signature and date

This project has been reviewed and approved by the SIUC Institutional Review Broad. Questions concerning your rights as a participant in this research may be addressed to the committee chairperson, office of research compliance, SIUC, Carbondale, IL 6290. Phone (618)453-4534. Email: SIUHSC@SIU.edu.

APPENDIX C

Demographic information Sheet

- Sex:
- Age:
- Social status: Do you have children?
- Nationality:
- Qualifications:
- Occupation:
- Type of work: (inside or outside)
- How long have you been working in the construction industry
- How many hours do you work weekly?
- Where did you work before?
- Annual income:

APPENDIX D

Semi-Structured Interview Guide

Environmental working conditions (its risks, etc.)

- How do you feel about the air temperature in your workplace?
- Do you think the temperature gets worse yearly?
- What is the average time you spend in hot environments every day?
- Do you work in an inside or outside environment or in both?
- How often do you get fresh air at your workplace?
- How do you feel about humidity levels in the workplace?
- Do you get thirsty minutes after drinking water while working at high temperatures?
- How many times do you get fresh water at your workplace?
- When the temperature rises during the day, do you feel tired and tired in the workplace?

Health-related questions

How often do you take reasonable breaks to rest and hydrate the body?

- Do you sweat a lot in the workplace, especially in the summer?
- How do you describe your heart rate at work?
- How often do you have headaches at work?
- How often do you feel dizzy at work?
- How often do you have shortness of breath at work?
- How often do you get a rash or sunburn on your skin at work?
- How often do you have muscle contractions in your body at work?
- What is your level of concentration at work?
- How often do you visit your healthcare provider for heat-related diseases?
- When working in direct sunlight, how can you describe your vision?
- How often do you take medications without a prescription to treat heat-related diseases?
- How do you build your endurance to work when working?
- How often do you call emergency services because of severe symptoms of heat-related diseases that require immediate medical attention while in the workplace?

Relationships (family and friends)

- Do you think high temperatures affect your relationship with others in the workplace?
- How often do you discuss and blame extreme heat waves with your co-workers?
- How often do you discuss the signs and symptoms of heat-related diseases with other people, such as skin irritation?
- Do you get angry when interacting with co-workers in the summer?
- Do you answer family or friends' calls when you work at a high temperature?
- How often do you eat or drink with your co-workers?

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Perceived New Risks to Construction Workers in Kuwait Due to Rising Temperatures

Major Professor: Dr. Darren E Sherkat.