OCCUPATIONAL RISKS AND THEIR POTENTIAL IMPACT ON EMPLOYEES' HEALTH IN KENYA TEA DEVELOPMENT AGENCY'S MANAGED FACTORIES

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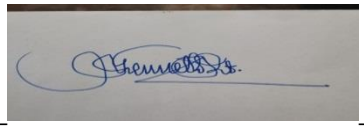
A Research Project Report submitted in partial fulfillment of the requirement for the Award of a Master of Arts in Environmental Planning and Management in the Department of Geography and Environmental Studies, University of Nairobi.

November 2020

DECLARATION

BY CANDIDATE

I declare this as my original research project report and has not been previously published or presented for the award of a degree in any other University.



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(REG. NO.C/50/7891/2002)

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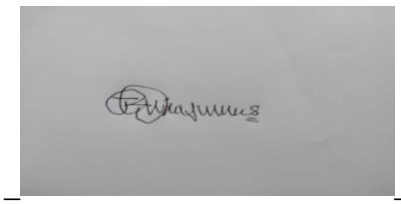

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DEDICATION

This research project report is dedicated to the people who are very close to my heart - my wife Mercy, son Ian, and daughters Ivy and Amy. Their love and encouragement is the inspiration I have always needed to go an extra mile.

To my children, I hope this research project report will inspire you to learn more and become valuable assets to humanity.

ABSTRACT

The study was conducted within KTDA managed tea factories in Kenya to study occupational risks and their potential impact on employees' health. The specific objectives included: examining the effect of injuries on employees' health, assessing the effect of noise on employees' health, establishing the effect of carcinogenic agents on employees' health, evaluating the effect of airborne particles on employees' health as well as determining the effect of ergonomic risks on employees' health. The study adopted explanatory research design. The study targeted 1500 workers; simple random sampling was used in identifying the sample size. Secondary data was collected from numerous authoritative sources including online journals, published articles, and books. Data was also gathered using questionnaires that were edited, coded, categorized, and presented in a methodical manner to permit accurate analysis. The generation of outputs was achieved using the Statistical Package for Social Sciences. Tools of inferential and descriptive statistics were used to conduct data analysis. Reliability test was carried out using Cronbach's alpha test. The study model's predictive power was established using multiple regression analysis. Presentation of the findings was done in form of charts, summarized tables with percentage scores, statistical mean and standard deviation together with outputs of inferential statistics. As a result, the study found out that injuries ($0.011 \leq$ p-value ≤ 0.05), noise ($0.010 \leq$ p-value ≤ 0.05) and ergonometric risks ($0.001 \leq$ p-value ≤ 0.05) were the occupational risks that had statistically significant impact on employees' health among KTDA managed tea factories in Kenya. Carcinogenic agents ($0.072 \leq$ p-value ≤ 0.05) and airborne particles ($0.618 \leq$ p-value ≤ 0.05) were found to be statistically insignificant. The study recommended that there be a provision for a proactive process to help management find and fix workplace hazards before workers are hurt, guidelines on the assessment and management of noise risks be provided, mechanisms are put in place that ensure reduction in high dose or accidental exposure, protect employees from high degree of exposure to organic and non-organic dust while ensuring provision of fitting face masks as well as ensure successful implementation of ergonomic solutions among others.

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ABBREVIATIONS AND ACRONYMS

BTEX	-	Benzene, Toluene, Ethyl benzene and Xylenes
EU	-	European Union
GDP	-	Gross Domestic Product
IARC	-	International Agency for Research on Cancer
ILO	-	International Labour Organization
KTDA	-	Kenya Tea Development Agency
PAHs	-	Polycyclic aromatic hydrocarbons
WHO	-	World Health Organization

DEFINITION OF KEY TERMS

Airborne Particles – refers to any particular matter like dust, soot, smoke or liquid droplets that are discharged into the air and they are small particles that can be suspended into the atmosphere (Black, 2006).

Carcinogenic agent – denotes an agent or substance that can result in the cells becoming cancerous by changing their genetic arrangement causing them to multiply nonstop and become malignant.

Ergonomic risks – entails the information regarding human abilities, behaviour and limitations as well as other characteristics associated with the design of tasks, machines, tools, environments and jobs for effective, comfortable and safe human use (McCormick and Saunders, 1993)

Injuries – It refers to any type of wound, cuts, bruises, abrasions, scratches, lesions and grazes that occur on the human body.

Musculoskeletal disorders – These are injuries that after occurring affect the muscles, tendons, nerves, discs and ligaments as well as blood vessels and these disorders lead to challenges in human body movement

(WHO, 2010)

Neurotoxic disorders – It is damage to the brain function and peripheral nervous system functioning when people are exposed to toxic materials that are either natural or man-made

Noise – refers to a sound, especially one that is loud or unpleasant or that causes disturbance

Occupational Risk – These are the working conditions and situations that cause injuries or illnesses to the workers or employees (Goelzer *et al.*, 2001)

Psychological disorders – these are conditions that are characterized by irregular behaviors, feelings and thoughts.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Throughout the world, many people spend most waking hours at work. Employees face various hazards in their places of work such as allergens, adverse ergonomic conditions, physical factors and chemicals and biological agents. These may result in health challenges such as hearing loss, reproductive, injuries, respiratory, psychological, cardiovascular, cancer, neurotoxic, skin and musculoskeletal disorders (Cincinnati, 2000). Other significant risky work-related factors cover aspects like infectious organisms, heavy metals, pesticides, and agents causing chronic obstructive lung illness and occupational asthma. Any analysis done at the international stage is unlikely to reveal the extent of the occupational risk factors since only the employees in the respective jobs who face these hazards are the ones affected by it (Goelzer *et al*., 2001).

Occupational hazards, such as carcinogenic agents, noise, injuries, ergonomic risks and airborne particles account for a significant portion of the problem of chronic illnesses: 37% of all cases of back pain, 11% of asthma, 8% of depression, 16% of hearing loss, 8% of injuries, 9% of lung cancer, 2% of leukemia and 13% of chronic obstructive pulmonary disease. Every year close to 12.2 million people, mostly living in developing nations and in their active working age, succumb to non-communicable diseases. Health problems that are work-related are responsible for economic losses of 4–6% of GDP for a majority of nations. Basic health care services costs which are aimed at preventing work-related and occupational diseases averages between 18-60USD against the purchase power parity for each employee. Close to 70% of employees are not covered by any insurance which will reimburse them in instances of injuries at the workplace and any diseases they suffer. The World Health Organization (WHO) reveals that measures put in workplaces for the health of the employees can reduce instances of absenteeism and sick leaves by approximately 27% and cut healthcare expenses for the firm by about 26% (WHO, 2014).

The occupational health level of employees and workstations tend to vary considerably depending on climatic conditions, industrialization level, developmental status, economic structure, and traditions associated with occupational health and safety. An estimated 20-50% of employees may be exposed to hazards at work in developed nations. Consequently, the rate of exposure to the hazards may be much higher in recently industrialized and developing countries. Some of the primary problems in the manufacturing sector include chemical and physical agents

and mechanical factors. On the other hand, pesticides, accidents, biological factors and organic dusts constitute the work-related challenges for agricultural workers. Several studies indicate that in the presence of poor working conditions account for between 50-100% of the employees in various hazardous industries face the risks of exposure to levels of biological, physical or chemical factors that surpass the minimum exposure limits. The various problems associated with health at workplaces and among the workers stress the importance of occupational health in all nations including least developed, newly industrialized, industrialized, and developing ones. The challenges in these countries may, however, differ significantly depending on the local and national cultural influences, necessities and conditions, among other local factors (WHO, 1994).

1.2 Statement of the Problem

The employees' health is a critical prerequisite for economic development, productivity, and household income, hence the need to restore and maintain the best working conditions. Additionally, all workers – especially those in high-risk professions – require health services to evaluate and lower their exposure to occupational hazards. At the same time frequent and timely medical check-ups and surveillance will help in detecting any work-related injuries and diseases to mitigate its effects (Tsai *et al.*, 1992). Health hazards at the workstation such as hazardous chemicals, psychological stress, noise, dust, heat, and unsafe equipment result in occupational illnesses and can worsen other medical conditions (Nurminen and Karjalainen, 2001).

One's position in the workstation hierarchy, occupation, and Conditions of employment also affect health (Loewenson, 2001). The human body can be adversely affected if it gets exposed to these occupational hazards. The effects may include asymptomatic changes, illnesses –its signs and diagnosis and in worst cases death (WHO, 2001). In some instances, the risk factors have a direct link to exposure and disease (Tsai *et al.* 1992).

When considering universal health coverage, the concept looks at access to health services with the aim of achieving good health through promoting, preventing, treating and rehabilitating people. Universal health coverage also looks at measures to address health determinants and financial protection such that ill people do not suffer poverty as they seek medication intervention (ICRP, 1991). There are measures that can prevent occupational factors leading to occupational diseases; including prevention and management of sources of pollution, controlling noise, use of less dangerous chemicals at the workplace, having sufficient ventilation and adoption of good working practices (Westgaard & Winkel, 1997).

The key role of having in place occupational health amenities is to be able to evaluate on occupational hazards and give recommendations that will deter work-related illnesses and injuries. Thus, this study provided a window to assess such occupational risks and any related effects on workers' health among KTDA managed factories in the eastern and western blocks of the Kenyan tea growing areas on either side of the Rift Valley. This was aimed at determining whether employees' health is exposed to danger and whether or not any interventions are required to mitigate them from exposure to such risks and eventual poor health.

1.3 Theoretical Framework

The study uses the updated Heinrich's Domino Theory, also referred to as "Bird and Germaine's Loss Causation Model," linked to Bird and Germaine (1985). This accident-causation model demonstrates the multi-linear relationship between the occurrence of accidents and their effects in a technologically evolving workplace, and the place of management intervention in the entire equation. The Domino Theory of 1931 initially indicated that accidents arise from a sequence of events beginning with the social environment and ancestry and ending with injury. In particular, the sequence of events in the Domino Theory includes social environment and ancestry, a person's fault, unsafe condition or act, accident, and injury. The occurrence of one event triggers the next, thus eliminating the key factors is essential in preventing the chain reaction's occurrence. According to Sabet et al. (2013), a majority of accidents arise from operation sources and human errors. The accidents result in the loss of properties, loss of life, and injuries. Wang and Jan (2019) postulate that peoples' shortcomings could be attributed to unsafe acts in the workplace. The shortcomings arose from the socio-environmental and genetic factors. Heinrich's domino-accident causation model places a direct correlation between accidents, unsafe conditions, and unsafe acts.

1.4 Research Objectives

1.4.1 Overall Objective of the Study

To assess the occupational risks and their potential impact on employees' health in Kenya Tea Development Agency's managed factories.

1.4.2 Specific Objectives of the Study

I. To examine the effect of injuries on employees' health in KTDA's managed factories
II. To assess the effect of noise on employees' health in KTDA's managed factories
III. To establish the effect of carcinogenic agents on employees' health in KTDA's managed factories
IV. To evaluate the effect of airborne particles on employees' health in KTDA's managed factories
V. To determine the effect of ergonomic risks on employees' health in KTDA's managed factories

1.5 Hypotheses of the Study

The study formulated the null hypotheses shown below:

1. Ho: Injuries have no significant effect on employees' health at KTDA's managed factories

2. Ho: Noise has no significant effect on employees' health at KTDA's managed factories

3. Ho: Carcinogenic agents have no significant effect on employees' health at KTDA's managed factories

4. Ho: Airborne particles have no significant effect on employees' health at KTDA's managed factories

5. Ho: Ergonomic risks have no significant effect on employees' health at KTDA's managed factories

1.6 Justification of the Study

The study will be useful to top management team at the factories in informing decisions, particularly on the issue of workers' occupational health and safety, in addition to ensuring that the health of workers exposed to higher threshold of occupational risks is safeguarded. This study helped to inform the development as well as application of occupational policies within the tea factories. This was necessary because the outcome would help reduce the cost associated with workers' poor health and boost the general working conditions of the employees within their respective shop floors.

1.7 Study Area

1.7.1 Location of Study Area

The study was conducted in KTDA managed factories in the Eastern and Western blocks of the tea growing areas in Kenya. KTDA encompasses 69 operational tea factories (KTDA Website, 2020). The maps showing the eastern and western blocks are as provided in figure 1 and 2 while figure 3 shows the tea growing districts of Kenya.

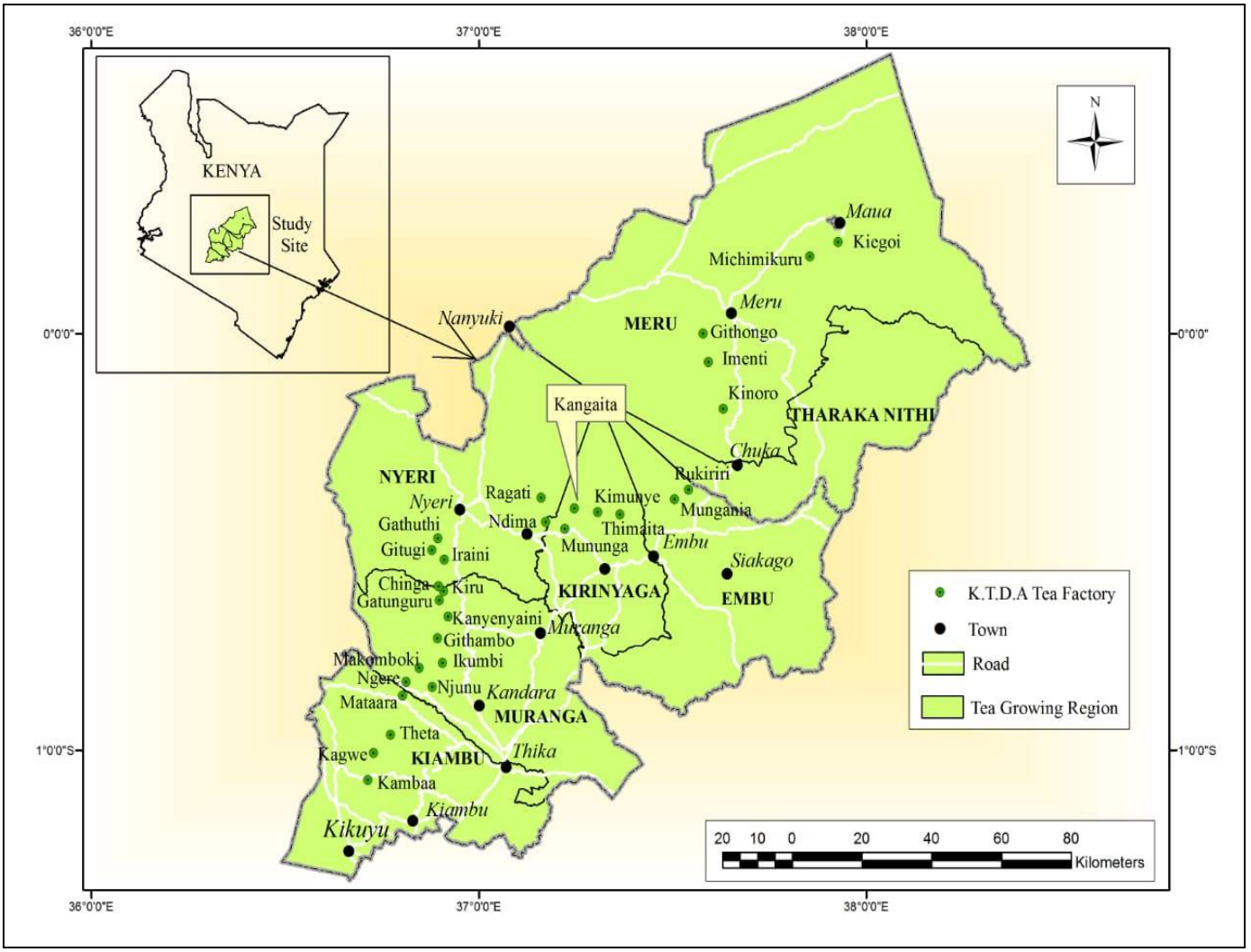


Figure 1: Kenya Tea Development Agencies' Factories-Eastern Block

Source: KTDA, 2011.

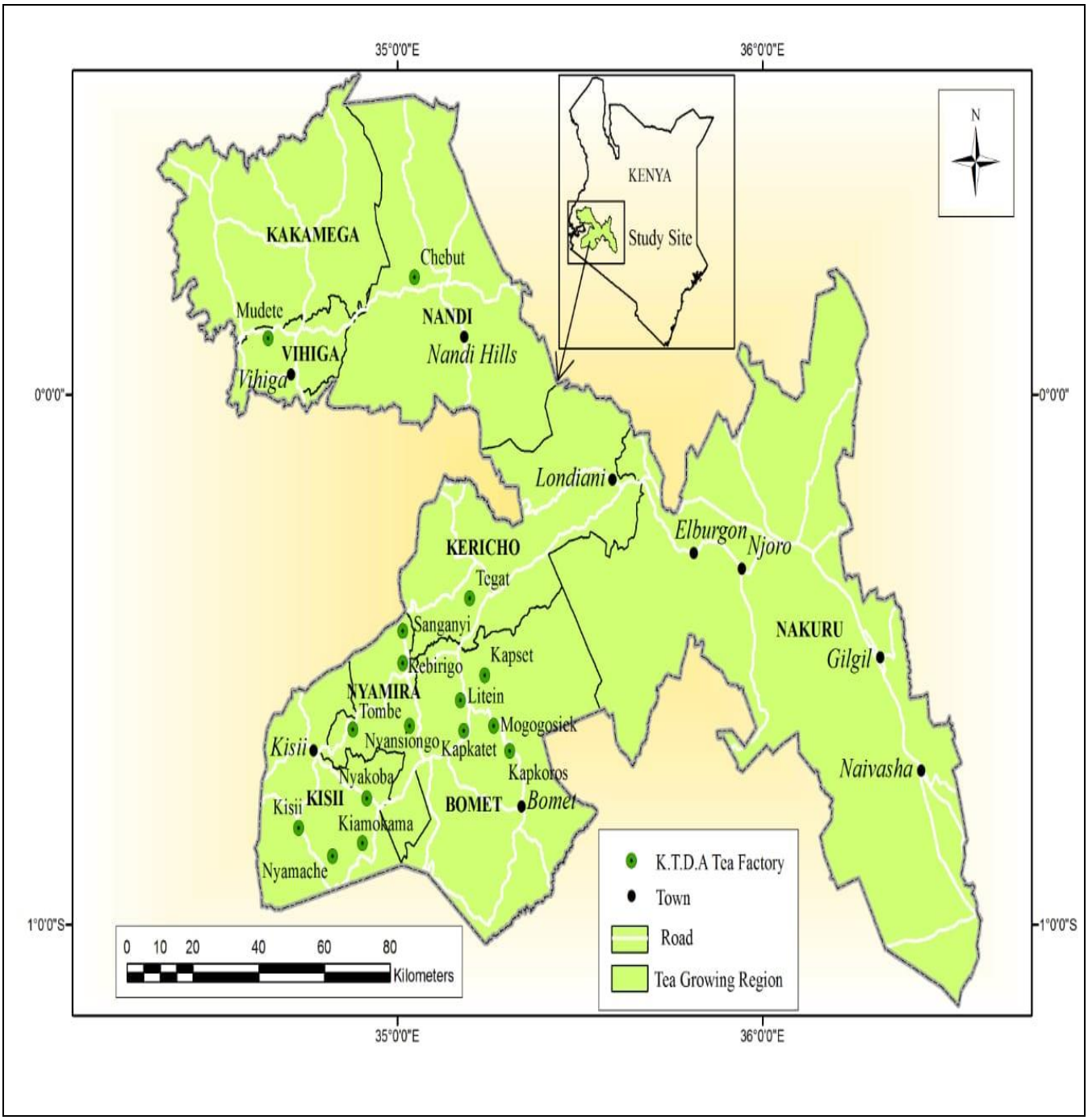


Figure 2: Kenya Tea Development Agencies' Factories-Western Block

Source: KTDA, 2011

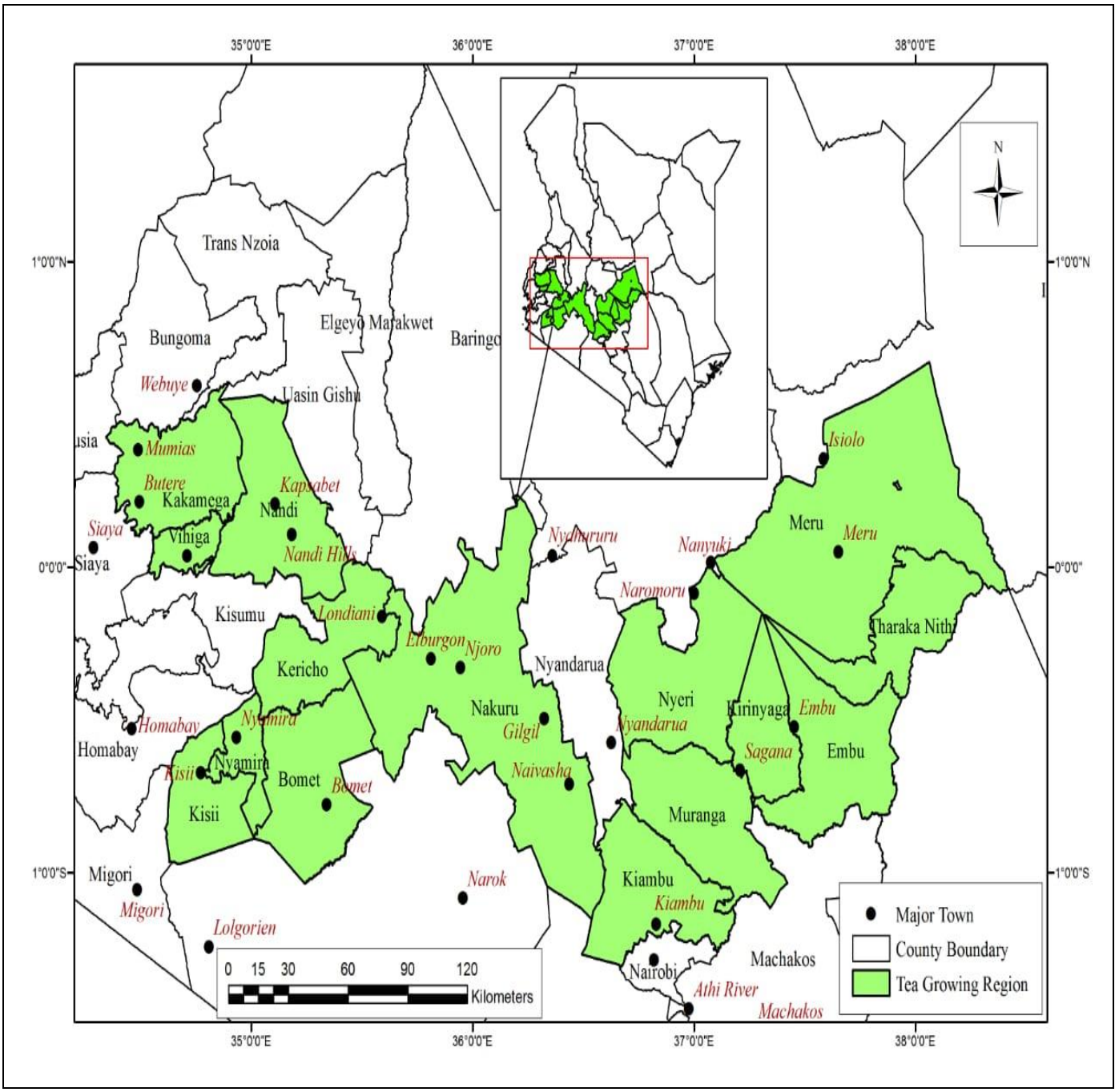


Figure 3: Tea Growing Counties of Kenya

Source: KTDA, 2011

1.7.2 Demographics of Small Scale Tea Farming

Small scale tea farming in Kenya started in the 1950's with the first tea factory set up in Ragati, Nyeri County. By then, there were only a few hundreds of tea farmers. In the 1960's, KTDA was established to provide comprehensive services to the small scale tea farmers country wide, who today number over 650, 000 besides other players in the tea value chain including those in the

agricultural extension, transport logistics, processing, marketing, packaging and distribution, warehousing, and other related services (KTDA Website, 2020).

1.7.3 Geology and Soil

Kenya's tea growing areas' landscape is diverse starting at 5,199m above sea level, being the highest point of Mt. Kenya. The dominant soil types include Nitosols, Phaeozems, Acrisols, and Ferralsols. Together with most areas, the soil nutrients have been greatly degraded due to deforestation activities, overgrazing and inappropriate farming practices that may lead to erosion of the rich volcanic top soils. Even with these activities the soil structure is good and has chances of resisting soil erosion (Muchena & Gachene, 2015).

1.7.4 Climate for Tea Agriculture

Tea growing areas in Kenya are located in high altitude areas (1400- 2700 metres above mean sea level) around East and West of the Great Rift Valley. Kenya's tea growing areas receive average annual rainfall between 1800mm to 2500 mm. Temperatures in the tea growing zones range between 19^0 C and 29^0 C. There have been notable changes in climatic conditions of these areas for the last three decades. Climate change factors include high temperatures, frost and hail together with dry and wet spells during tea growing seasons. These have a negative effect on tea growth and production (Cheserek, *et al*., 2015). Additionally, rainfall follows an erratic pattern throughout the year affecting the short and long planting seasons. The climate change is also responsible for the intense rainfall occurrence from July to December, which is the second season of the year (GoK, 2014).

1.7.5 Economic and Social Characteristics in Tea Growing Areas

In the tea growing zones, agriculture is the main economic activity, contributing 80% of income for many households and employing more than half of the areas' population. Tea growing areas records 41.3% of absolute poverty rate and the adverse climatic changes effect show variability of food security such that 38.7% live below the food poverty line (GoK, 2014).

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The chapter presents literature review on the perceptions of tea factory workers' empirical analysis relating to the study, overview of the literature review and the designed conceptual framework.

2.1 Literature Review

2.1.1 Employees' Health

The workplace plays a major role in impacting the health and well-being of people. When the workplace is poorly managed, it can result to sickness absence and work-related ill health. The consequences for individual employees influence on service delivery, and the cost involved make workplace health a cause for concern. Sickness absence is regarded to be a major issue in the business industry and it is considered to be one of the most important determinants of how well an organization is managed. A major review of the lack of trends in sickness has identified a clear link that addresses absence through sickness and modifying business performance. Several steps need to be taken in order to deliver these benefits. Workplaces have to be created where there is the protection and promotion of the well-being, safety and health of people; ensuring that employees have the ability of accessing expert occupational health advice as well as support; ease access to precautionary treatment and care for common medical conditions; facilitate workers to remain at the workplace while health complications are examined or treated; and supporting and involving medical professionals on return-to-work matters (Black, 2006).

A healthy workstation is one in which employees and management cooperate and employ a continuous improvement approach to safeguarding and maintaining the well-being, safety and health of all employees and the sustainability of the workplace, taking into account the following requirements: Health and safety issues in the physical working environment; well-being, safety and health problems in the psychodynamic working climate, including the role of the company and the workstation culture; health resources at the workplace; and community engagement to strengthen the health of employees, their families and community members (WHO, 2010).

Safe and conducive working environments are essential for a fruitful employment relationship and often lead to successful businesses. An employer has to work with the staff members to pinpoint hazards and address them. Fashioning a safe as well as healthy workstation is an elementary part of the relationship between the employer and the employees (Hikina, 2013). The principles of safety and health are universal; however, the level of action needed to implement them depends on the organization's size, the hazards its activities present the organization's physical characteristics, sufficiency of its current structures and the products or services it offers. A majority of features associated with effective management of safety and health are related to sound practices of management which are championed by exponents of business excellence, protection of the environment, and quality management. Management of health in the workstation encompasses people's protection and building a safe culture between employers and staff members. (HAS, 2006).

Quality management systems are critical because they continuously help in improving the safety and health of people in the place of work. These systems help in promoting and maintaining all organizational aspects. Their process entails the identification of key processes and taking corrective actions and identification of improvement opportunities. In addition, systems of quality management suggest that there be active participation of all workers in the quality process along with management's practice of visible leadership. Organizations that effectively implement their safety and health policies tend to have active safety dialog mechanisms in place, and a strong safety culture. In addition, successful businesses can launch and maintain a culture that safeguards safety and health measures (HSA, 2006).

2.1.2 Injuries

Risk factors that could result in injury are found in each workstation. Industrial and agricultural employees in particular face the highest risks, though workers are also at risk in schools, retail stores and offices (Cincinnati, 2000, European Union, 1993). Work-related falls, contact with machinery, and motor vehicle injuries cause approximately a thousand occupational deaths daily all over the world. The other ramification of work-related injury is disability, which can lead to the absence of workers from work and, at times, to lifelong inability of resuming to work. Due to variability in insurance coverage and the reporting systems accuracy, reliable data on injuries can be difficult to obtain even in nations that are industrialized. Nevertheless, the job fatality rates reported in developing countries are around two to five times higher than those reported in developed countries (Loewenson, 2001).

Every year, almost 310 000 employees lose their lives because of accidental job injuries. Motor vehicles, machines, falls, drowning, falling objects, fires, poisoning and intentional (homicide) may cause these injuries. Most of these deaths can be prevented. Occupational accidents account for 0.9% of global DALYs (13.1 million) and 16% of DALYs associated with accidental injuries for staff aged 15-69 (Wargocki *et al.,* 2002). In 2014, the Bureau of Labor and Statistics estimated that for every 100 full-time workers 3.0 million non-fatal workstation accidents as well as illnesses identified by private sector employers ranged at 3.2%. The figure arrived at after the U.S. Bureau of Labor Statistics performed an analysis of workplace injuries and illnesses.

In 2014, the rate reported followed a declining patter, with the exception of 2012. The downward trend was recorded annually since 2002. In 2014, private sector employers reported close to 54,000 fewer nonfatal injuries and ailments compared to the previous year. The decline together with a growth in reported hours worked caused the overall recordable cases incidence rate to fall to 0.1 cases for every 100 full-time employees. The decline in other recordable cases also resulted in the fall in the TRC rate. However, the rates for both days away from work and for cases of restriction or job transfer remained unchanged in 2014.

2.2.3 Noise

One rising workplace hazard is excess noise. The most severe consequence is permanent impaired hearing. Hearing impairment that is caused by noise usually starts in the frequency range of the human voices through the spoken speech interference. Accidents can be caused by impaired communication in the places of work. Exposure levels in excess of 85 dB are considered hazardous to employees and are widespread among manufacturing, mining and construction workers, especially in countries that are developing (Goelzer *et al.,* 2001).

The analyses utilize the WHO definition concerning hearing impairment that sets 41 dB as the threshold for hearing loss for frequencies ranging from 500 to 4000 Hz. A threshold of 25 dB for hearing loss is usually used in the work-related setting.

Close to 16% of hearing loss by employees around the world is attributed to the exposure of occupational noise. This is about 415000 DALYs (0.3 %). Occupational noise is generally blamed for approximately 4.2 million DALYs (0.3 %). Loss of hearing caused by the noise is permanent and can’t be reversed. It's entirely preventable, too. Luckily, a majority of the noise at the working places can be curtailed by utilizing controls of engineering to help in the reduction of noise from the source. Examples of programmes that can assist in preventing hearing loss include audiometric monitoring of employees' hearing, noise assessment, record keeping, and

proper usage of hearing protectors, programme assessment, and employee education (Bernard, 1997).

Noise produces notice of harmful effects among the exposed persons. People can have the ability of forgiving the noise but their bodies do resist. Noise pollution debates are typically based on industrial noise that is considered to be an attraction of most attentions as compared to other noise sources. WHO defines health as a complete mental condition, social and physical well-being, rather than a lack of disease or infirmity (Van, 2007). Excessive noise is then considered to be a health issue. Extended exposure to noises that are very disturbing or even a pleasurable sound at the end of an exhausting or too noisy day may cause extreme mental disorientation and even aggressive actions.

Noise is a major disturbance of a person's rest, work, communication, and sleep and damages hearing capability and arouses other physiological, psychological, and pathological responses. Noise can result in the development of cardiovascular complications such as hypertension and heart disease due to damage to peripheral vascular system. Studies have indicated increase in body plasma concentration and serum cholesterol in employees that are exposed to noise. Noise pollution interferes with the central nervous system, causes peptic ulcer and allergies like eczema and asthma gets worsened. There are three distinct levels where the interference is felt: sociological, biological and audio logical (Kapoor, 2006, Liptak, 1999). However, the harmful effects of noise on health cannot be measured in a straightforward manner due to their variability, complexity and interaction with noise and other factors of environment. Machine tools and operations that make and handle the product are responsible for the intense noise in factories. The noise comes from air turbulence, reciprocation, impact and friction (Jerry, 1984).

2.2.4 Carcinogenic Agents

According to IARC (2002), roughly 150 biological agents are likely or known carcinogens. The problem is that carcinogens exposures like benzene, cadmium and asbestos occur in the working environments. Occupational exposure entails the body of a person coming into contact with the possibly harmful environment or agent in the station of work. Key exposures depend on peoples' occupation, the location of their operation or the industrial sector − also referred to as the economic sector and the strategies adopted to limit their exposures. The chances of workers developing cancer depends on the total dose of the carcinogen that their body receives, the carcinogen's potency, the occurrence of other exposures such as tobacco smoking, and the susceptibility of an individual.

Excessive carcinogen contacts may bring about cellular level changes, leading to uninhibited growth of atypical cells which attack and damage the normal tissues found in the blood system and lungs. These exposures were chosen based on the strength of the proof for causativeness, the degree of the risk due to contact, and the accessibility of data. Adequate evidence, arising from research on humans, must be available before an agent can be labeled as carcinogenic. Enough evidence means that a causative correlation has been proven between cancer in humans and exposure or contact to the exposure circumstance, agent or mixture. Conversely, with fair confidence, contradictory facts, chance and prejudice can be omitted. IARC has categorized 87 exposure circumstances, mixtures, or agents as Group 1 carcinogens to human beings, like various viral and bacterial infections, chemical compounds, and pharmaceuticals. An extra 63 exposure circumstances, agents, or mixtures have been categorized as Group 2A possibly carcinogenic to human beings (IARC, 2001). Some of the cancers associated with Group 1 and 2A include lung cancer, malignant mesothelioma, and leukemia.

It is approximated that around the world, 20-30 % of male workers and 5-20 %of female workers (aged 15-64 years) are said to have been exposed to lung carcinogens such as asbestos, silica, diesel exhaust, chromium, cadmium, beryllium, nickel and arsenic at their workplaces. These occupational exposures, around the globe, account for close to 10.3% of cancer of the bronchus, trachea and lung. These cancers are often referred to as occupational cancers. Occupational exposures are believed to approximately cause 2.4% of leukemia in the entire world. 146 000 (0.3%) deaths were the attributable mortality while the attributable burden was 1.4 million (0.1%) DALYs (Souter *et al.,* 2000).

2.2.5 Airborne Particles

Millions of employees with various occupations, such as abrasive blasting, construction and mining, are left unprotected to floating particles of coal dust, asbestos and silica (Cincinnati, 2000, Chen *et.al.,* 1992). Inhaling these particles causes cancer of the bronchus, trachea and lung as well as non-malignant respiratory diseases such as coal and asbestos pneumoconiosis or "dusty lung" and silicosis. Dust toxicity and the level of exposure are considered to be the causes of these ailments. The rates of diseases have been seen to gradually decrease even in countries that have the ability of recognizing and controlling the exposures because the diseases are believed to have long latency periods (Cincinnati, 2000).

Trend rates in emerging nations are generally unknown but the degree of the situation is extensive (Chen *et.al.,* 1992). Studies indicate that approximately 5-18% of asthma cases may be linked to occupational exposure.

One research, in particular, indicated a median value of 15 % for cases of asthma arising from occupational exposure. Around 14 % of all chronic obstructive pulmonary disorders have occupational causes, according to one broad population study. The estimated attributable mortality that result from chronic obstructive pulmonary disease was at 243 000 deaths (0.4%) while the attributable burden was at 3.0 million (0.2%) DALYs. Numerous deaths are also linked to coal dust, asbestos and silica. Globally, the burden seems to be low because not all employees operate in environments with these particles. However, the risk to employees in construction, mining, and other professions is high. For instance, a majority of workers who have been exposed to low-to-moderate concentrations of silica in the long term will develop silicosis. These illnesses are usually prevented by implementing measures, brought forward by ILO/WHO, to eliminate silicosis. These measures include elimination of exposure or contact through ventilation, wet methods, and substitution for nontoxic materials (Goelzer *et al.,* 2001).

Universally, there are four primary categories of indoor pollutants. The first group consists of pollutants derived from combustion like sulfur, particulates, and carbon monoxide and nitrogen oxides from cigarettes, space heaters and cooking stoves. The second group comes from chemical products, furnishings and building materials including formaldehyde, volatile organic compounds, and pesticides. The third group emanates from the ground under the building such as radon. The fourth category comes from biological processes, such as mold, mildew, mites, etc. indoor emissions in concentrations directly relies on ventilation, i.e. airflow and the volume of mixing (Chen *et al.,* 1990).

The global estimation is that over half of households cook have unprocessed solid fuels such as biofuels or coal on a regular basis. An unknown, but important, proportion of the operation occurs in situations or environments where a lot of airborne effluent escapes into the living zone. While ventilation levels can be relatively high, these fuels have high emission factors which can be very significant indoor concentrations as well as exposures or contacts. Wood releases more than 50 times more pollutant when cooking an equivalent meal compared to gas stoves which use cleaner biofuels (Smith, 1990).

2.2.6 Ergonomic Risks

Low back pain is a pointer of various ergonomic stressors at places of work. These include including carrying or lifting heavy loads, demanding physical work, awkward postures, twisting, frequent bending, whole-body vibration, and forceful movements (Bernard, 1997). There are complex and interrelated factors that lead to low back pain such as social, organizational and physical factors at the stations of work, social and physical aspects of life outside the workstation, and the psychological and physical characteristics of the individual. It is reported that particular groups of employees including farmers, nurses, heavy machinery operators and construction workers experience high levels of low back pain (Leigh & Sheetz 1989). Although low back pain isn't life-threatening, it can cause discomfort and restrict work, leisure, and household activities.

In developed nations, low back pain tends to occur frequently. About half of all employed Americans, for example, complain of back pain each year (Nachemson, 1985). Although there are scarce data from developing countries, the rates recorded in China and the industrialized countries are the same. Low back pain is preventable, but cooperation among partners is required for successful intervention. These include the management, workers, scientific research community, medical practitioners, ergonomists and industrial engineers. This analysis indicates that occupational risk factors are responsible for approximately 37% of low back pain complaints by workers. The figure varies comparatively across regions ranging from 31% to 45% for men and 12% to 38% for women. Low back pain does not cause mortality among the employees. However, it results in considerable morbidity, leading to a projected 0.8 million DALYs (0.1%) around the world. It also results to lack of jobs, hence leading to a high loss of the economy (Leigh & Sheetz, 1989).

2.3 Empirical Review of the Study

The study’s empirical review considered global, regional and local perspectives. A study that was conducted in Finland by Seo and Salminen (2005) regarding the occupational future of injuries in a Finnish Delphi in comparison to a British scenario concluded that occupational injuries in industrialized countries are decreasing but work violence has been rising. A study carried out by Kumie and Yiha (2010), in Ethiopia, assessing occupational injuries occurring in TAD established that the rate of workplace injury was 783 per 1000 workers exposed per year as a result of various factors relating to the working organization and the actions of the employees. In Kenya, a study by Sang (2005) on description of safety and health committees among selected

industries concluded that industrial accidents and injuries are still frequent citing poor balancing of committee duties, lack of training, inadequate funds as well as inadequate facilities as major occupational health and safety challenges;

A research by Altin, Peker and Etmaca (2005) on industrial noise and its impact on humans at the global scene in Turkey concluded that the noise levels observed in all industries exceeded the 80 dBA stated in the Regulations. The review found out that 73.83% of workers in these companies felt disturbed by the noise, 60.96% have grievances concerning state of their nervous system and 30.96% suffer from hearing problem. In and around Africa in Nigeria, a study done by Ojelabi *et al.,* (2014) on how the pollution of noise affects workers during the processing of wheat concluded that 33 % of the examined workers had defects in their left or right ear. In Kenya, a study by Ibrahim *et al.,* (2004) on the hazardous effects of occupational health among Assiut Spinning Factory workers concluded that respiratory problems are caused by cotton dust.

A study by Ruchirawat et.al (2008) on the possible health effects of carcinogenic exposure in incense smoke in temple workers on the global scene in Thailand concluded that burning of incense produces substantially higher rates of airborne benzene ($P<0.01$), 1.3 butadiene ($P<0.001$) and total PAHs ($P<0.01$) in temples compared to those managing the work place. A study by Knight *et al.,* (2015) on occupational exposure to benzene, toluene, ethylbenzene and xylenes (BTEX) by employees working at the diesel station in and around Africa in South Africa concluded that attendants face adverse health effects from inhaling volatile organic compounds found in fuels. In accordance to the study, the released contaminants included BTEX, which are important because of their high toxicity level. A study conducted by WHO (2004) on human carcinogenic risk assessment in Kenya revealed that carcinogenic concentrations in Nairobi City Street soils ranged from 137-219.6 mg / kg.

In the USA, Zanobetti et al., (2000) on the airborne particles at the global scene dubbed, “are there sensitive subgroups that affect the airborne particles?” It was concluded that patients suffering from defects in their heart’s electrical control or acute respiratory infections are likely to be affected by particulate matter. A research by Jimoda (2012) on how particulate matter affects human health, ecosystem, atmosphere and materials in and around Africa in Nigeria concluded that airborne particulate matter is a major concern in the global environment because of the health issues and the degradation of the environment it causes. The study also suggested that there be establishment of policies that should be aimed at ensuring proper control of quality air. Locally, no empirical evidence is available regarding to how airborne particles affect the health of workers.

McCormick and Saunders (1993) conducted a study, in Ireland, on ergonomic risks at the workplace. The study concluded that ergonomics applied information related to the behavior of a human being, limitations and abilities and other traits of designing tools, tasks machines, environments, and jobs for industrious, safe, convenient and effective human usage.

In South Africa, Krajewski et al. (2009) researched on mine safety and health administration. It was revealed that 46% of the illnesses resulted from repeated trauma in 2004, while 35% of non-fatal lost days were associated with handling of the material between 2001 and 2004. It was also revealed that an ergonomics process could be implemented systematically and effectively integrated with existing health and safety programmes. Locally, no empirical evidence has been found relating on the impact of ergonomic risks on workers' health.

2.4 Literature Review Gaps

The reviewed literature outlined that several studies with regard to the study topic have been done but empirical evidence lacked in most areas. It was also outlined that the majority of the done were in the global and African context hence creating a gap when it came to the scope that offered a justification for more studies so as to help in closing the gap, especially with regard to the local setting.

Firstly, when reviewing at the injuries, the empirical evidence suggested that no work had been done with regard to the health of workers in a tea factory set up

Accordingly, objective I of this study was aimed at examining the effect of injuries on employees' health in Kenya Tea Development Agency's managed factories in an attempt to bridge this gap. Secondly, relating to noise, no evidence was available to indicate its impact on employees' health in a tea factory, hence the need of objective I of this study that aimed at assessing how noise affects the health of employees in Kenya Tea Development Agency's managed factories. Thirdly, as well, no empirical evidence was found to indicate the effect of carcinogenic agents among workers in tea factories. Objective III of this study therefore, is an attempt of establishing how carcinogenic agents affect the health of employees in Kenya Tea Development Agency's managed factories.

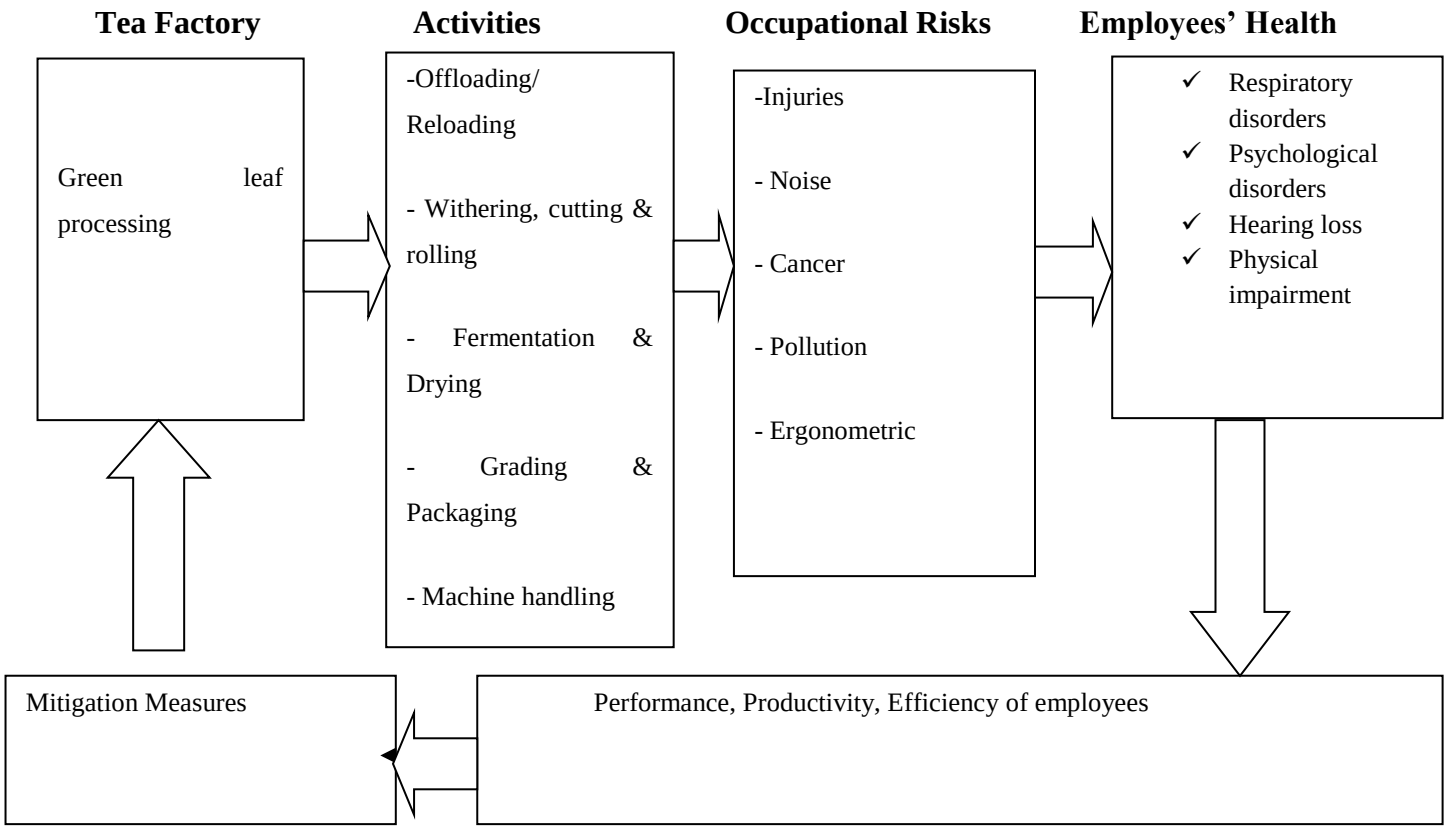
Fourthly, most of the studies done on airborne particles were either on their effect on nonsmokers, petrol stations attendants and or individuals at home. No empirical evidence was found relating to tea processing, prompting the researcher include in the study objective IV, so as to evaluate the effect of airborne particles on employees' health in Kenya Tea Development

Agency's managed factories. Finally, the empirical evidence indicated that ergonometric risks are widely studied within industrial settings but however no such evidence was available for similar studies in tea factories. Consequently, it was in this sense that the researcher envisaged the need of assessing the impact of ergonomic risks on the health of Kenya's employees. The managed factories of the Tea Development Agency as provided for in Objective V and further exploring and documenting the same for use in academia and in practice in the context of a Kenyan tea factory

2.5 Conceptual Framework

The conceptual framework for this study was based on five independent variables which included; injuries, noise, carcinogenic agents, airborne particles, and ergonomic risks. Employees' health was the study's dependent study. Performance of workers and Efficiency of tea processing were the intervening variables and output of employees' health. Figure 4 illustrates how the independent and dependent variables relate to each other.

Figure 4: The Conceptual Framework



Source: Researcher, (2020)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This section presented the study's methodological features including the design and population of the study, techniques used in sampling, sample size, techniques of collecting data, analysis of the data and lastly the ethics adhered to research.

3.1 Research Design

A descriptive research design was adopted by the study, where each aspect of the social unit is researched at individual level, before the data is generalised to cover the whole unit (Leedy, 2003). This design is based on the insight and perceptions of the researcher and looks at the direct approach of the matter by using real records on personal experiences of the study items. When the researcher uses real records and data they can decipher the motivations that drive the actions of the subject matter and the forces that lead to adopting a specific behaviour pattern.

3.2 Target Population

This study intended to target 1500 workers of the tea factories under study, which are shown in Table 1.

Table 1: Target population

Tea Factory	**Pop frequency**	**Percentage**
Kambaa	150	10
Makomboki	150	10
Githambo	150	10
Gatunguru	150	10
Gianchore	150	10
Kanyenyaini	150	10
Kapkoros	150	10
Tegat	150	10
Mogogosiek	150	10
Chebut	150	10
Total	**1500**	**100**

Source: KTDA Resource Centre (2019)

3.4 Data Sources

3.4.1 Primary Data

Collection of primary data was done through questionnaires that were edited, classified, coded and tabulated in a systematic manner to allow for accurate analysis.

3.4.2 Secondary Data

Secondary data was obtained from several sources such as on-line journals, books, and published articles.

3.5 Sampling Procedures

3.5.1 Sampling Design

The study used systematic sampling method in obtaining data from the selected workers in tea factories. This is a random sampling technique, which according to Mugo (2010) allows each unit to have an equal chance of being selected in the study. The interval *(k)* of selection was 10 meaning that every 10^{th} employee in the target factories was interviewed based on a list provided by the management.

Table 2: Sample Design

Tea Factory	Population	Sample	Percentage
Kambaa	150	15	10%
Makomboki	150	15	10%
Githambo	150	15	10%
Gatunguru	150	15	10%
Gianchore	150	15	10%
Kanyenyaini	150	15	10%
Kapkoros	150	15	10%
Tegat	150	15	10%
Mogogosiek	150	15	10%
Chebut	150	15	10%
Total	1500	150	100

Source: Researcher, (2020)

3.6 Data Collection Instruments

3.6.1 Design of Study Instruments

Collection of data in this study was done by the administration of questionnaires, which had formal questions as per the research topic and its variables. The questionnaire was designed to cover the five study variables by seeking information from the study participants. The study conducted a pilot survey in order to ensure clarity, validity and reliability of the instrument in answering the research questions. The pilot survey was done before performing the actual data collection exercise.

3.6.2 Reliability and Validity of Study Instruments

Reliability for this study was done using Cronbach's alpha reliability coefficient according to Koul (2005), where outcomes of 0.70 and above are deemed sufficient in terms of consistency of the collected data. Content validity was tested by the researcher using correlation analysis so as to detect the degree to which the instrument measured the topic, its contents and sub themes of the research study.

3.7 Data Analysis

The study used both descriptive and inferential statistics in an attempt to achieve the stated objectives and to test the formulated hypotheses. Descriptive statistics were mainly used to give data summaries as well as bar graphs. In order to establish if there was functional relationship among and between health of tea factory employees and the activities happening in their work place, Multiple Regression and Correlation analyses were performed to establish linear relationship and the strength of the independent variables; injuries, noise, carcinogenic agents, airborne particles and ergonomic risks to employees' health, the dependent variable.

The regression equation estimate was in the form;

$$y = \hat{a}_0 + \hat{a}_1 x_1 + \hat{a}_2 x_2 + \hat{a}_3 x_3 + \hat{a}_4 x_4 + \hat{a}_5 x_5 + \hat{a}$$

Where $\hat{a}_0$ is the y-intercept (value of y when all the independent variables X_1, X_2, X_3, X_4, X_5 are each 0)

$\hat{a}_1$, $\hat{a}_2$, $\hat{a}_3$, $\hat{a}_4$, $\hat{a}_5$ are regression coefficients for the 5 independent variables against the dependent variable Y.

The 5 independent variables used in this analysis are defined below as X_1 for injuries, X_2 for noise, X_3 for carcinogenic agents, X_4 for airborne particles and X_5 for ergonomic risks.

3.8 Ethical Considerations

Permission was sought and obtained by the researcher from NACOSTI before the commencement of data collection. In addition, all respondents of the study were identified and recruited using the prescribed procedures after being requested to give informed consent in writing. Participants who were unwilling to partake in the study received a similar treatment. Moreover, information and data collected from the respondents was treated confidentially and used for this study only.

CHAPTER FOUR

RESULTS, INTERPRETATIONS AND DISCUSSIONS

4.0 Introduction

This section outlines the results and findings from analysis done on the collected data. It is divided into sections as per the variables and covers both the descriptive analysis and inferential statistics that were employed in drawing conclusions.

4.1 The Response Rate

The rate of response was 80% since 120 questionnaires were fully filled and returned from the 150 administered. The rate of percentage is sufficient for purposes of analyzing and drawing study conclusions.

4.2 General Information

4.3.1 Distribution of Respondents by Gender

Majority (63%) of respondents were found to be male while minority (37%) of respondents was female. This partly explained male dominance in factory jobs in KTDA managed tea factories in Kenya.

4.3.2 Distribution of Respondents by Age

Figure 5 below shows that the majority (45%) of respondents were be below 30 years while minority (3.3%) of respondents were 50 years and above. This indicates that most employees were between 30-49 years' age bracket. This is expected in most work stations due to the fact that the productivity and efficiency are highly dependent on age.

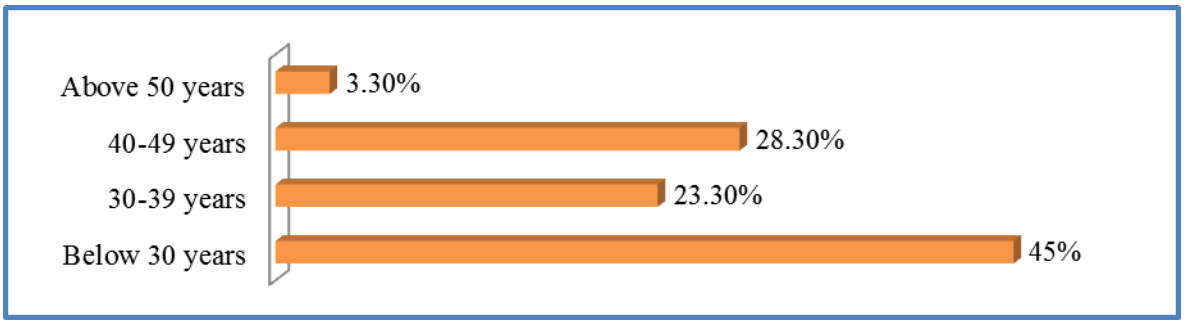


Figure 5: Distribution of Respondents by Age

Source: Survey data (2020)

4.3.3 Distribution of Respondents by Job Experience

The majority (53.3%) of respondents as shown in figure 6 below had experience of between 1-9 years while only 8.3% had less than a year's experience within their work stations. About 38.3% of them had 10 years and more of experience. This partly explained that employees had been exposed to occupation risks for a reasonable duration in their work stations. This justifies their responses on experience and exposure to risks to be dependable.

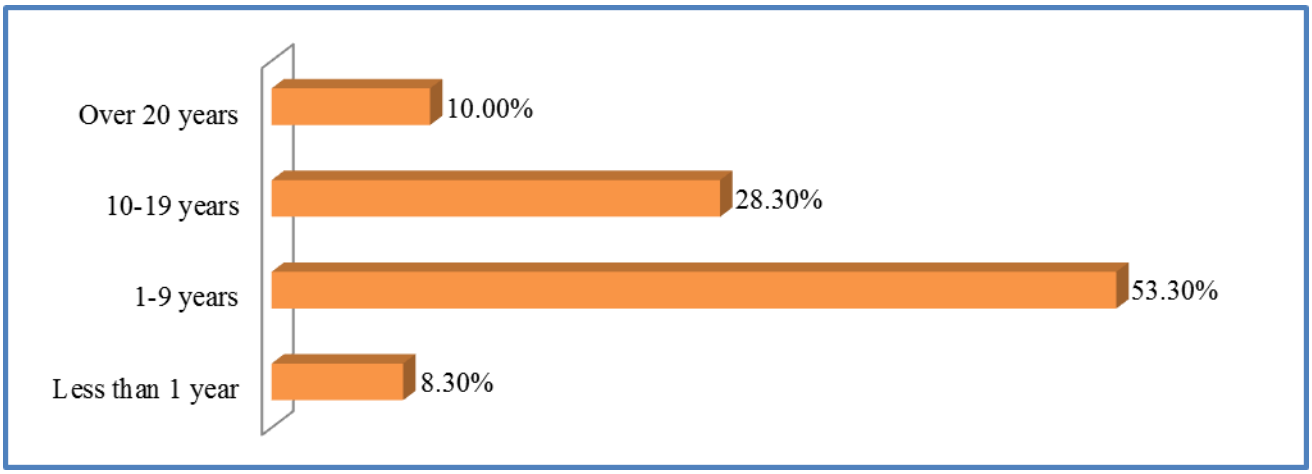


Figure 6: Distribution of Respondents by Job Experience

Source: Survey data (2020)

4.3.4 Distribution of Respondents by Level of Education

Majority (50%) of respondents has attained tertiary education level probably in technical areas reminiscent of operations in a factory shop floor while minority (8.3%) of respondents was undergraduate reminiscent of management in the same set up. Another good fraction (41.7%) of respondents was secondary school graduates reminiscent of casual laborers in a factory set up. This is as shown in figure 7. This implies that most of the employees were knowledgeable of the occupational health risks associated with the factory operations.

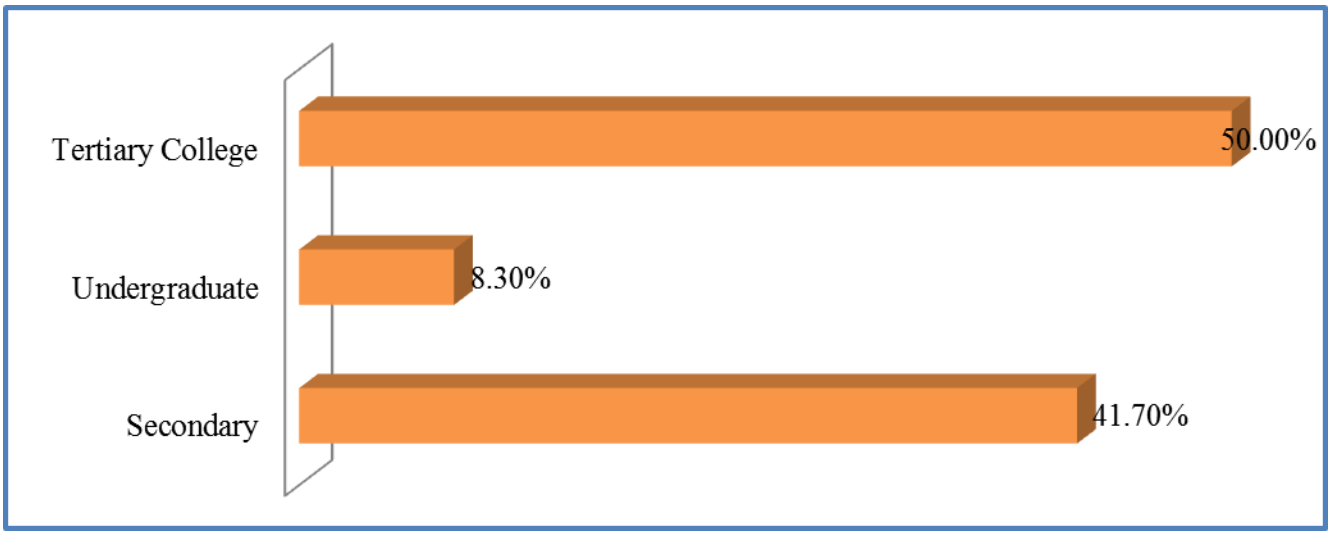


Figure 7: Distribution of Participants based on their Level of Education

Source: Survey data (2020)

4.4 Weighting of Occupational Risks and Their Measures

Workers were asked to rate the potential impact of selected measures per variable on their health. The scores generated from the findings then used to indicate how each of the measures impacted their health at the work place. In addition, scores generated for the variable measures were summed up, weighted and ranked to indicate their prevalence and level of impact on employees 'health within KTDA managed tea factories. The following sections provide a presentation of the findings.

4.4. 1 Spread of Respondents by Employees' Health

Factory employees were found to suffer from injuries mostly and from cancer the least. They were also found to suffer from hearing loss, respiratory disorders, musculoskeletal disorders and psychological disorders in that order. Skin and neurotoxic disorders also followed in that order as shown in figure 8.

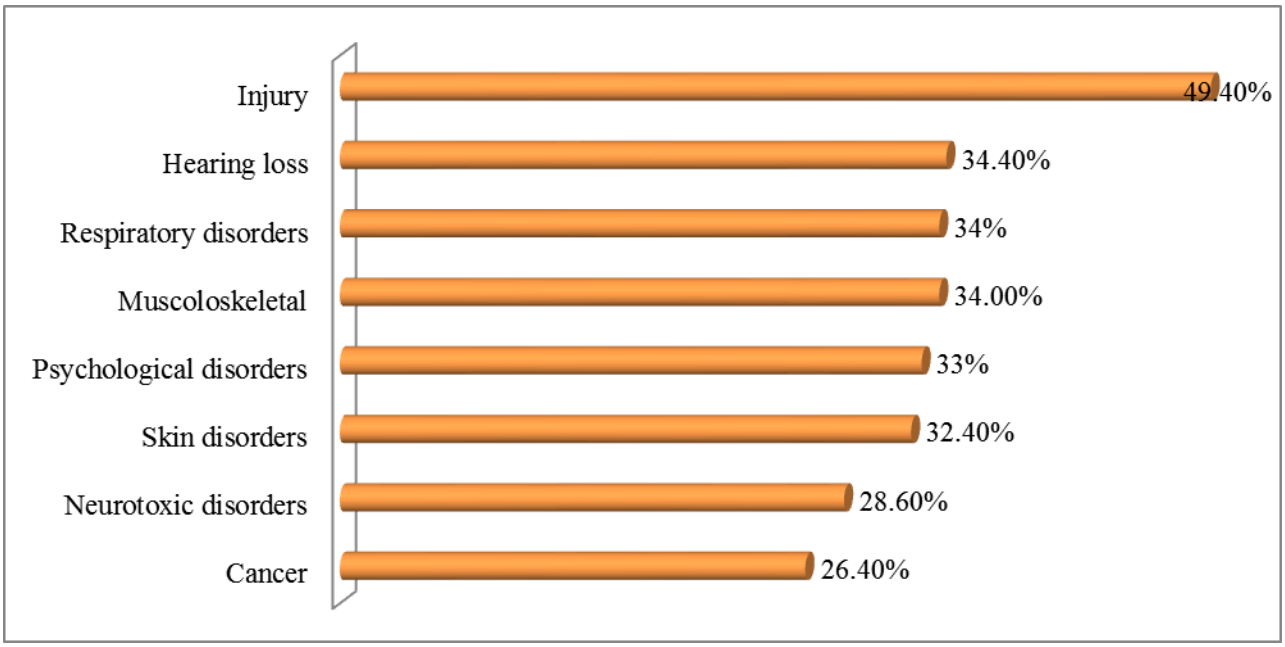


Figure 8: Spread of Respondents by Employees' Health

Source: Survey data (2020)

4.4.2 Spread of Respondents by Injuries

On injuries as an occupational risk; contact with machines was found to have the greatest impact on employees' health at 41% while poisoning presented the least impact at 26.6%. Work related falls constituted 37%, falling objects 35.4%, hurting by fire 30%, and motor vehicle injury followed in impact at 29.6% as shown in figure 9 below.

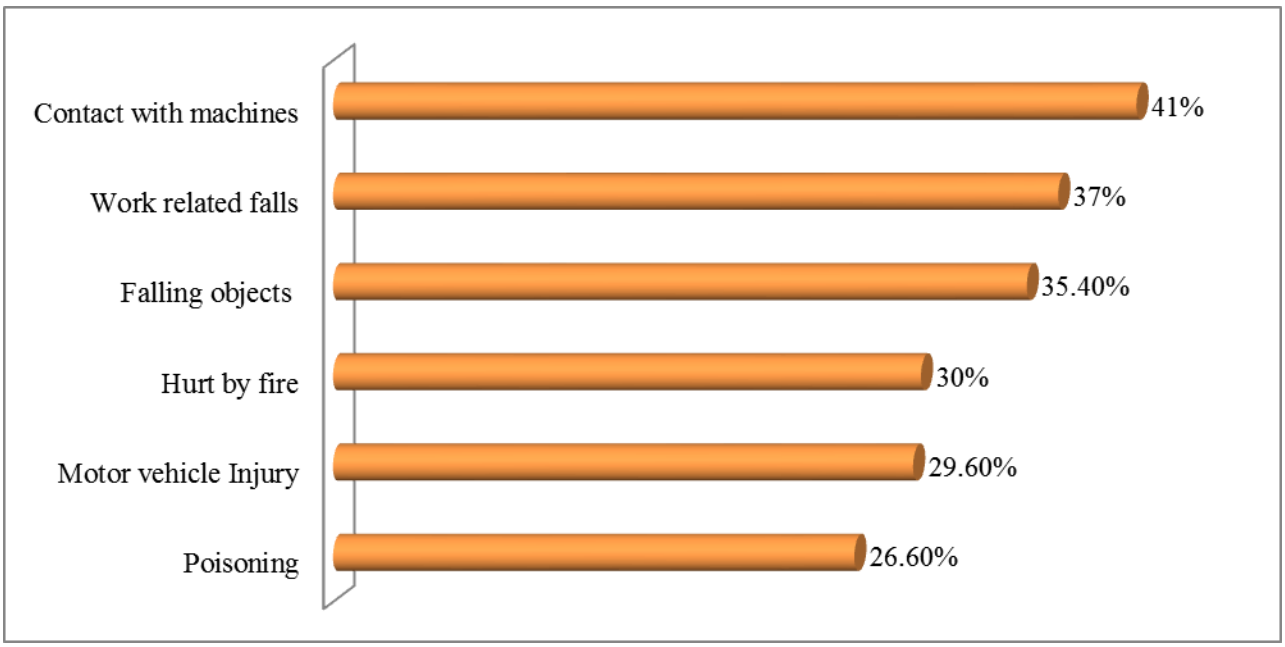


Figure 9: Spread of Respondents by Injuries

Source: Survey data (2020)

4.4.3 Spread of Respondents by Noise

Prolonged unpleasant noise as an occupational risk under noise presented the greatest impact on employees' health while lack of sleep presented the least. Impaired communication, work disturbances, hearing loss and violent behavior followed in impact and in that order respectively. This is as shown in figure 10.

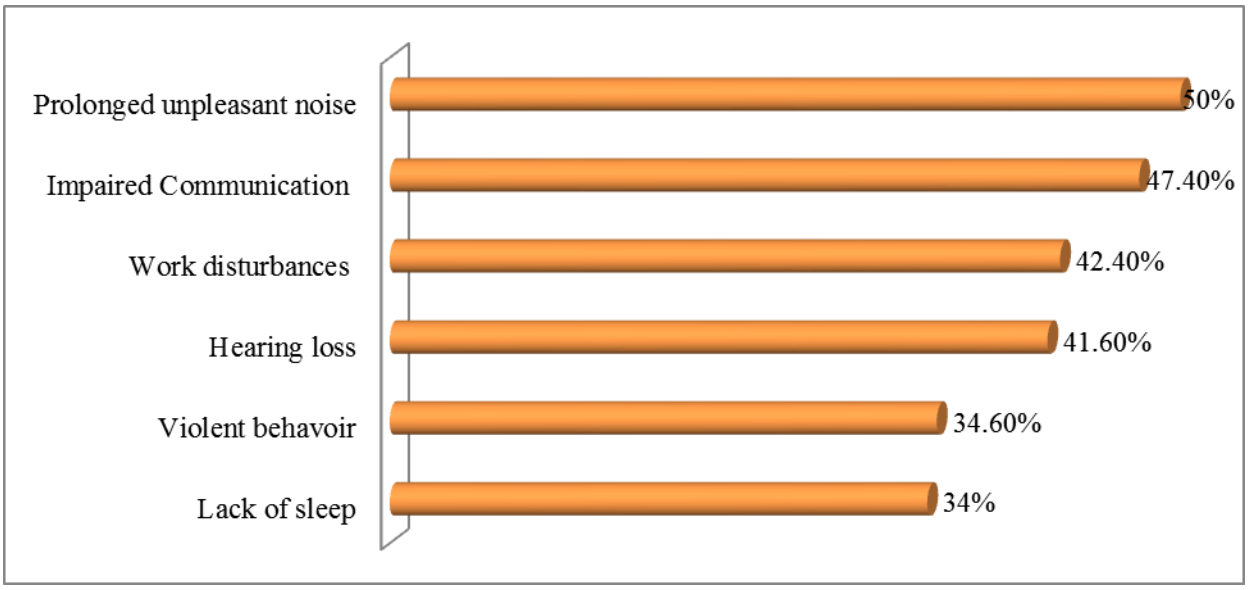


Figure 10: Spread of Respondents by Noise

Source: Survey data (2020)

4.4.4 Spread of Respondents by Carcinogenic Agents

Regarding carcinogenic agents, respiratory complications were found to have the largest impact employees' health while cancer of the bronchus was found to have the least impact. Lung cancer, health complications, malignant mesothelioma, leukemia and cancer of the trachea impacted on employees' health and in that order as shown in figure 11.

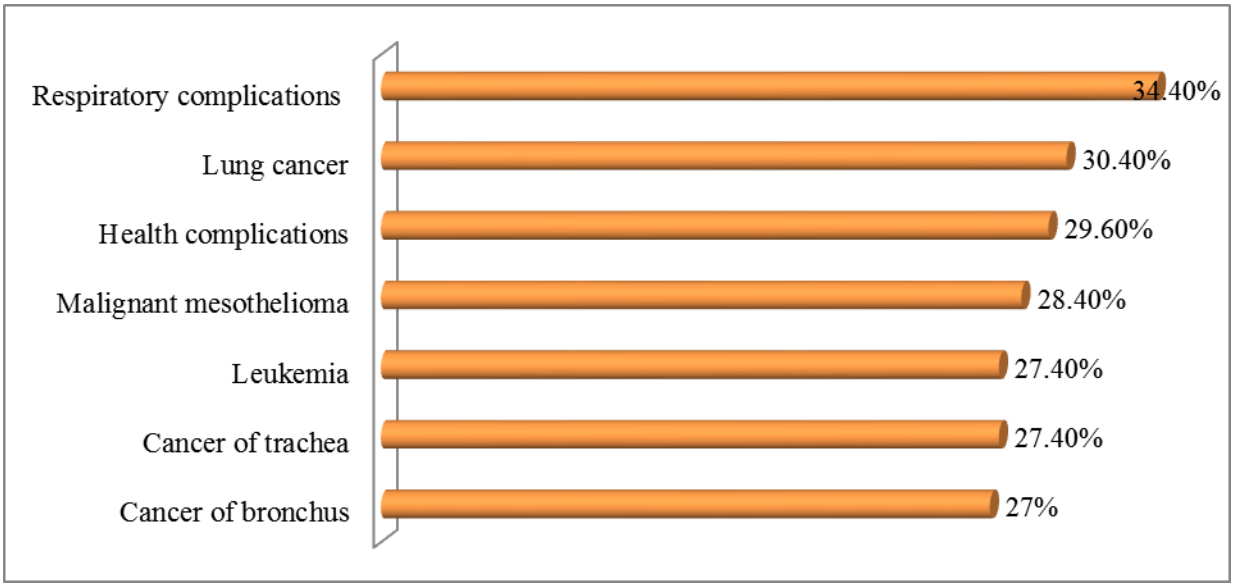


Figure 11: Spread of Respondents by Carcinogenic Agents

Source: Survey data (2020)

4.4.5 Spread of Respondents by Particulate Particles

On particulate particles' measures used in this study, pneumoconiosis was found to present the greatest impact on employees' health while extreme toxicity was found to present the least impact. Asthma, silicosis and suffocation impacted employees' health within KTDA managed tea factories and in that order respectively as indicated in Figure 12.

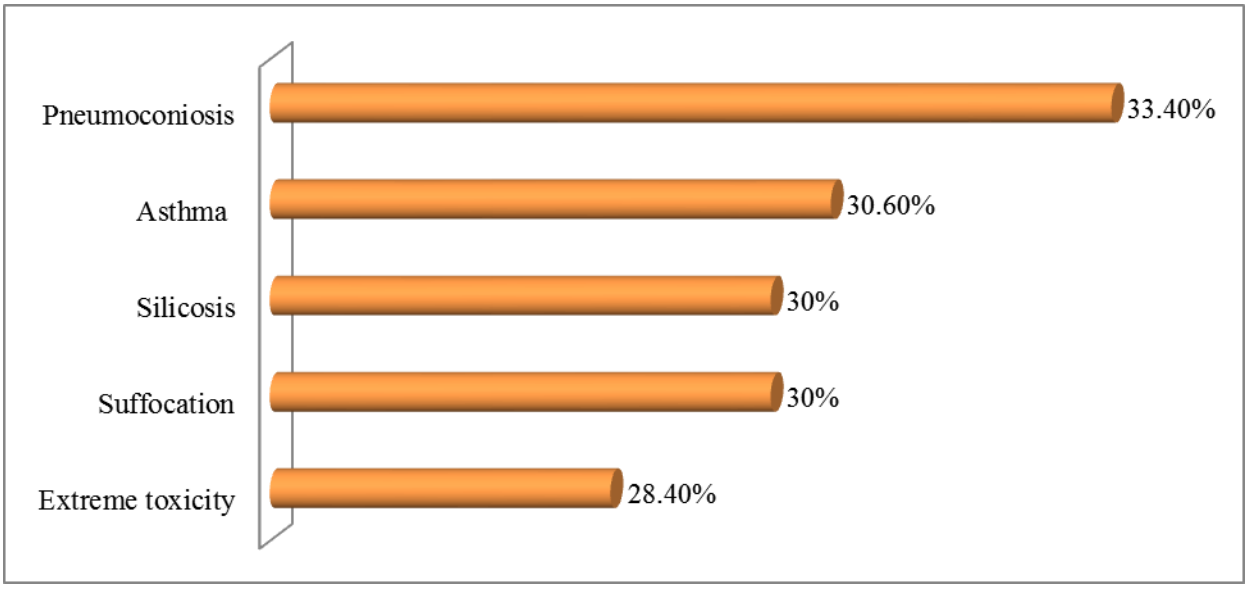


Figure 12: Spread of Respondents by Particulate Particles

Source: Survey data (2020)

4.4.6 Spread of Respondents by Ergonomic Risks

The ergonomic risk that was found to present the greatest impact on employee's health was lifting of objects. This was followed by frequent bending, frequent twisting and frequent posturing and in that order respectively. Whole body vibration was found to present the least impact as shown in figure 13.

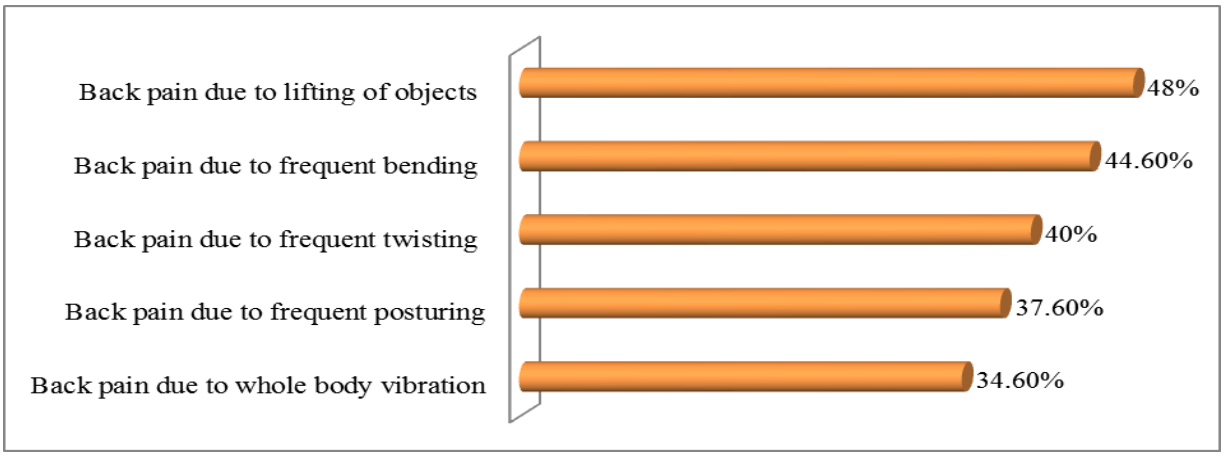


Figure 13: Spread of Respondents by Ergonomic Risks

Source: Survey data (2020)

4.4.7 Weighting of Occupational Risks by Score

Weighting of occupational risks was done by scoring to establish their prevalence and level of impact on employees' health within the factories under study. Noise was found to be the most prevalent occupational risk impacting employees' health with a score of 41.70% while carcinogenic agents were found to be the least prevalent returning a score of 29.20%. Ergonomic risks, injuries and air borne particles had intermediate scores of 40.96%, 33.30% and 30.50% respectively as contained in figure 14.

Figure 14: Weighting of Occupational Risks by Score

Source: Survey data (2020)

4.5 Reliability Test

The reliability test was conducted through the use of Cronbach's Alpha reliability coefficient to ensure internal consistency and the are shown in Table 3.

Table 3: Reliability statistics

Construct	Cronbach's Alpha	N of Items
Employees health	.773	8
Injuries	.750	6
Noise	.891	6
Carcinogenic agents	.822	7
Airborne particles	.917	5
Ergonomic risks	.820	6

Source: Survey data (2020

The alpha coefficients for all the five independent variables are above 0.70, indicating that the consistency of the data are acceptable and also reliable.

4.6 Correlation Analysis

Pearson product moment correlation coefficient was calculated to show the strength of the relationships among health of employees and the 5 independent variables. Results showed a positive but moderate causal relationship (r=0.505, p=0.010) between injuries and employees' health on the lower side and no causal relationship (r=0.00, p=0.010) between the same on the upper side. The study also indicated a positive moderate causal relationship (r=0.427, p=0.010) between noise and employees' health on the lower side and no causal relationship (r=0.00, p=0.010) between the same on the upper side. There was a marginal but positive causal relationship (r=0.185, p=0.05) between carcinogenic agents and employees' health on the lower side as well as a marginal positive causal relationship (r=0.043, p=0.05) between the same on the upper side. It was also indicated that there was a marginal positive causal relationship (r=0.139, p=0.00) between airborne particles and employees' health on the lower side as well as a marginal positive causal relationship (r=0.131, p=0.00) between the same on the upper side. Finally, the study indicated that there was a positive moderate causal relationship (r=0.452, p=0.010) between ergonomic risks and employees' health on the lower side and no causal relationship (r=0.00, p=0.010) between the same on the upper side.

The implication of this correlation analysis to this study is that any increase in the frequency of incidents recorded of injuries, noise and ergonomic risks as occupational risks on the shop floor would moderately increase the potential impact of the occupational risks on employees' health on one side while any variation downwards in occurrence of the same would have no impact. Further implication is that any variation upwards or variation downwards of carcinogenic agents and airborne particles as occupational risks on the shop floor would marginally impact on employees' health as indicated in table 4.

4.7 Model Formulation and Estimation

Multiple regression analysis was performed for the research data with the outcomes shown in Table 5 below.

Table 4: Multiple Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.368	.318		1.158	.249
	Injuries	.573	.117	.391	4.892	.011
	Noise	.366	.095	.309	3.864	.010
	Carcinogenic agents	-.292	.161	.184	1.814	.072
	Airborne particles	-.103	.206	.047	.500	.618
	Ergonomic risks	.325	.096	.290	3.396	.001

a. Dependent Variable: Employees' health

Source: Survey data (2020)

Since X_1 – injuries, X_2- noise, X_3- carcinogenic agents, X_4 - airborne particles, X_5 - ergonometric risks and Y- employees' health and β_0=0.368, β_1=0.573, β_2=0.366, β_3=-0.292, β_4=-0.103 and β_5=0.325, then the multiple regression equation for this model would be as follows

$$\mathbf{Y= 0.368 + 0.573X_1 + 0.366\ X_2 - 0.292\ X_3 - 0.103\ X_4 + 0.325\ X_5}$$

4.8 Analysis of Variance

An analysis of variance was done to determine whether or not the difference in the means of the group of ten KTDA managed tea factories under study was significant. At a significance level of 0.05, where $\alpha = 0.05$, and p-value $\leq \alpha$, there would be evidence that the difference of the means of the groups is significant. However, if p-value $> \alpha$, there would be no sufficient evidence to conclude that the difference of the group means was significant. From the results of the analysis of variance, p=0.000, hence ($p=0.000 \leq \alpha$), it indicated that the difference in the means of the groups was significant, and that the groups were either independent or not. The absence of independence of such groups could signify that the findings obtained from analyzing the data, could not be used to draw conclusions that are representative of the whole population and in this case all the Kenya Tea Development Agencies' managed factories. This is as shown in table 6.

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	93.176	5	18.635	16.508	.000[b]
	Residual	128.691	114	1.129		
	Total	221.867	119			

a. Dependent Variable: Employees' health

b. Predictors: (Constant), Ergonomic risks, Noise, Airborne particles, Injuries, Carcinogenic agents.

Source: Survey data (2020)

4.9 Model Fit

The fit of the model was also conducted utilizing the multiple regression to show how the model fits the data set and the coefficient determined the predictive power of the model. The coefficient determination of this study was found to be 0.420 as shown in table 7, implying that 42% variations in employees' health are explained by occupational risk variables used in the study. This further implied that 58% variations in employees' health among KTDA managed tea factories are explained by extraneous variables that do not form part of this study. Consequently, the adopted multiple regression equation is not very useful in making predictions since the r^2 is not close to 1.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.648[a]	.420	.395	1.062

a. Predictors: (Constant), Ergonometric risks, Noise, Airborne particles , Injuries , Carcinogenic agents

Source: Survey data (2020)

4.10 Test of Hypotheses

The study hypotheses were: 1.Ho: Injuries have no significant effect on the health of employees at KTDA's managed factories;2.Ho: Noise has no significant effect on the health of employees at KTDA's managed factories; 3.Ho: Carcinogenic agents have no significant effect on the health of employees at KTDA's managed factories; 4.Ho: Airborne particles have no significant effect on the health of employees at KTDA's managed factories and 5.Ho: Ergonomic risks have no significant effect on the of employees at KTDA's managed factories

It was therefore concluded that at the $\alpha = 0.05$ level of significance, since the p-value for injuries was found to be less than 0.05 (i.e. $0.011 \leq 0.05$), the p-value for noise found to be less than 0.05 (i.e. $0.010 \leq 0.05$) and the p-value for ergonometric risks found to be less than 0.05 (i.e. $0.001 \leq 0.05$), then there exists enough evidence to conclude that the slope of the multiple regression line is not Zero and hence the variables namely; injuries, noise and ergonomic risks are good occupational risk predictors of the impact on employees health among KTDA managed tea factories in Kenya and thus qualify to be retained in the study model, while carcinogenic risks (i.e. $0.072 \leq 0.05$) and airborne particles (i.e. $0.618 \leq 0.05$) are poor predictors and hence qualify to be excluded from the study model, since there is no significant statistical evidence to show that they could be a cause of concern as regards the health of employees in KTDA managed tea factories to warrant emergency intervention.

CHAPTER FIVE

SUMMARY OF THE KEY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter outlines a summary of the key findings, the drawn conclusions and recommendations in policy and practice and suggestions for areas to further studies.

5.1 Summary of the Key Findings

The study was done at factories managed by KTDA within Kenya and the study was on occupational risks and their potential impact on employees' health. Specifically, the focus of the study was on examining how injuries affect employees' health, assessing how noise affects employees' health, establishing the effect of carcinogenic agents on employees' health, evaluating the effect of airborne particles on employees' health as well as determining the effect of ergonomic risks on employees' health. The study found out that injuries ($0.011 \leq$ p-value ≤ 0.05), noise ($0.010 \leq$ p-value ≤ 0.05) and ergonomic risks ($0.001 \leq$ p-value ≤ 0.05) are the occupational risks that have statistical significance to employees' health in KTDA managed tea factories in Kenya. Carcinogenic agents ($0.072 \leq$ p-value ≤ 0.05) and airborne particles ($0.618 \leq$ p-value ≤ 0.05) were found to be statistically insignificant.

The weighting of occupational risks using scores indicated that noise as an occupational risk was the most prevalent in employees' health within KTDA managed tea factories. Noise had a score of 41.70% with carcinogenic agents being the least with a score of 29.20%. Ergonomic risks scored 40.96%, injuries scored 33.30%, and airborne particles scored 30.50%.

On the impact of individual variable components on employees' health relating to injuries, the study indicated that injuries due to contact with machines had the highest impact on employees' health. This was followed by human falls, then falling objects, fire, motor vehicle injury and lastly poisoning. Relating to noise, findings indicate that unpleasant noise had the highest impact on employees' health. Impaired communication, work disturbances, hearing loss, violent behavior as well as lost sleep followed each other in impact and ratings are as listed.

On carcinogenic agents, findings show that respiratory complications had the highest impact on employees' health. This was followed by lung cancer, exposure to smoke, malignant mesothelioma and exposure to potentially harmful agents respectively. On airborne particles, findings show that pneumoconiosis had the highest impact on employees' health. Asthma,

silicosis, suffocation as well as extreme toxicity followed in impact and in that order respectively.

Finally, relating to ergonomic risks, the study indicated that lifting of objects and frequent bending had the highest impact on employees' health among KTDA managed tea factories. Frequent twisting, frequent awkward posturing as well as whole body vibrations followed in its impact to health respectively.

5.2 Conclusions

The study concluded that even though injuries, noise and ergonomic risks were found to have significant impact on employees' health, this was not enough in itself to inform a shift in policy relating to occupational risks and employees' health among KTDA managed tea factories in Kenya. Secondly, the study concluded that any measures that the management of tea factories could initiate as a means of intervention relating to injuries, noise and ergonometric risks could yield positive results on employees' health.

On injuries as an occupational risk, the study concluded that in order to improve on employees' health among tea factories, proper measures including taking safety precautions with equipment and tools, conducting proper training for employees in their respective work area, providing and maintaining proper personal protective equipment, following set operational procedures for each task on the shop floor, communicating effectively with each employee, installing safety clearly visible signage especially on motorized machines for leaf cutting, curling, drying, sorting and packaging, and keeping all licenses valid at all times were required to guide contact of employees with the shop floor machines. As well, relating to noise, the study concluded that measures such acquiring and installing technologically improved machines that generate less noise, providing employees with protective personal equipment, enhancing acoustics of the offices and factory processing areas under the same roof were required to curb emissions of unpleasant noise from the shop floor machines.

Relating to carcinogenic agents, the study concluded that measures to reduce exposure to hazardous substances such as wearing gloves or facemasks were required to be put in place to check on employees' respiratory complications while, on airborne particles, interventions were required to check on pneumoconiosis that was found to impact negatively on employees' health.

Finally, on ergonometric risks, the study concluded that measures such as the introduction of forklifts to aid in lifting of heavy objects, training employees on the correct posture to reduce the strain of repetitive motions, providing comfortable furniture for employees who sit for long hours working, and allowing the employees to rest through effective management of shifts required due consideration by management of the tea factories.

5.3 Policy Recommendations

The following recommendations were made by the study with regard to the management of the tea factories under study for consideration to reduce or minimize the impact of occupational risks on employees' health. On injuries, a proactive process must be present to assist the management in finding and fixing workstation hazards before employees get hurt by adopting prevention programs that will curb the extent of injuries, severity of illnesses that may cause fatalities. On noise, the study recommends provision of guidelines in assessing and managing noise risks and control through use of less noisy machines and tools, using hearing protection and conducting regular health checks.

On carcinogenic agents, mechanisms need to be put in place that ensure reduction in high dose or accidental exposure as well as considering the conduct of epidemiological studies to investigate carcinogenicity of low dose exposure. Equally, on airborne particles, put in place common sense prevention measures such as protecting employees from high degree of exposure to organic and non-organic dust while ensuring provision of fitting facemasks. In addition, mechanisms should be put in place which ensures adequate ventilation of all places of work within the factories. Training on safety procedures should also be considered to curb the negative effects of airborne particles.

On ergonometric risks, successful implementation of ergonomic solutions by employing such strategies as modification of available equipment, adopting sound work practices and use of modern and new tools and devices during the production process.

5.4 Suggestions for Further Study

Kenya is the third largest producer of tea in the world. This shows that tea is a very vital foreign income earner. Therefore, more studies to investigate other factory activities that may have negative impacts on tea factory workers should be initiated. This is because the occupational risk variables considered in this study only explain 42% variations in employees' health among KTDA managed factories in Kenya. It implies that 58% variations are explained by other variables that are not investigated by this study. Suggested variables include but are not limited to employees' income levels, family history or genetic predisposition to various health conditions, individual behavior such as smoking, exercise and nutrition, housing conditions, access to clean water, health care provisions, and spiritual or religious values.

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APPENDIX I

QUESTIONNAIRE

Serial No…….

This is to collect data on occupational risks and their potential impact on employees' health among Kenya Tea Development Agency's managed factories. Please respond to all the questions by marking in the spaces provided. Confidentiality of the information you provide will be assured as well as ensuring your identity is kept secret. The information collected will be for academic purposes only.

SECTION ONE: DEMOGRAPHIC INFORMATION

1. Gender Male ❑ Female ❑
2. Age ❑ below 30 years ❑ 30-39 years ❑ 40-49years ❑ Above 50 years
3. For how long have you worked in your position?
   - i. Less than one year ☐ ii. Between 1-9 years ☐
   - iii. Between 10-19 years ☐ iv. Over 20 years ☐
4. What is your highest level of education? (Please tick one)
   - i. Secondary ☐ iii. Tertiary College ☐
   - ii. Undergraduate ☐ iv. Postgraduate ☐
   - v other (specify) …….

SECTION TWO: EMPLOYEES' HEALTH

5. The following are statements about your health. Do you concur with these statements? Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

No	Description	1	2	3	4	5
I	I have at least once been **injured** while at work					
Ii	I have at least once developed complications related to **cancer** as a result of my work place conditions					
Iii	I sometimes develop **hearing loss** due to my work place conditions					
iv	I sometimes develop **respiratory disorders** due to my work place conditions					
v	I sometimes develop **musculoskeletal disorders** due to my work place conditions					
vi	I sometimes develop **neurotoxic disorders** due to my work place conditions					
vii	I sometimes develop **skin disorders** due to my work place conditions					
viii	I sometimes develop **psychological disorders** due to my work place conditions					

SECTION THREE: INJURIES

6. Comment on injuries at your work place. Guide: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

No	Description	1	2	3	4	5
i	I have at least once suffered from **work related falls** due to my work place conditions					
ii	I have at least once suffered from **motor vehicle injury** due to my work place conditions					
iii	I have at least once suffered injuries due to **contact with machines**					
iv	I have at least once suffered from **poisoning** due to my work place conditions					
v	I have at least once been hurt by **falling object(s)** due to my work place conditions					
vi	I have at least once been **hurt by fire** due to my work place conditions					

SECTION FOUR: NOISE

7. Comment on noise at your work place. Guide: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

No	Description	1	2	3	4	5
i	I am exposed to **prolonged unpleasant noise** at my work place					
ii	Noise at my work place sometimes make me develop **impaired communication with colleagues**					
iii	Noise at my work place sometimes make me develop **violent behavior**					
iv	Noise at my work place sometimes result to **work disturbances**					
v	Noise at my work place sometimes make me **lose sleep at home**					
vi	Noise at my work place sometimes induces **hearing loss**					

SECTION FIVE: CARCINOGENIC AGENTS

8. Comment on carcinogenic agents at your work place. Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

No	Description	1	2	3	4	5
i	I have once developed **respiratory complications** due to exposure to potentially harmful agents at my work place					
ii	I have once developed **lung cancer** due to exposure to potentially harmful agents at my work place					
iii	I have once **health complications** due to exposure to smoking at my work place					
iv	I have once developed **leukemia** due to exposure to potentially harmful agents at my work place					
v	I have once developed **malignant mesothelioma** due to exposure to potentially harmful agents at my work place					
vi	I have once developed **cancer of the trachea** due to exposure to potentially harmful agents at my work place					
vii	I have once developed **cancer of the bronchus** due to exposure to potentially harmful agents at my work place					

SECTION SIX: AIRBORNE PARTICLES

9. Comment on airborne particles at your work place. Guide: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

No	Description	1	2	3	4	5
i	I have once suffered from **silicosis** due to exposure to airborne particles at my work place					
ii	I have once suffered from **pneumoconiosis (dusty lungs)** due to exposure to airborne particles at my work place					
iii	I have once suffered from **asthma** due to exposure to airborne particles at my work place					
iv	I have once suffered from **suffocation** due to exposure to airborne particles at my work place					
v	I have once suffered from **extreme toxicity** due to exposure to airborne particles at my work place					

SECTION SEVEN: ERGONOMETRIC RISKS

10. Comment on ergonomic risks at your work place. Guide: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

No	Description	1	2	3	4	5
i	I have at least once developed back pain due to **lifting of objects** at my work place					
ii	I have at least once developed back pain due to **whole body vibration** at my work place					
iii	I have at least once developed back pain due to **frequent bending** at my work place					
iv	I have at least once developed back pain due to **frequent twisting** at my work place					
v	I have at least once developed back pain due to **frequent awkward posturing** at my work place					

THANKS FOR YOUR RESPONSE