THE UNIVERSITY OF NAIROBI

INCIDENCE AND PATTERN OF NON-FATAL OCCUPATIONAL INJURIES AMONG CONSTRUCTION WORKERS AT THREE PUBLIC HEALTH FACILITIES IN NAIROBI

By

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H58/6865/2017

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A dissertation Submitted to the Department of Surgery, Faculty of Health Sciences, University of Nairobi in partial fulfillment for the Award of the Degree of Master of Medicine in Orthopaedic Surgery

April 2022

My Declaration

1. I hereby declare that this dissertation is my original work and has not been presented as a proposal at any other university.
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Declaration by supervisors

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DEDICATION

I dedicate this dissertation to my family for their support and encouragement during my studies.

ACKNOWLEDGEMENT

My pursuit of a master's degree and this dissertation in particular is the result of a challenging journey, upon which many people contributed immensely.

First and foremost, I would like to thank God the Almighty for His unending grace and the gift of life during this time and beyond.

I further would like to express my deep and sincere gratitude to my Masters supervisor, Doctor Vincent Muoki Mutiso. This dissertation would not have been possible without his help, support and patience. I deeply appreciate all his contributions of time, ideas, and guidance in the making of this work.

I am also am deeply grateful to my Master's thesis co-supervisor, Doctor Ezekiel Oburu for his guidance and particular presence for input whenever requested, I cannot thank him enough. He guided me through my research, provided encouragement, personal guidance and sound advice.

Besides my supervisors, I would like to thank Madam Mary, Kinoti Kanyua of the department of community health- University of Nairobi. She was extremely helpful and her expertise in matters occupational health was instrumental in the formulation and creation of this dissertation.

I would like to acknowledge the University Of Nairobi and particularly the department of Orthopaedic Surgery for offering me admission.

I will forever be indebted to the county government of Kiambu and the ministry of health for giving me the opportunity to further my education.

To my classmates, Kagia, Bosire and Macharia. They provided sound and jovial company and together we burnt the midnight oil.

Lastly, and most importantly, I wish to extend my thanks to my loving wife Lydia for her personal support and great patience. Without her encouragement and understanding, it would have been impossible for me to finish this work.

COLLABORATING INSTITUTIONS

1. Kenyatta National Hospital
2. Mama Lucy Kibaki Hospital
3. Mbagathi County Referral Hospital

LIST OF ACRONYMS

BMI	Body Mass Index
CIF	Construction Industry Federation.
DOSH	Directorate of Occupational Safety and Health.
DOSHS	Directorate of Occupational Safety and Health Services.
EAP	Emergency Action Plan
FY	Financial Year
GDP	Gross Domestic Product.
HSE	Health and Safety Executive
ILO	International Labour Organisation.
ISS	Injury Severity Score
KNH	Kenyatta National Hospital
KNH-ERC	Kenyatta National Hospital Ethics and Research Committee
KNBS	Kenya National Bureau of Statistics.
MLKH	Mama Lucy Kibaki Hospital
NACOSH	National Council for Occupational Safety and Health
NCA	National Construction Authority
OSHA	Occupational Safety and Health Act
UoN	University Of Nairobi
USA	United States of America
SMS	Safety Management Systems
SPSS	Statistical Package for Social Sciences

TBI Traumatic Brain Injury

WIBA Work Injury Benefits Act

OPERATIONAL DEFINITIONS

Occupational accident- Is an unexpected and unplanned occurrence, acts of violence included, arising out of or in connection with work which results in a worker incurring an injury, disease or death.

Occupational injury- Is any personal injury, disease or death occurring as a result of an occupational accident or from subjection to risk factors occurring in the course of work.

Occupational Disease- Unlike an occupational injury is an illness contracted from an exposure over a period of time to risk factors from work activities.

Incapacity for work- Is the inability of an occupational disease/injury to perform normal duties in the position held at the time of the occupational accident.

Permanent Incapacity- Inability of the injury victim to ever perform normal duties of work in the position held at the time of the occupational accident.

Temporary Incapacity-the inability of an injury victim to work from the day after the accident but was able to later resume normal duties in the position held at the time of the occupational accident.

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ABSTRACT

Background. According to the International Labor Organization(ILO) report on Kenya, construction work is one of the most dangerous occupations only second to road traffic accidents in causation of worker injuries and fatalities. In the financial year 2010-2011, the construction industry ranked second in reported accidents accounting for 16% of accident fatalities and 7% of non-fatal accidental injuries. This study established the incidence and pattern of the non-fatal occupational injuries in the construction industry.

Broad objective. The broad objective of this study was to determine the incidence and pattern of non-fatal occupational injuries at three public health facilities in Nairobi.

***Methods and materials*.** This was a cross sectional study carried out at three public health facilities namely, Kenyatta National Hospital (KNH), Mama Lucy Kibaki Hospital (MLKH) and Mbagathi Hospital. The study population were consenting adults who presented to these fa cilities having sustained occupational injuries from construction works. Data was collected through pretested questionnaires administered to consecutive patients. The data collected was cleaned and entered into a Microsoft Access database then exported to SPSS version 23.0 for data analysis. Descriptive statistics were computed for continuous variables i.e. age and frequency and percentages which were used for categorical variables i.e. gender, type of injury and part of body injured. Common types of injuries were analyzed using proportions. Incidence of particular injuries were calculated by dividing the number of new cases by the total population (132) and multiplying the outcome by 100.
publication.

Results A total of 133 injured patients were recruited. Data was analysed for 132 participants. The mean age was 34 years. The proportion of males to females was 97.7% to 2.3%. Most of the injured workers were unskilled casual employee at 69.7%. Skilled contractual employees were 26.5% while only 3.8% were permanent professional employees. Falls from heights was the leading cause of injuries at 42.6%, followed by equipment related failures at 26.9% and cuts by sharp objects at 15.7%. Injuries to the

lower limbs were commonest at 45.1% followed by upper limb injuries at 28.1%. Fractures and dislocations dominated the type of injuries sustained at 62.3%.
Conclusion: Injuries were predominantly witnessed among young male workers of age 19-40yrs working at informal construction sites with little or no safety training at all.
Recommendations: There is need for improved safety training, supervision as well as proper use of PPEs in the construction industry; measures which would greatly reduce injuries at construction sites.

CHAPTER ONE: INTRODUCTION

1.1 Background information

The construction industry encompasses all civil engineering works, building works as well as the repair and maintenance of existing establishments and facilities (1,2). Such facilities include residential and commercial buildings, roads and bridges, dams, airports and canals among others (3). There was a regime change in Kenya in the year 2002, which witnessed the onset of a construction boom as indicated by KNBS statistics (4). At the same time, the Kenyan population is rapidly increasing necessitating a similar increase in construction works to meet the infrastructure, housing, office and workplace needs. Indeed, the construction industry is one of the industries that defied the COVID-19 pandemic to record a 6.6% increase in the third quarter of 2020 compared to a similar period the previous year. In Kenya the construction industry contributes 4.9 per cent of the GDP (5,6,7). Further, it is estimated that over 130,000 people were employed in the construction industry in the year 2013 (5,7).

An injury can be defined as any physical damage to the body as a result of acute exposure to some form of energy (8). Trauma on the other hand describes in medical terms the severity of the injury that may require specialized surgical attention (8, 9). Therefore, occupational injury can be described as an accidental physical damage that occurs to a worker in the course of doing their job, and can be fatal or non-fatal depending on severity and the body part that is damaged (10).

According to the International labor organization report on Kenya, construction work is one of the most dangerous occupations only second to road traffic accidents in causation of worker injuries and fatalities. In FY 2010-2011, the construction industry ranked second in reported accidents accounting for 16% (40 cases per 100,000 workers) of accident fatalities and 7% of non-fatal accidental injuries. (10,11). This is attributed to the labor-intensive nature of the industry coupled to a congested work station involving working from heights, confined places, using often unfamiliar machines and power tools in a dynamic work environment that changes as the construction progresses. The ILO further estimated that there are 42 million occupational injuries in sub-Saharan Africa

every year, leading to some 54,000 deaths (10). These accidents occasion a minimum of three days' temporary incapacity.

Construction sites are usually characterized with a beehive of activities and are often prone to accidents. While many of those accidents may not lead to injury or property damage, they may foretell future accidents with not so lucky outcomes, and as such, occupational injuries at construction sites are no strange occurrences. Furthermore, the laws on occupational safety and health are not strictly enforced in Kenya (11).There are no Safety rules in most construction sites and if there are, the authorities are too weak to implementing each rule effectively. Many workers are hired on temporary basis as casuals and may not even know the name and address of the nearest medical facility as stipulated in the emergency action plans (EAP) required for each construction site by the Directorate of Occupational Safety and Health (DOSH).

1.2 Statement of the Problem

There is growing consensus from the discourse in both the developed and developing economies that the construction industry presents one of the most hazardous working environments, as backed up by statistics on both fatal and non-fatal occupational injuries. The social and economic implications of such work-related injuries in the construction industry are far-reaching, and especially disheartening since most of them have a specific patten, and are preventable, if appropriate safeguards are taken. This study investigated the incidence and pattern of occupational injuries among construction workers in the fast-growing city of Nairobi, using patient data from three health facilities.

1.3 Rationale for the study

There are many incidences of accidents at construction sites within Nairobi, yet at the time of this study there was no documented hospital-based research on the incidence and pattern of occupational injuries among construction workers in Kenya. Similarly, there was less information about the prevalence and associated risk factor of occupational injuries among construction workers in Kenya in particular, and developing countries at large.

This study has therefore provided baseline information on the pattern of injuries for healthcare providers as first responders to such cases, as well as to policy makers and implementers of occupational health guidelines, while also serving as an eye-opener for further research.

Summarily, it is envisaged that the findings of this study will help achieve among others the following;

i. Highlight the incidence and pattern of occupational injuries among construction workers in Nairobi.
ii. Assist first responders and healthcare providers in screening for injuries among accident victims from construction sites and inform the evacuation of injured workers without aggravating the injuries
iii. Establish the commonest kind of injuries at construction sites within Nairobi.
iv. Highlight the gaps in policy making and policy implementation that can be bridged to ensure safer construction sites and improved treatment of injured workers.
v. Estimate the injury load in the construction industry for insurance purposes.

1.4 Aims and Objectives

The broad objective of this study was to determine the incidence and pattern of occupational injuries among construction workers presenting at the three public hospitals within the county of Nairobi.

There were a number of specific objectives;

i. To determine the pattern of injuries at construction sites in Nairobi
ii. To evaluate the use and effectiveness of preventive measures at construction sites
iii. To study the variation of incidence and pattern of injuries among different construction workers

1.5 Research questions

In order to achieve the study's aims and objectives, the following research questions were answered;

a) What is the incidence and pattern of occupational injuries at construction sites in Nairobi?
b) How effective are the injury prevention measures at the construction sites?
c) How does the pattern of occupational injuries vary among the different worker types at construction sites?

1.6 Scope of the research

This study had specific focus on the incidence and pattern of occupational injuries at construction sites around Nairobi, using data from emergency admissions and outpatient clinics, at three hospitals. Like in many other research projects the data herein was representative and not complete for all construction sites within the city. Furthermore, there was a definite leaning on the medical perspective of the injuries with specific attention to their pattern. A preventive approach on best practice at the construction sites including following safety protocols and what to do in the event of an accident were also covered in great detail, exploring how non-compliance led to accidents and injuries.

The National Construction Authority (NCA) and the Directorate of Occupational Safety and Health (DOSH) are mandated to authorize construction work. Many construction sites, however, lack the required approvals and it is insinuated that safety regulations are disregarded in these sites. As a hospital-based study, this research captured injured workers from both NCA approved and non-approved sites. In the same breath, hospital data was limited to the three selected major hospitals, leaving out many outpatient and inpatient cases at lower-level facilities. Autopsy reports on fatal injuries was also excluded from this study, focusing rather on non-fatal injuries. Primary data was collected through interviews with injured construction workers.

1.7 Limitations of the study

This study focused on the incidence and pattern of occupational injuries at construction sites around Nairobi, using data from three selected health facilities. The study did not focus on general injury case count or all construction projects regulated or not by the National Construction Authority (NCA) and the Directorate of Occupational Safety and Health (DOSH).

Minor injuries that are treated at the construction sites or at smaller health facilities not forming part of the study centers could not be included.

This study also omitted cases of fatal injuries from construction sites, except in cases where death occurred much later after medical attention and participation in the study. This is another area that requires further studies as recommended by this study in other sections.

1.8 Conceptual framework

The conceptual framework is represented in Figure 1.1, and shows the relationship between the three categories of risk factors, namely; individual, job-related and organizational factors that can lead to occupational accidents. These accidents result in various work-related injuries, which if studied depict a pattern that relate to the various causal factors

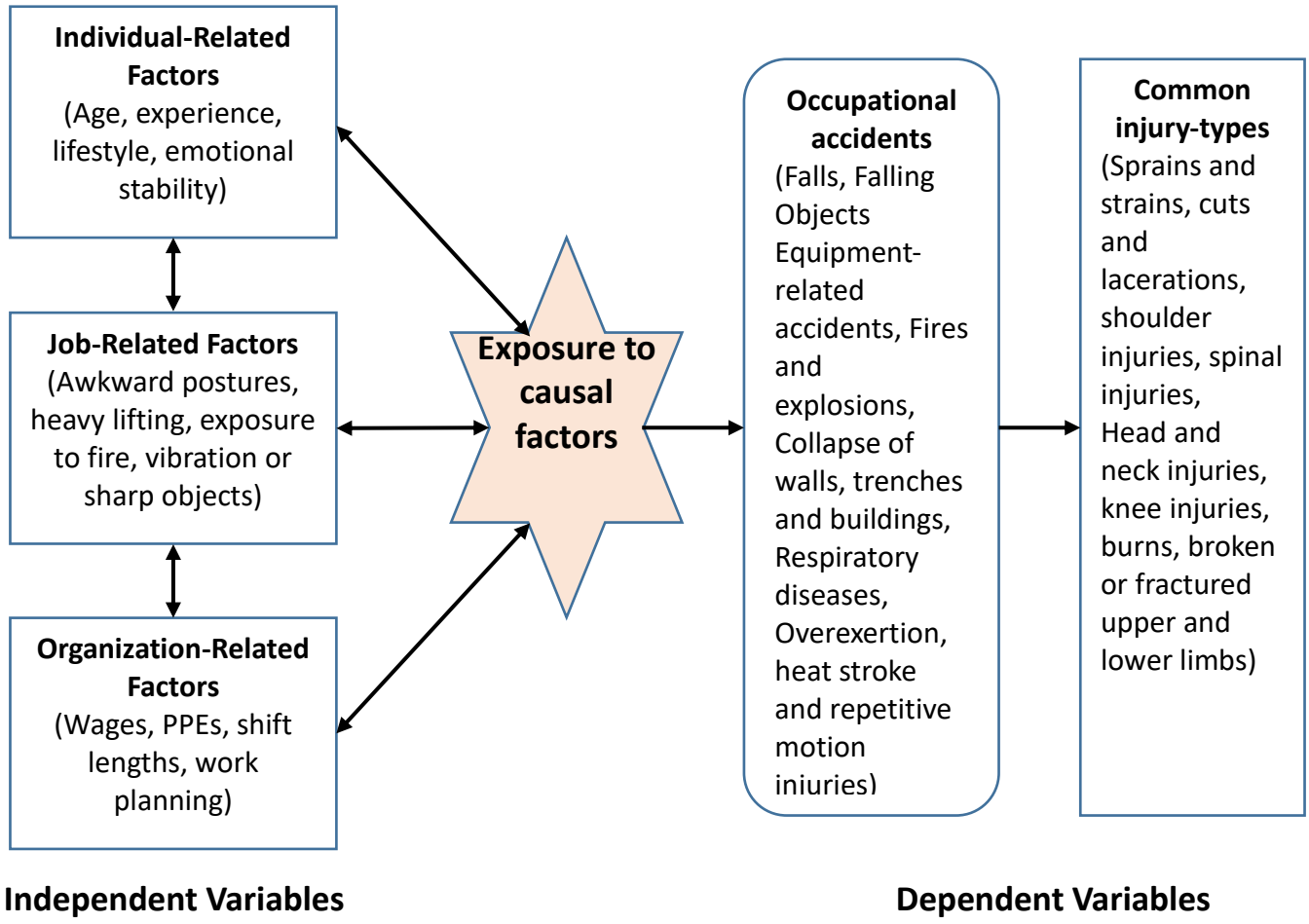

Figure 1 Conceptual Framework

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This second chapter lays the foundation onto which this research was conducted. While this research did narrow down to the pattern of incidents and injury characteristics for non-fatal accidents in the construction industry, this chapter introduces a much broader understanding. The causal factors of occupational injuries as well as the safety laws are covered in great detail. The patterns and characteristics of occupational injuries are also well examined from existing literature and the author's knowledge as a long-term resident of the study area, the city of Nairobi.

2.2 Common accident types at construction sites

The construction industry is notorious as one of the most dangerous places to work in, the world over. Peckar ranked it only second to the transportation industry in terms of fatal accidents in the USA (12). He further stated that by being aware of the hazards and injuries commonly suffered at construction sites, workers would greatly prevent these accidents from taking place, thereby reducing injury cases and related severity. The documented causes of these occupational injuries are numerous and varied.
A number of studies have categorized the common occupational injuries as follows: (13, 14,15)

i. **Falls:** These are considered as the commonest of reported construction site injuries. They include falls from ladders, cranes, roofs, scaffolding and other heights at work which poses the risk of severe to fatal injuries to the construction workers.
ii. **Falling Objects:** These may include construction materials that are not properly secured above the working areas, or tools and equipment used above some worker and they subject those working below to great risks. Depending on the mass of falling objects, workers may suffer severe injuries or even death, regardless of all other safety measures such as PPEs.

iii. **Equipment Related Accidents:** There is a variety of equipment at every construction site, such as dumpster and forklifts, which may fail to function without notice, or be mishandled altogether, thereby causing accidental injuries. In other instances, a nail gun could misfire and injure unsuspecting worker on the other side.

iv. **Crushed –Between and Back overs**: It is also a common accident for workers to be pinned or crushed between large vehicles or other movable equipment, and concrete or walls. Such vehicles or huge trucks may also run over workers, while backing out of construction sites or transporting material. These types of accidents can be attributed to negligence on the part of supervisors or other workers.

v. **Explosions and Fires:** Certain construction sites may contain hazardous materials such as exposed wiring, flammable substances or leaking pipes that could lead to accidental fires and explosions. These are however a little uncommon as compared to other types of accidents but have the potential to cause serious injuries, even fatalities.

vi. **Collapse of Building, Trench or Wall:** The structures under construction such as the building, wall or a trench may collapse or give in, thereby trapping workers underneath. This is a common type of construction injury and fatalities are often recorded. In other instances, it may be that the intention is actually to demolish the building or other structure, which may then collapse suddenly or towards an unintended direction thereby collapsing on workers, or throwing dangerous debris on them. This too can seriously injure or even kill the victims.

vii. **Heat Stroke, Repetitive Motion Injuries and other overexertion:** Most types of work at construction sites often involve hard physical labour, which may cause slower injury processes that can lead to sudden breaking point. Such injuries from overexertion include repetitive motion injuries, muscle and joint damage, heat stress that may lead to heart, kidney or brain injury, hypothermia or frostbite in cold climates, which have reportedly led to workers losing their fingers or permanently damaging certain muscles.

viii. **High Lead Levels:** Construction workers are exposed to lead which is harmful to their life due to unsafe work practices and poor site settings.

ix. **Respiratory Diseases:** Pneumoconiosis is a major cause of morbidity and mortality among construction workers. Usually it affects coalmines workers but construction sites are not free from dust either hence the occurrence of this disease among its workers. Asbestos, silicosis and Coal Workers' Black Lung are the most common pneumoconiosis conditions that have resulted in death of many construction workers.

There are numerous serious injuries that could result from the described accident types (16,17). These include fractures, different degree burns, lacerations or cuts from sharp or exposed machinery and most unfortunately, death. The victim's dependents or family are left to suffer with medical bills, caregiving or funeral expenses. Ideally, they should file for claim of compensation for a wrongful injury or death in an extremely tedious process in many instances without success. Mbuya & Lema (18) remarked that there is not proper consideration for health and safety in construction project implementation plans and such measures are deemed additional burden that should be foregone whenever possible. There are reported inconsistencies in the information on such injuries due to employees underreporting on inducement or frustration, or misclassification as reported by rogue contractors and greedy business people.

2.3 Causal factors of construction site accidents and injuries

Occupational injuries constitute a sizable part of the injury burden to society in general, affecting people in their most productive years, and mostly again lower income people in developing countries. The problems compound within family setting due to disability and lost income or even death. Accident and injury rates are so high in the construction industry compared to other sectors, making it important to understand their causal factors, and what preventive measures can be implemented, as well as how injury victims can be attended to, starting at the working sites (19).

The subject of occupational injuries in the construction industry is enormous and highly complex. A combination of legislative, social, scientific, psychological, sociological, cultural, organizational, technological, geographic, economic and other factors have a direct bearing on it. Even where all of these factors have been taken into account in order to create an optimum construction project implementation plan, workers are still prone to accidental injuries.

A number of researchers have grouped the accident causation factors into three major thematic areas or theories (20,21); Individual-related, Job-related and Organization-related factors.

2.3.1 Individual-Related Factors

Work experience and age of the worker are the leading individual related causal factors. Less experienced workers have higher injury, which reduces when an individual acquires sufficient work experience. Unfortunately, the risk again rises with aging (22). Younger workers are generally at higher risk in non-fatal accidents while older ones are mostly found to be at higher risk of fatal occupational accidents (23,24). There have also been studies which found some tasks in construction to be age-neutral (25)

Other studies have also linked living habits such as alcohol or tobacco consumption to work-related injuries. Similarly, emotional instability can lead to mistakes and violations of guidelines which may then cause an incident and injury (26,27,28). Furthermore, negative individual traits such as risky behavior, violations, negative affectivity to the organization and absenteeism were cited by Hill and Trist (29) as contributing to injury incidents.

2.3.2 Job-Related Factors

There is higher risk of injury to the worker undertaking certain responsibilities or tasks at the site. The jobs of masons, plant operators, carpenters among others have different risk levels. Other job-related factors are specific hazards in the job and location of work (30). Roofing a ten-storey building is riskier than laying the foundation. Paul and Maiti (31) also found that whenever construction materials are handled manually, they tend to cause musculoskeletal disorders, sprains and strain (32). They also cited job stress,

responsibility and dissatisfaction as explaining other injuries. For example, a worker under financial pressure and feeling oppressed is more prone to injury.

2.3.3 Organization-Related Factors

These are the most important factors because they can shape the other two groups of factors, thereby minimizing the overall risk of work-related injuries. Organization-related factors include the commitment of management to safety, supervisory and coworker support, as well as the general workplace safety status (33). Whenever the workers are appropriately trained and there is higher commitment to safety standards by management as well as supervisory and coworker support, there is usually low injury risk.

In summary, the following will drastically reduce construction site accidents;

a) Proper enforcement of safety regulations
b) Skilled labour
c) First aid measures
d) Sufficient supervision and technical guidance
e) Proper working tools and equipment that are well maintained
f) Safety consciousness by workers
g) Proper information flow
h) Adequate personal protective equipment
i) Clear operational procedures

2.4 Accident patterns at construction sites

Research has found a specific pattern in the nature of occupational injuries in the construction industry(34,35). Similar findings were demonstrated by another research in 2014 (36) and yet another research conducted in the united states(37). A summary of their findings is listed below.

i. A majority of injured workers are male. This is mainly because the construction industry in general in dominated by male workers.
ii. Younger workers are more prone to accidents due to inexperience. However, older workers experienced more severe injuries whenever they were involved in accidents.

iii. Most accidents in Kenya occur around the month of June and July, when the financial year is ending and contractors are under pressure to complete their projects on schedule. There is therefore little regard for safety.

iv. Most accidents occur in the periods preceding or after tea break and lunch break. This was attributed to the rush to complete certain tasks before taking a break, or to catch up after the break.

v. Construction sites where management is negligent and fail to train new recruits, to hire enough workers or to provide proper working equipment usually record higher accident cases. Several contractors comply with all required legal procedures and certifications, but fail to implement the stipulated standards. This can be attributed to limited government inspection or corruption.

2.5 Common injury types in the construction industry

The construction industry is characterized with complex workplaces and many people taking on different tasks (38). Most of the duties involves physical work and workers are prone to certain types of injuries. These may range from simple sprains and strains to serious injuries that could be life-threatening. Some of the most common such injuries are described below: -

2.5.1 Sprains and Strains

Sprains can be defined as stretching injuries that occur to ligaments. When the ligament is torn apart, the injury is called a strain. Sprains and strains mostly occur in the ankle or shoulder, when a worker twists a certain body part while moving or lifting a heavy object. The worker has to be reliable because such injuries are not visible to the naked eye, the supervisors might find it difficult to believe.

As a result, most sprain and strain injuries remain unreported or untreated. They are however avoidable with proper ergonomic practice acquired through training.

2.5.2 Cuts and Lacerations

These mostly occur on the limbs, and are commonly associated with overcrowded or disorderly workplaces or whenever workers are newly recruited, without proper training and less experienced on the job. Cuts and lacerations leave open wounds that if they are not attended to may become infected. Stitches are often required as part of the treatment

3.5.3. Effects Of Electrical currents

Electrical burns are not an uncommon occurrence at construction sites. The use of power tools and massive amounts of water used in the concrete mixing creates a recipe for short circuits that may result in injuries ranging from electrical burns to fatal electrocution.

2.5.3 Shoulder Injuries from Construction Accidents

Injuries to the shoulder may occur after falls from heights, or may develop over a long period of time from minor strains leading to serious impairment. These sprains and strains can be caused by repetitive shoulder motions or overexertion of pressure during lifting or pushing. Typically, treatment plans may include medication and physical therapy, or surgery in severe injury cases.

2.5.4 Spinal Injuries Caused by Construction Accidents

These are some of the most serious injuries among construction workers. A spinal injury is usually a bulging or herniated disc in the back or neck or a fracture of one or more vertebrae causing compression of the cord. They can be easily misdiagnosed as simple sprains or strains in the back or neck especially if the victim is not in excruciating pain. Spinal injuries may require surgery or lasting pain management, thereby limiting the victim’s ability to do a similar job in the construction industry. It is not uncommon for workers to die from spinal injuries that occur from falls.

2.5.5 Knee Injuries Caused by Construction Accidents

The knee is one of the largest joins in the body connecting the two longest and strongest bones in the body. Any of the components namely, bones, ligaments, tendons and cartilage may be injured. It is one of the most easily injured body parts among

construction workers. Common knee injuries include dislocations, fractures, sprains and ligament tears. Most of these can be treated through observation and rest, physiotherapy and or bracing while others may require surgery. Severe injuries can necessitate amputations leading to permanent impairment and inability to work.

2.5.6 Head and Neck injuries among construction workers

Hard helmets are recommended to be worn at all times to guard against head injuries at construction sites, that may result from falling objects, electric shocks, heavy equipment and burns. The most common non-fatal traumatic brain injuries (TBIs) occur among construction workers. Construction workers can also suffer neck injuries due to the repetitive motion of some work processes, or the same risks to the head above.

2.5.7 Fractures and joint dislocations

While bone dislocations occur in many parts of the body, they are common in the shoulders, fingers and knees among construction workers. Broken bones on the other hand are much more severe and can lead to chronic pain and severe limitations. Such fractures are common among the upper and lower limbs, as well as the ribs. They require specialized treatment and often heal over time in the course of medical attention.

2.6 Safety laws and regulations in Kenya

2.6.1 Introduction

So important is the issue of safety in the construction industry that the International Labour Organisation convened in 1937; the “Safety Provisions (Building) Convention” followed up by 1988’s “Safety and Health in Construction Convention No: 167” to streamline safety requirements in a move to reduce injuries at construction sites.

Occupational Safety Laws in Kenya can be traced back to the colonial era in 1950 when the “Factories Act, Chap 514” was enacted, later in 1990 amended to ‘Factories and other Places of Work Act’ to widen its mandate. This established guidelines on the safety, health and welfare of factory employees among other workers. The Occupational Safety

and Health Act (OSHA) and the Work Injury Benefits Act (WIBA) were enacted in 2007, and remain the prominent laws that govern OSH in Kenya. There are other laws that touch on OSH, but they are managed by other government ministries and corporations

2.6.2 Building Operations and Works of Engineering Construction Rules, 1984

These are subsidiary rules that were established through an act of parliament in 1984 to set specific guidelines for building and construction sites in Kenya. Government inspectors are authorized to access buildings and examine documents, ask questions and request for certificates and other legal documents. Under these rules, a contractor must write to the director with a seven days' notice prior to commencement of any building or construction work, giving details on the nature of the project to be implemented. It also requires that all players are well aware of their responsibilities and the safety law of construction. Since 1984, the following subsidiary legislation has been made //by the Directorate of Health and Safety in order to protect workers even better: -

- Woodworking Machinery rules L.N 431/1959.
- Dock rules L.N 306/1962
- Cellulose solution rules L.N 231/1957, L.N 87/1964
- Eyes protection rules L.N 160/1979
- First Aid rules L.N 160/1979
- Electric power special rules L.N 340/1979
- Noise prevention and control rules L.N 296/1996, L.N 25/2005.
- Health and Safety committee rules L.N 31/2004.
- Medical examination rules L.N 24/2005

2.6.3 Occupational Safety and Health Act, OSHA (2007)

The ILO explained that as a discipline, occupational safety and health (OSH) is concerned with the welfare, health and safety of employees, organisations, and other individuals that may be linked to the work being undertaken such as suppliers, customers and members of the public (24)

OSHA (2007) is an act of the National Assembly that was enacted in 2007 in order to ensure the safety, welfare and good health of all workers and other people at workplaces. The most compelling justification for OSH standards is primarily moral. A worker should not fear to report to work because of the risk of getting injured or even dying, nor should others who are linked to that work.

OSH standards are so important, they are further reinforced in law; as it is believed that without the additional "fear" of potential litigation and substantial penalty, many organisations would choose to ignore their moral obligations.

OSHA (2007), is applicable to most places of work. If an employer has even one worker alone, it still applies and the employer must comply with sections of the act as applicable. The OSH Act (2007) has the following objectives and mission: -

- To reduce workplace hazards.
- Encourage the implementation of safety and health programs.
- Encourage research into the methods of addressing workplace safety and health challenges
- Establish the rights of employers pertaining workplace safety and health.
- Establish a monitoring system for job-related injuries and illnesses by reporting and recording mechanisms.
- To set up training and educational programs for safety and health professionals
- To set up and enforce mandatory workplace safety and health standards
- To facilitate the establishment of local level workplace safety and health programs.
- To ensure that local-level safety and health programs are continuously monitored, analysed and evaluated

2.6.4 National Construction Authority Act, NCA (2011)

The NCA was enacted in the year 2011to streamline and regulate the construction industry in Kenya, which for a long time had suffered poor policy and legislative framework being dominated by shrewd contractors and unqualified persons. It established high quality and safety standards in the industry. It also constituted a board,

the National Construction Authority (NCA) to enforce those high standards by registering and regulating the work of all contractors in the construction industry in Kenya. Under the act, all construction sites should record all accidents and incidents in their accident register book, and as a preventive measure, all workers should wear appropriate personal protective gear and have access to clean and safe welfare facilities. There should also be fire-fighting equipment on site.

2.6.5 Employment and Labour Relations Act, (2007)

The Employment and Labour Relations Act of 2007 is a very important act of parliament that covers basic employment standards, core labour rights, a framework for collective bargaining, the prevention and settlement of disputes in the construction industry and beyond.

The Act sets minimum wages, forbids child and forced labour, guarantees freedom of association, regulates working hours and controls various types of leave, such as annual leave, parental leave and sick leave. Under this act, the responsibilities, privileges and even penalties of both workers and employers are defined, including the freedom of forming trade unions.

2.6.6 Workers Compensations Act, 2007

The Workers Compensation Act of 2007 is an act of parliament that outlines the procedures for any employee that has been accidentally injured or dies while working, to be compensated. However, the employer has to be at fault and responsible for the injury or death. In this way, the Act was aimed at encouraging proper safety and health at construction sites and other workplaces.

2.7 Control of injuries at construction sites

2.7.1 Administrative controls

They refer to the adjustments and changes made in job procedures of schedule and assignment in order to reduce duration, magnitude and frequency of exposure to injury risk factors (39). For example, health breaks and stretch exercises have been seen to increase performance while reducing injury risk (40,41,42,43). These studies reported that morning warm-up exercise groups realized stronger hamstring and thigh muscle stretch-ability as well as increased mobility of the thoracic and lower back regions. Another study reported similar outcomes when the exercise sessions were done at home (44). Participating workers showed work satisfaction and better shoulder function. These reduce the risk to job-related injuries(45).

2.7.2 Personal Protective Equipment (PPE)

Risk prevention from the source is an effective and cheaper method of protecting construction workers. Employers must provide PPEs as defined in the governing safety laws. They serve to prevent injury or reduce it significantly in case of an accident. They include helmets, safety boots, hand gloves, full body suits, eye protection goggles or shields, protective hearing devices and respirators.

2.8 Existing Research gaps

In the developed world including countries in North America and Europe, many studies have been done on the characteristics and patterns of injuries in the construction industry. As a result, there are high safety standards and less injury incidents. Sometimes accidents and incidents are reported without injuries and deaths. However, in the developing countries including Kenya there is a research gap on such studies and the casualty rate is very high, making construction sites high risk working environments.

According to Smallwood (46), the fatality and injury rates in the construction industry in Sub-Saharan Africa are at 21 and 16,012 per 100,000 workers respectively, while in developed countries it is only 4.2 for fatality and of 3,240 for injury per 100,000. Studies are therefore required to investigate these worrisome statistics in order to improve working conditions and medical preparedness (47,48). It is for this reason that this

research was carried out to study the context in Nairobi, one of Africa's fastest growing cities.

2.9 Summary

The literature review was discussed in three prongs: The common injury patterns at construction sites, causal factors and finally the laws and regulations governing occupational health and safety in regards to the construction industry.

The chapter discussed in depth the mechanisms that result in injuries at construction sites as well as the types of resulting injuries. Several authors have described in detail these injuries and a note of the same is deeply discussed in the chapter.

Understanding injury causation is key to their successful prevention. In this chapter, the Domino theory of accident causation is discussed. This theory proposes that accidents don't just occur, they are a result of systemic failures that include individual factors, organizational factors as well as work related factors all of which have been discussed in great length.

The final part of this chapter dwelt on the occupational safety laws and regulation in Kenya. A great deal was taken to discuss the evolution of these laws and their application especially to the construction industry.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter details the methods and materials applied and utilized in the course of this research. Generally, a pre-tested and structured, interviewer administered questionnaire was adapted and customized from previous studies and also by reviewing pre-existing literature, relevant to the research to include all the possible variables that address the aims and objectives of this study. The questionnaire was designed to obtain information on variables included in the study such as socio-demographic profile (age, sex and occupation), mechanism of injury, type of worker (painter, mason, carpenter, casual labourer etc) safety measures in place as well as the date and time of accident. Additionally, medical records of the victims were reviewed to obtain information regarding body region injured and types of injury.

3.2 Research design

A cross sectional study approach was used, where by definition the researcher does not have control over independent variable because inherently, they cannot be manipulated or their manifestation has already occurred. This approach is known to be empirical inquiring and systematic, further presenting the advantage that it can be carried out within a relatively short time and since the required data is available immediately.

A pretested questionnaire was administered to patients who presented at the three participating health facilities with injuries sustained while working at construction sites.

3.3 Research setting and period

This research was carried out within a period of three months, collecting data from patients with occupational injuries from the construction sites who visited or were admitted at KNH, MLKH and Mbagathi level 5 hospital within Nairobi County. Kenyatta National Hospital is the oldest and largest hospital in Kenya with a bed capacity of 1800. It is the leading national referral hospital that has been in operation for over a century. KNH is also the teaching hospital of the University of Nairobi College of Health Sciences.

Mbagathi County Hospital is a government county-level health care facility serving a catchment area of over a million people and with a bed capacity of 320. Its location adjacent to the largest slum in Nairobi makes it particularly strategic to the likely construction workers residing in Kibera. It is also used by the ministry of health to decongest KNH.

Mama Lucy Kibaki Hospital is a level-4 county referral hospital located in Nairobi's populous eastlands side in Embakasi Constituency, and is named after the former first lady, the late Lucy Kibaki who was the wife to the third president of the Republic of Kenya Mr. Mwai Kibaki. The facility was officially opened in 2013 and has a bed capacity of 112.

3.4 Study timelines

Table 1 Study timelines

Activity	Jan 2021	June-Oct 2021	Nov – Dec 2021	Jan 2022	Feb 2022	March-May 2022	June 2022
Concept development							
Proposal development							
Proposal presentation and corrections							
Ethical approval							
Data collection							
Data analysis and presentation							
Dissertation writing and submission							

3.5 Pilot study

A pilot study was done prior to commencement of this research. It involved 9 respondents who were injured construction workers visiting Mama Lucy Kibaki Hospital. This helped to pretest the efficacy of the questionnaires. MLKH was selected for pretesting due to its location within the study area of Nairobi, and the many people it serves in the eastlands part of Nairobi where there is plenty of construction work going on, and also many low-income dwellers who are likely to work as casual laborers in the construction industry. A pilot study is carried out by administration of a questionnaire(s) to just a few individuals in order to pre-test the questions and questionnaire, and therefore help the researcher to establish whether there are any flaws, biases, limitations or other weaknesses hence necessary revisions prior to the implementation of the study. (49,50),

3.6 Target population

All adult patients that reported at the study healthcare facilities with injuries sustained while working as construction workers. The three hospitals were KNH, Mbagathi County Referral Hospital and Mama Lucy Kibaki Hospital.

3.7 Sample size

BLS (51) estimated that the construction industry was responsible for an estimated 8.5% of all injuries that result in lost days of work in the USA. This presents an infinite population size and was adapted for this study, where there has not been a substantive study in Kenya (52,53,54).

When the population size is infinite, Cochran formula is used to estimate the sample size (55,56)

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where n is the sample size, Z is the desired confidence level (95%), p is the estimated proportion of an attribute that is present in the population (0.093), q =1-p and e is the desired level of precision (0.05)

Substitution yields:

$$n_o = \frac{1.96^2(0.085)(1-0.085)}{0.05^2}$$

$$= 119.512$$

To get the population size;

From the registries of the three healthcare facilities, there were approximately 40 patients presenting with injuries from construction sites in the month of October, 2021 during the pilot study. This would give around 120 patients in 3 months of study.

Then the sample size would be

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

Where N is the population size (of 120). Substituting gives;

$$n = \frac{119.512}{1 + \frac{(119.512 - 1)}{120}} = 120.499$$

Adding 10 % for non-responsive questionnaires gives a total of **132 participants**

3.8 Sampling procedure

Convenient sampling was employed to enroll respondents to this study.

3.9 Data collection procedure

All respondents meeting the inclusion criteria were given the consent forms in order to ensure voluntary participation. This came after a detailed discussion with the research assistants. Then an interviewer-administered questionnaire was given so as to instill a sense of privacy while ensuring a sense of integrity of the data collected.

3.10 Population inclusion and exclusion criteria

The population targeted were

a.) Adults between age 18- 70 years
b.) Patients from the construction industry who reported to KNH,MLKH and Mbagathi hospital with construction work related injuries.
c.) Those who gave voluntary informed consent.
d.) Patients who were fully conscious and oriented

The following group of patients were excluded from the study:

a) Patients who refuse to consent to the study
b) Construction workers injured while not on duty.
c) Minors who had not attained the age requirements for employment.

3.11 Data processing, analysis and presentation

Quantitative data was collated from the administered questionnaires, cleaned for errors, coded and tabulated for ease of processing before being entered into the software known as Statistical Package for Social Sciences (SPSS) Version 23 for analysis. Summary results obtained were used to analyze relevant qualitative data.

Multiple regression analysis was conducted to test and determine the incidence of the various injury types among construction workers within the study hospitals in relation to their cadre of work and injury suffered.

3.12 Ethical considerations

This research was done with strict adherence to the Helsinki Declaration guidelines regarding medical research involving human subjects

As a first step, the principal investigator sought the approval of the department of orthopedic surgery at the University of Nairobi. Further approvals were obtained from the (KNH/ERC). There was also the courtesy to get authorized by management at each of the three hospitals where research was done. Consent was sought from each participant, with clear explanation of the study objectives and their choice to participate or otherwise. The research assistants and principal researcher also explained to the participants (patients) that their treatment protocol would not be altered by their decision to participate or decline, and that their personal information would not be revealed to anyone.

3.13 Budget

Table 2 Budget

Particulars	**Rate (KES)**	**Units**	**Days**	**Amount (KES)**
Pilot study	500	3	10	15,000
Stationery and printing	30,000	1	1	30,000
Research Assistants	500	3	90	135,000
KNH-UoNERC fees	2,000	1	1	2,000
Final project writing, printing, and binding	2,000	7	1	14,000
Miscellenious	50,000	1	1	50,000
Total Cost				**246,000**

3.14 Study Results Dissemination Plan

The study results will be presented in the Department of Orthopedics of UoN and KNH. Additionally, will be presented in seminars, workshops, abstracts, and used to compile a thesis which shall be available at the University of Nairobi department of Orthopaedics, as well as the University's Libraries. Manuscripts submitted to reputable peer reviewed journals with open access for wide readership for publication. The findings shall also be presented in scientific conferences whenever opportunities arise.

CHAPTER FOUR: RESULTS

4.1 Participant characteristics

A total of 133 participants were recruited to the study. One participant submitted incomplete results and was therefore excluded from data analysis.

The age distribution was clustered into classes the lowest age being 19-29 years and the highest being 60-69 years. There were no participants above the age of 70 years. The mean age was 34 years and the median class was 30-39years. The median age was 32 years. The participant characteristics are summarized in the figures 1,2 and 3 below.

Table 3 Age distribution of participants

Class (1)	**Frequency** (f) (2)	**Mid value** (x) (3)	$d = \frac{x - A}{h} = x - 44.5$, $A = 44.5, h = 1$ (4)	$f \cdot d$ (5) = (2) × (4)	$f \cdot d^2$ (6) = (5) × (4)	cf (7)
19 - 29	53	24	-20.5	-1086.5	22273.25	53
30 - 39	48	34.5	-10	-480	4800	101
40 - 49	21	44.5=A	0	0	0	122
50 - 59	8	54.5	10	80	800	130
60 - 69	2	64.5	20	40	800	132
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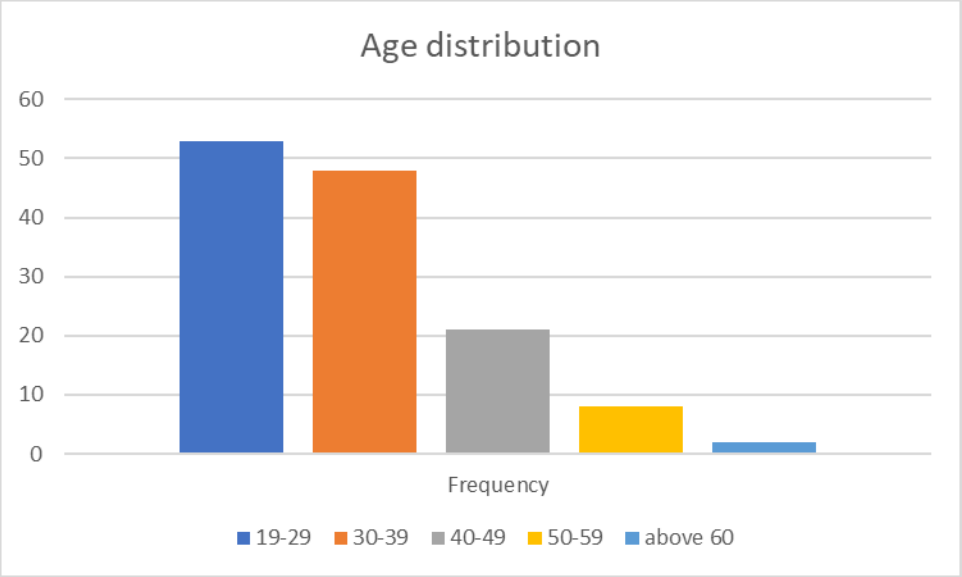
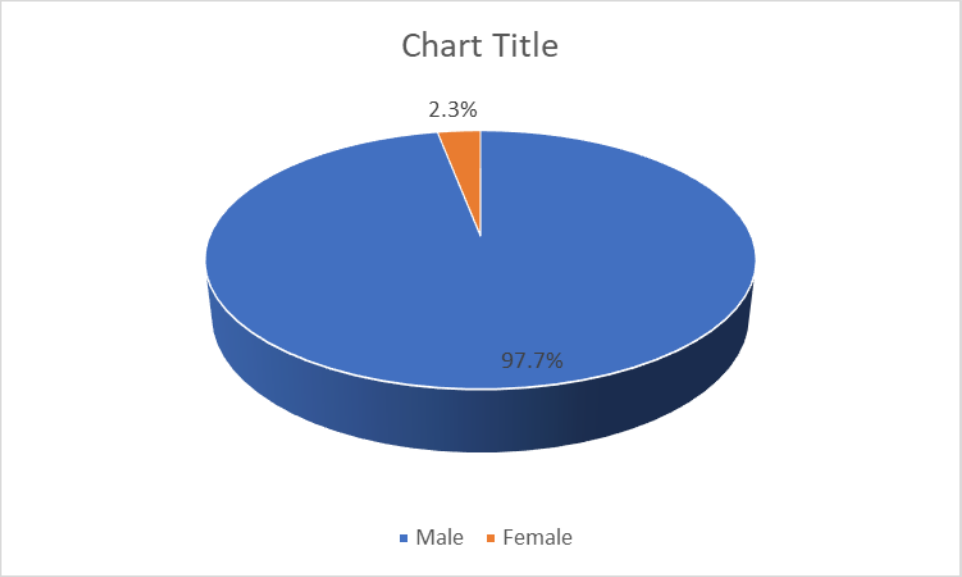
	$n = 132$	-----	-----	$\sum f \cdot d = -1446.5$	$\sum f \cdot d^2 = 28673.25$	-----

Figure 2 Age distribution



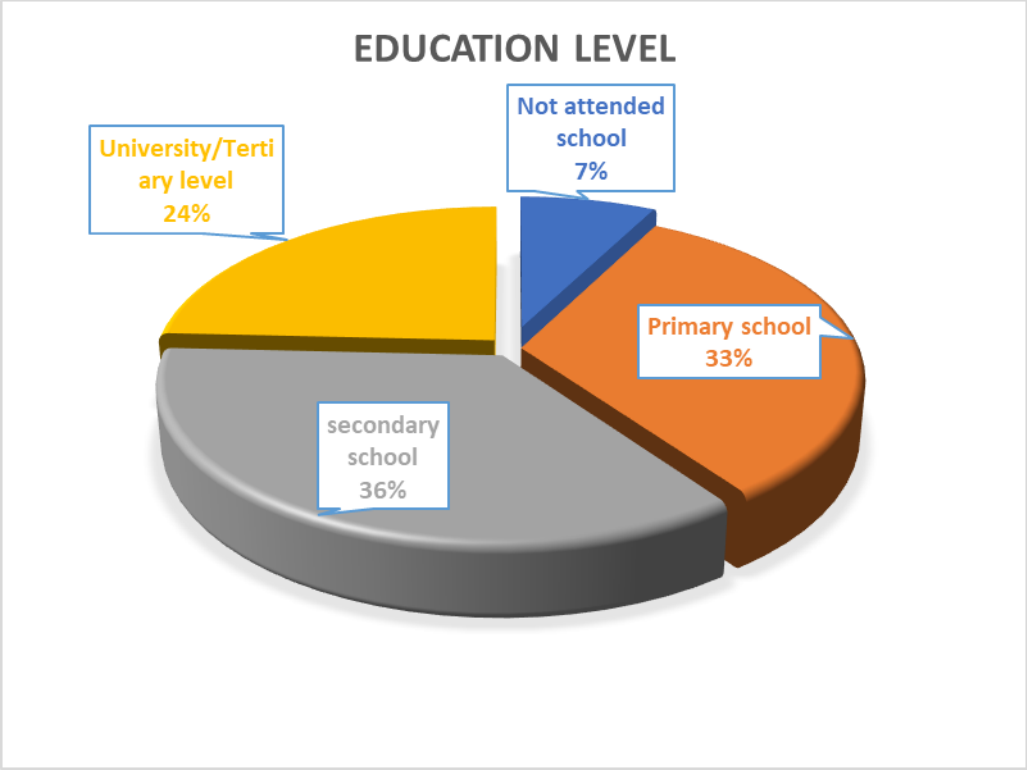
Among them were 129 men and 3 women accounting for 97.7% and 2.3% respectively.

Figure 3 Gender distribution



A small number of participants, 7.6% had no formal education at all. 43 participants representing 32.6% had primary school completion certificates. The majority of participants,47, representing 35.6% had secondary school certification while 24.2% had university and or tertiary level education as represented below.

Figure 4 Education level



4.2 Job description and characteristics

A majority of the injured workers-92 were employed on casual basis as unskilled workers accounting for 69.7% of the total participants. There were 35 skilled yet contractual workers representing 26.5% and the least participants were in the category of permanent staff at only 3.8%. This data is demonstrated in the figure below.

Further to that, only 28.6% of the injured workers had any formal training in the job they were undertaking at the time of the accident. See table 2 and figure 3 below

Figure 2 Job description

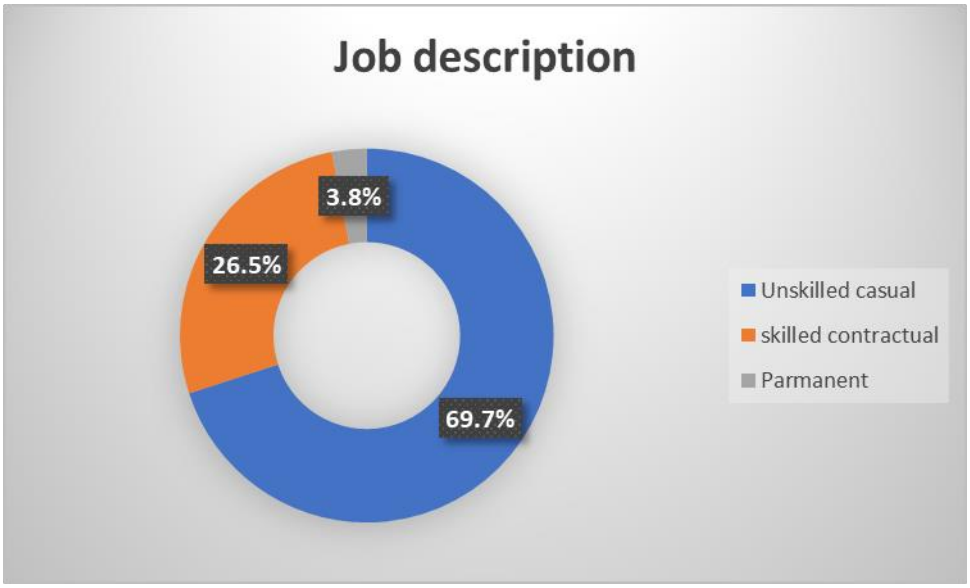
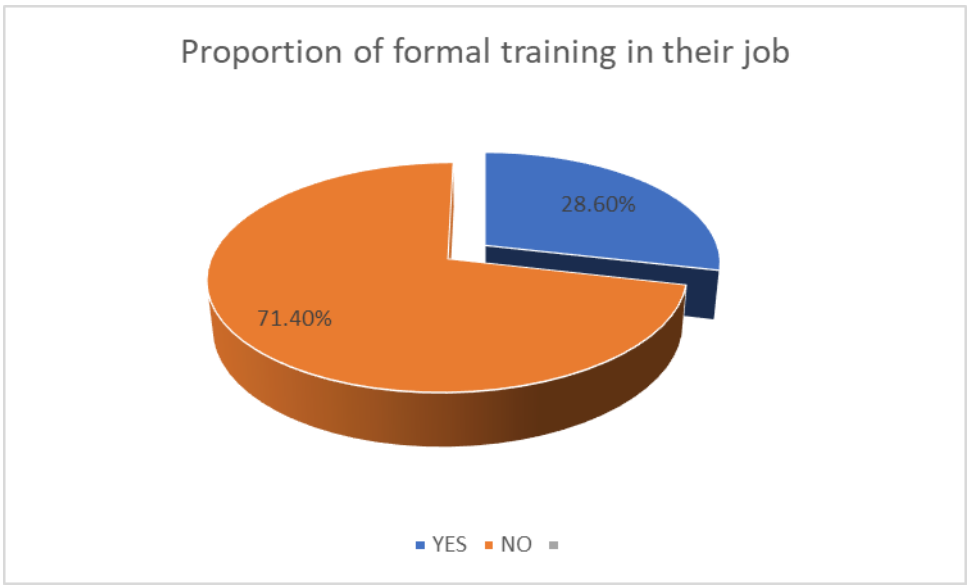


Figure 3 Proportion of formal training

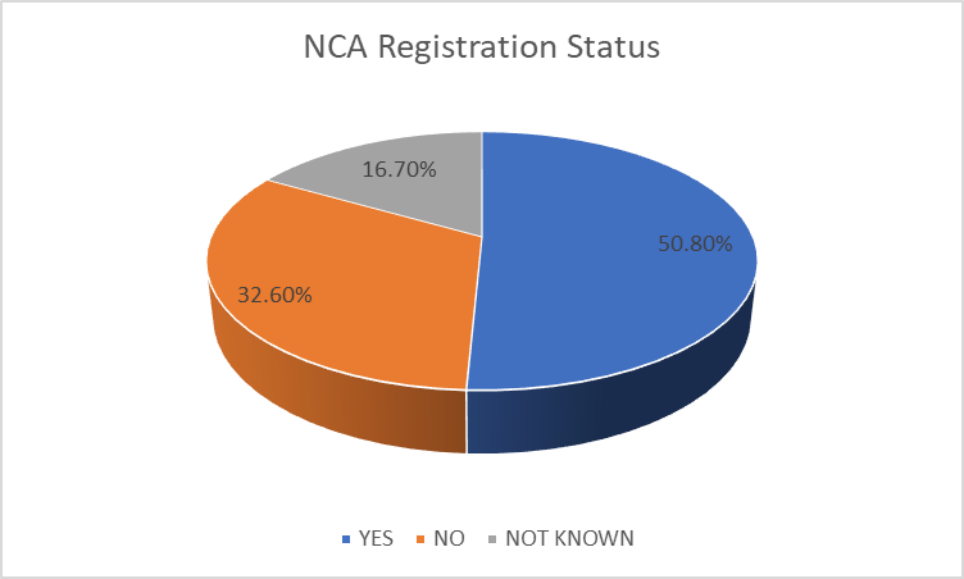


In terms of job experience, most of the participants, 59% had less than 3 years' experience. Only 5 participants had over 20 years' experience on the job. The participants' job experience in years is represented in the graph below.

Figure 4 Job experience

More than 50.8% of the construction sites where participants were injured were not registered by the National construction agency (NCA). Only 32.6% were registered while the registration status of the site was unknown to the participants in 16.7%.

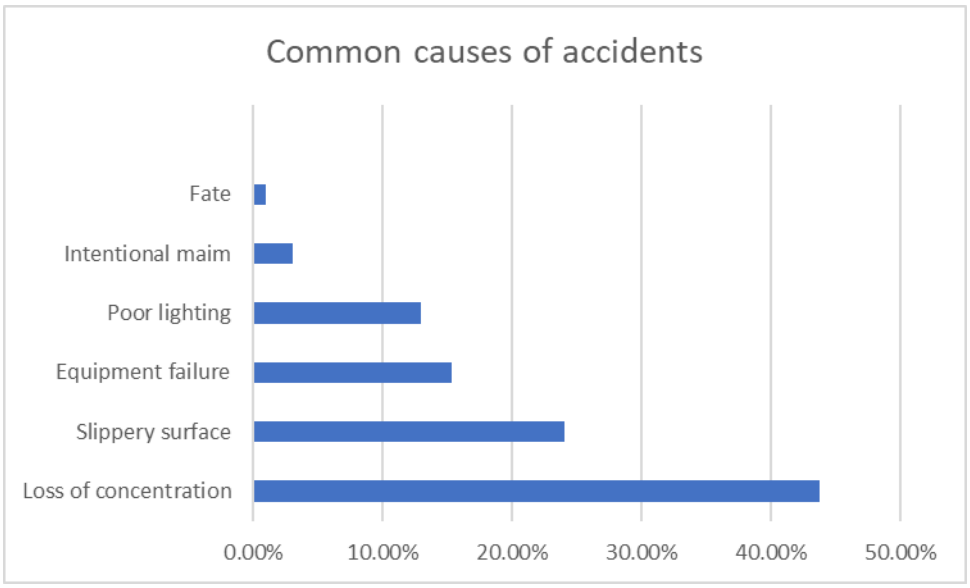
Figure 5 NCA registration status



4.3 Injury Mechanism and Pattern

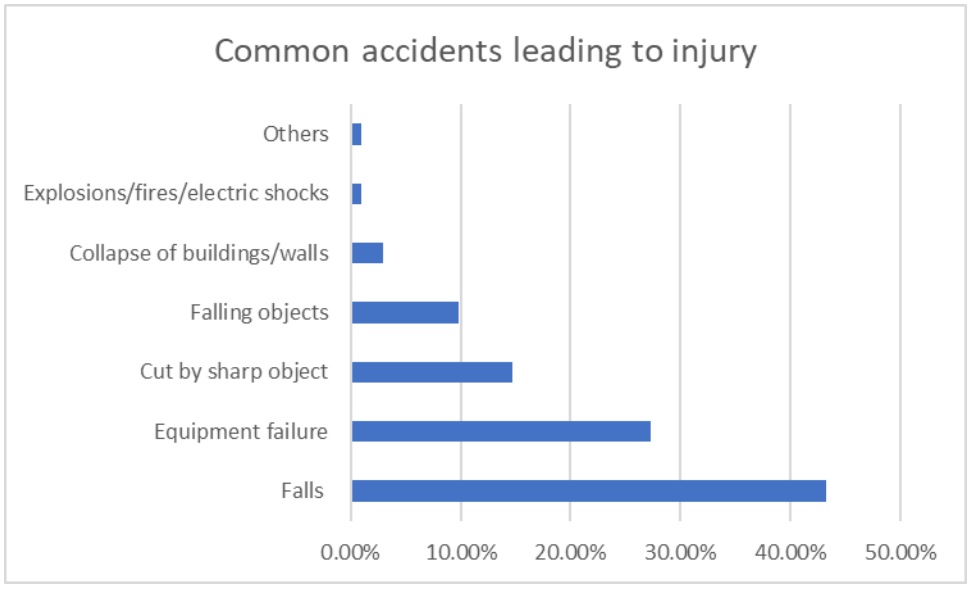
A marjority of respondents at blamed loss of concentration for the accident that led to their injuries. Another 24% had a slippery surface as the cause of the accident. Equipment failure was responsible for 15.3% of the accidents. Poor lighting was attributed to accident causation in 12.9% while in 3% of cases the accident resulted from intentional maim by fellow workers. In about 1% of accidents, the victim had nothing to blame but fate.

Figure 6 Causes of accidents at the workplace



The commonest accidents leading to injury were falls from a height accounting for 42.6% of the injuries. This was followed by Equipment related failures at 26.9%. Cut by sharp objects resulted in 15.7% accidents while falling objects were the injury cause in 9.8%. Collapse of buildings/walls were responsible in 3% of the injuries. Explosions, fires and electric shocks were responsible in about 1%of cases. Other causes represented about 1% of injury causation.

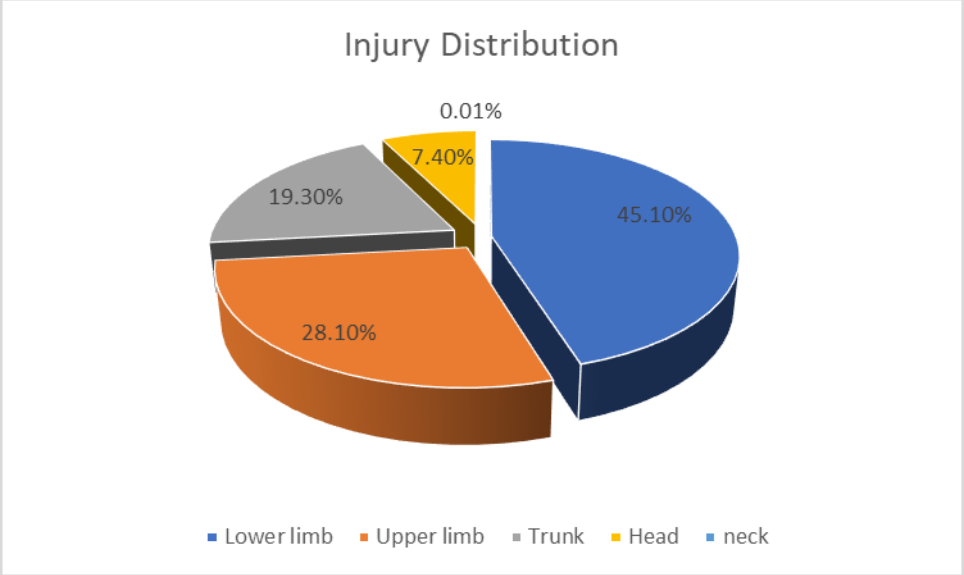
Figure 7 Common workplace accidents in percentage



In terms of body part injured. The results demonstrated that injuries to the lower limb were commonest at 45.1%. This was followed by upper limb injuries at 28.1% while injuries to the trunk represented 19.3%. Injuries to the head were at 7.4% while there was a single neck injury representing 0.01%

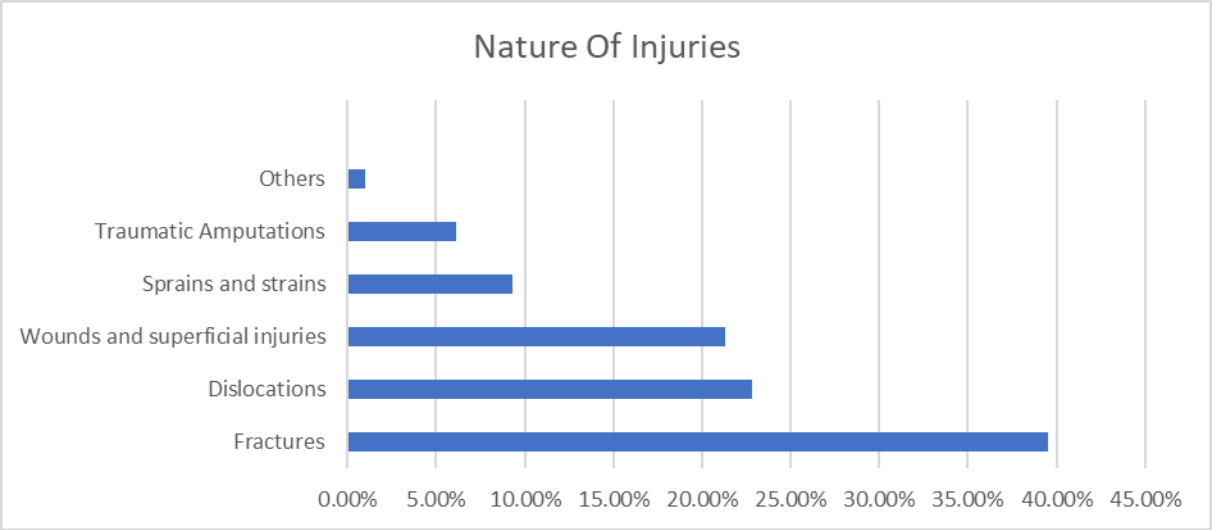
Out of these, injuries to multiple locations represented 12% of all injuries while the majority, 78% were injuries to one body part.

Figure 8 Injury distribution



Injuries were further classified according to their nature. Here, fractures dominated at 39.5%. There were 22.8% dislocations while wounds and superficial injuries followed at 21.3%. Sprains and strains occurred at 9.3% while traumatic amputations represented 6.1% of the injuries. Other type of injuries grouped together represented 1% of the injuries.

Figure 9 Nature of injuries



CHAPTER FIVE: DISCUSSION

5.1 The incidence of construction site injuries

The construction industry is notorious for many occupational accidents and injuries worldwide (57). Various field studies are available in Kenya and the larger African continent investigating the pattern of these injuries as well as their incidences. However, no study locally, to the best of our knowledge, has investigated these injuries at hospital level.

Our study therefore uniquely fills the gap that has existed of correlating the types of accidents and their resultant injuries serious enough to send the victims to hospital. Yiu and Chan (58) demonstrated that evaluation of construction site accidents by their cause enables effective formulation and implementation of safety management systems (SMS).

Our study included 133 adults recruited from three centers. Data analysis of the 132 completed questionnaires showed that falls from heights was the leading cause of construction site accidents at 42.6%. This was followed by equipment related failures at 26.9%. Cut by sharp objects resulted in 15.7% accidents while falling objects were the injury cause in 9.8%. Collapse of buildings/walls were responsible in 3% of the injuries. Explosions, fires and electric shocks were responsible in about 1%. Other causes resulted in less than 1% of the injuries. One peculiar cause of injuries came out resulting from injuries sustained from fights among workers at construction sites.

Shafique and Rafiq (59) found similar results, that falls from heights were the leading causes of injuries at construction sites in Hong Kong. Jo et al (60) demonstrated that falls from heights apart from being the commonest were the most dangerous accidents resulting in the severest of injuries and the most fatalities at construction sites.

Our study further established that fractures and dislocations were by far the commonest of injuries sustained by construction workers. Together they represented 62.3% of all the recorded construction site injuries. Superficial wounds were third at 21.3%

Injuries to the lower limb were most common followed by the upper limbs, trunk, head and neck in that order. Abbas and Marwa in their study (61) found upper limb injuries to be most common followed by lower limbs, head, neck and trunk. This was a field based cross sectional study that included all injuries regardless of their seriousness or whether

they required care. Our study being hospital based, isolated only major injuries serious enough to send the victims to hospital. It therefore can be postulated that upper limbs are most commonly injured but the injuries are mostly minor, treated at the site or requiring a period of rest rather than actual hospital visit.

5.2 Common causes of construction site injuries

5.2.1 Individual-related Causes

i. Gender

The construction industry predominantly employs males. This study found 97.7% males and just over 2% females. The few females were also found to take on certain duties which were less risky compared to males, including support, administration and office tasks.

The U.S Bureau of labour statistics data of 2011 shows that only 9% of workers in the construction industry were women. Of these, a mere 2.3% were engaged in real production ie laborers, electricians and masons. About half of them held less risky clerical and support jobs while the remaining one third were in management and professional positions that carry negligible risk of injury. Other studies (62, 63) have also shown that men have many more accidents at work compared to their female counterparts.

ii. Age

This study categorized the workers into age brackets. Results of the data analysis showed that workers between the ages of 19-29 reported the most injuries at 40.2% followed by those in the age bracket 30-39 years at 36.4%. Those of the ages between 40-49 years reported injuries at 15.9% before older workers took the remaining percentage of injuries. It is therefore evident that the risk to injuries was inversely proportional to age, implying that younger workers were more prone to injuries. This is also consistent with other studies (64) Many construction projects choose to deploy younger workers to riskier jobs as concluded by Guadalupe and Maria (65).

Different authors investigating age as a risk factor for injuries among construction workers have come up with varying conclusions in different countries. However, a large international review by Salminen (66) examining whether younger workers suffered more injuries gave a more universal outlook to the topic. In his review of 63 papers on non-fatal accidents, 56% of the papers concluded that indeed higher rates of injuries were associated with young age, there was no age difference in 27% of the papers while 17% of the papers showed lower rates of injuries in younger workers. These results are comparable with the findings of our study.

iii. Education and experience

Many studies have demonstrated an inverse relationship between level of education and unsafe behavior resulting in occupational injuries. The disproportionally low number of participants with no formal education and those with primary school education in our study population meant that the data could not be reliably interpreted.
However, our study found a higher proportion of injuries among unskilled workers. Low level of knowledge, lack of awareness and or disregard for safety procedures are attributes that have been associated with low education level and lack of safety training in other studies (67)

5.2.2 Job-related Causes

This category comprised factors that were driven by the nature of the job, and are summarized as follows:

i. Nature of the job

Some jobs involve working at heights hence the risk of a fall, working in awkward positions thus the risk of getting injured and working with fire and electricity risking electrocution. More injuries in our study were found among frontline workers rather than managers and supervisors. A number of studies have elaborated the relationship between the risk of injury and the job or duty allocated to a worker (68, 69, 70)

ii. Faulty equipment and tools

Among equipment failures noted in our study are breaking of ladders, snapping of ropes and cranes, scaffolding failures and failure of wiring insulation.

5.2.3 Organization-related Causes

i. Safety training

84.1% of the respondents reported that they did not receive safety training on their jobs subjecting them to higher risk of getting injured. In his study, O'Toole (71) found that construction site accidents were tremendously reduced with effective safety training. Other studies also made similar findings (72). They agreed that there should be the commitment of and interest of management as well as suitable expertise for a successful health and safety training

Mohammad et al (73) demonstrated that negative consequences of human errors can be mitigated by selecting people with capabilities and appropriate skills required to perform a specific job. This will reflect a reduction in errors and therefore accidents. Our study results showed that many of the injured workers had no formal training in the job they undertook and a majority of them lacked safety training as well.

ii. Commitment of management to safety

This study showed that accidents mostly occurred at sites not properly registered by the NCA. The respondents were aware that the site was not properly registered in 50.8% Ndege et al (74) while investigating safety awareness in the informal construction sector in Nairobi concluded that such unregistered sites have no regard for safety requirements. He further demonstrated that safety management practices and associated documentations are not only inappropriate but almost totally non-existent in these sites. This could explain the higher injury rates reported by workers at such sites.

iii. Personal Protective Equipment (PPE)

Construction regulation stipulates that companies provide their workers with the necessary Personal Protective Equipment (PPE), which include helmets, safety belts, hand gloves, safety ropes, retaining belts and safety harness to guard against falling materials and falling from heights. In this study, 59.1% of the injuries in respondents happened when the respondents were not wearing PPEs. Reason for this varied from lack of the PPEs, lack of strict enforcement to a complaint that some of the safety equipment were too heavy.

iv. Others

Injuries from intentional maim by colleagues during fights featured as a significant cause of injuries in this study. Security at construction sites as well as dispute solving procedures at construction sites could help mitigate such injuries. Similarly, slippery surfaces were prominent as a cause of accidents and injuries. These and other causes can be prevented by action of management at construction sites.

5.3 Types of construction site injuries

Two major categories were identified:

5.3.1 Mechanism of injuries

The research revealed that falling from heights was the most prevalent at 42.6%, followed by equipment related malfunction at 26.9%. Other mechanisms of injury included cuts by sharp objects, injury from falling objects, equipment-related accidents as well as heat stroke and repetitive motion of body parts among others.

5.3.2 Nature of Injuries

Lower limb injuries were the commonest occurring in 54.5 % of all respondents, followed by upper limbs at 34% and then trunk injuries at 23%.
Fractures and dislocations were the predominant injury type amongst the participants.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This research had three specific objectives that were defined in Chapter 1. In order to meet these objectives, the following were key findings on the achievement of the study objectives;

a) That the most common mechanism of injury at construction sites in Nairobi was falling from heights and equipment related malfunction.
b) Workers in the age segment between 18-39 are the most injured at construction sites, and this can be attribute to inexperience, tougher assignments and lack of training
c) The leading causes of accidents and injuries at construction sites are lack of safety training and non-compliance to existing laws including the use of PPEs.

6.2 Recommendations

Based on the findings of this study, the following recommendations can be made:

i. A number of safety measures need to be taken at construction sites in order to reduce the incidents of accidents and injury. These include (a) enforcement of existing regulation (b). ensuring safe working environment devoid of slippery surfaces etc. (c) sensitize all stakeholders about safety and hazards (d) implement suitable inspection and audit measures to collect feedback (e) adopt supervisory training that is embedded with hazard control measures (f) ensure the provision of PPEs and training on their use.
ii. Youthful workers under the age of 39 were injured the most. Safety training, supervision and emphasis should be put on such workers to improve their workplace safety.
iii. Falls and falling or flying objects were a common mechanism of injury. To reduce such accidents, it is recommended that, there be the adaptation of robotics

as an effective safety strategy at dangerous heights, it is technology being implemented elsewhere in the world.

iv. Even workers with university and tertiary education reported injuries. It is our recommendation therefore that institutions incorporate Health and safety training within other subjects concerned with the industry such as Construction Management, Civil Engineering, Project Management and Architectural programs.

6.3 Recommendations for further study

This study recommends a future study to evaluate the actual cost of occupational injuries in the construction industry. The quantification of such injuries at family level, impact on society and the economy of the country at large as well as lost man hours would be invaluable. A further area of investigation would be the fatal injuries which could not be covered under this study.

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APPENDICES

APPENDIX 1 : CONSENT FORM

PARTICIPANT INFORMATION AND CONSENT FORM

TITLE OF STUDY: *INCIDENCE AND PATTERN OF NON-FATAL OCCUPATIONAL INJURIES AMONG CONSTRUCTION WORKERS AS SEEN AT THREE PUBLIC HEALTH FACILITIES IN NAIROBI.*

Principal Investigator and institutional affiliation:

Dr Juma Olunga Wakhayanga, department of Orthopaedic Surgery, College of Health Sciences-UoN

Co-Investigators and institutional affiliation:

1. Dr Ezekiel Oburu (UoN)
2. Dr Vincent Mutiso (UoN)

Introduction:

I would like to tell you about a study being conducted by the above listed researchers. The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in the study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a volunteer, and anything else about the research or in this form that is not clear. When we have answered all your questions to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent'. Once you understand and agree to be in the study, I will request you to sign your name on this form. You should understand the general principles which apply to all participants in a medical research:

i) Your decision to participate is entirely voluntary

ii) You may withdraw from the study at any time without necessarily giving a reason for your withdrawal

iii) Refusal to participate in the research will not affect the services you are entitled to in this health facility or other facilities. We will give you a copy of this form for your records.

May I continue? YES( ) NO( )

This study has approval by The Kenyatta National Hospital-University of Nairobi Ethics and Research Committee protocol No. .....

WHAT IS THIS STUDY ABOUT?

The researchers listed above are interviewing and examining patients who have been injured in the course of their work as construction workers.

The purpose of the interview and examination is to find out the patterns of these occupational injuries and how they vary among different cadre of construction workers. Participants in this research study will be asked questions about how they got injured, which parts of their bodies were injured, and how they are doing after the injuries. Participants may also have to undergo tests such as x-ray, CT scan or laboratory tests such as urine analysis as deemed appropriate for their care. There will be approximately 132 participants in this study randomly chosen. We are asking for your consent to consider participating in this study.

WHAT WILL HAPPEN IF YOU DECIDE TO BE IN THIS RESEARCH STUDY?

If you agree to participate in this study, the following things will happen: You will be interviewed by a trained interviewer in a private area where you feel comfortable answering questions. The interview will last approximately half an hour. The interview will be about how you got injured, what the injuries are, what was done to you and how you are faring on so far. After the interview has finished, you will be examined in a private area where you feel comfortable. There may be laboratory tests that will be needed, blood or urine may be drawn from you. There may be radiological imaging that is needed, you will be taken to the X ray or CT scan department. We will ask for a telephone number where we can contact you if necessary. If you agree to provide your

contact information, it will be used only by people working for this study and will never be shared with others. The reasons why we may need to contact you include knowing how you are faring on.

ARE THERE ANY RISKS, HARMS DISCOMFORTS ASSOCIATED WITH THIS STUDY?

Medical research has the potential to introduce psychological, social, emotional and physical risks. Effort should always be put in place to minimize the risks. One potential risk of being in the study is loss of privacy. We will keep everything you tell us as confidential as possible. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet. However, no system of protecting your confidentiality can be absolutely secure, so it is still possible that someone could find out you were in this study and could find out information about you. Also, answering questions in the interview may be uncomfortable for you. If there are any questions you do not want to answer, you can skip them. You have the right to refuse the interview or any questions asked during the interview. It may be embarrassing for you to have clinical examination. We will do everything we can to ensure that this is done in private. Furthermore, all study staff and interviewers are professionals with special training in these examinations/interviews.

ARE THERE ANY BENEFITS BEING IN THIS STUDY?

You have the right to receiving health information regarding your injury and the way it affects you now and in the future. This information will be offered to you. We will refer you to a hospital for care and support where necessary. Also, the information you provide will help us better understand the way the certain types of work accidents cause certain types of injuries, and how certain parts of the body are injured at the same time. This information is a contribution to science and will help policy makers in drafting or improving safety regulations in the construction industry.

WILL BEING IN THIS STUDY COST YOU ANYTHING?

Your involvement in this study will not cost you anything extra. We are simply following your management and evaluation and detecting the injuries that are associated with your occupational accident. Your hospital bills will be the same as those patients who choose not to participate in this study.

WILL YOU GET REFUND FOR ANY MONEY SPENT AS PART OF THIS STUDY?

As stated above, you will not incur any costs solely for this study. You costs will be the regular costs paid by all patients receiving treatment in the hospital. Your involvement in this study will not cost you any money.

WHAT IF YOU HAVE QUESTIONS IN FUTURE?

If you have further questions or concerns about participating in this study, please call or send a text message to the study staff at the number provided at the bottom of this page. For more information about your rights as a research participant you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email uonknh_erc@uonbi.ac.ke. The study staff will pay you back for your charges to these numbers if the call is for study related communication.

WHAT ARE YOUR OTHER CHOICES?

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits.

CONSENT FORM (STATEMENT OF CONSENT)

Participant's statement

I have read this consent form or had the information read to me. I have had the chance to discuss this research study with a study counsellor. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I

understand that my participation in this study is voluntary and that I may choose to withdraw any time. I freely agree to participate in this research study.I understand that all efforts will be made to keep information regarding my personal identity confidential By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

I agree to participate in this research study: Yes ( ) No ( )

I agree to provide contact information for follow-up: Yes ( ) No ( )

Participant printed name:_____

Participant signature ----------

Thumb stamp _____ Date _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

Researcher's Name: Date:

Signature:

Role in the study:

For more information contact DR at UNIVERSITY OF NAIROBI, DEPARTMENT OF ORTHOPEDICS from MONDAY to FRIDAY WEEKDAYS.

Witness

Name: **Contact information:**

Signature /Thumb stamp: **Date:**

SEHEMU I: HATI YA HABARI ZA MAJALI

HABARI YA IDHINI

Idhini ya habari ni kwa wagonjwa ambao wanawasilishwa katika hospitali kuu ya Kenyatta, Hospitali ya Kaunti ya Mbagathi na Hospitali ya Mama Lucy Kibaki ambao wameumia wakiwa kazini mwa mijengo.

Mada ya utafiti: Tathmini ya matukio na miundo ya maumivu yanayotokana na kazi ya mijengo kama itakavyoonekana kwa wagonjwa katika hospitali tatu za serikali jijini Nairobi.

Jina langu ni Dk Juma Olunga Wakhayanga, mwanafunzi wa uzamili katika Idara ya upasuaji wa Mifupa katika Chuo Kikuu cha Nairobi. Ninafanya utafiti ili kubaini matukio na miundo ya maumivu yanayotokana na kazi ya mijengo kama itakavyobainika kwa wagonjwa katika hospitali hizi tatu.

Faida za Utafiti

• Matokeo ya utafiti huu hayawezi kuwa ya faida ya moja kwa moja / ya haraka kwako lakini inaweza kusaidia katika kuzuia maumivu kama yako siku zijazo.

• Maswali yote utakayoulizwa katika utafiti na uchunguzi wa mwili unaofuata ni sehemu ya mchakato wa matibabu yako. Kukataa kushiriki katika utafiti haitaathiri ubora wa matibabu yako kwa njia yoyote.

• Hakutakuwa na faida za kifedha kwa kushiriki katika utafiti huu. Pia hautapa gharama zozote za kifedha kwa kushiriki katika utafiti huu.

Habari iliyopatikana itakuwa kutumika kwa utafiti tu.

• Matokeo katika utafiti huu yatatoa data kwa upangaji wa afya, uboreshaji wa usalama kazini haswa katika kazi za mjengo na kuarifu kiwango cha matukio ya maumivu kazini
.

Usumbufu, hatari na haki ya kujiondoa kwenye utafiti

• Unaweza kupata usumbufu kwa sababu ya maswali ya kibinafsi kwenye mahojiano.

• Unaweza kuamua kutoka kwenye utafiti wakati wowote, kwa muda mfupi au kabisa.

Kushiriki katika utafiti ni kwa hiari tu. Hii haitaathiri ubora wa matibabu yako kwa njia yoyote.

• Hakuna hatari au hatari zinazohusiana na kushiriki katika utafiti huu.

• Ukikubali kushiriki, utaulizwa kutoa maelezo ya kibinafsi. Pia utahojiwa na msaidizi wa utafiti (afisa wa matibabu) au mimi mwenyewe; Dkt. Juma Olunga Wakhayanga (Mchunguzi wa Msingi).

Usiri

• Usiri mkali na faragha ya mgonjwa anayeshiriki katika utafiti huu utadumishwa.

Hojaji haitachukua jina lako na data zote zilizopatikana zitapatikana kuhifadhiwa salama. Habari juu yako itatambuliwa tu na nambari ya utafiti.

• Tutanuia kushiriki matokeo yetu na watu wengine wanaofanya tafiti kama hizi.

Uchapishaji wa matokeo yetu katika majarida ya kisayansi au mawasilisho katika mikutano ya kisayansi haitakuwa na habari inayoweza kukutambulisha. Utambulisho wako hautafunuliwa katika chapisho lolote.

Maswali na uchaguzi

• Maswali yoyote ambayo unaweza kuwa nayo yanaweza kushughulikiwa kwa mchunguzi mkuu kupitia njia ya mawasiliano iliyotolewa hapa chini. Ushiriki wako katika utafiti ni wa hiari. Wewe unaweza kuchagua kukataa kushiriki au kuondoa ushiriki wako kutoka kwa utafiti huuwakati wowote bila athari yoyote.

MAWASILIANO

Dkt. Juma Olunga Wakhayanga [Mchunguzi Mkuu]

Idara ya Mifupa, Shule ya Tiba, Chuo Kikuu cha Nairobi.

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Barua pepe: drolungajuma@gmail.com

Katibu,

KNH / UON-ERC

P. O. Box 20723-00202 KNH, Nairobi.

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Barua pepe: uonknh-erc@uonbi.ac.ke

Mwenyekiti,

Idara ya Mifupa, Shule ya Tiba, Chuo Kikuu cha Nairobi

P. O. Box 19676-00202 KNH, Nairobi.

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WASIMAMIZI WA UTAFITI CHUO KIKUU CHA NAIROBI: -

1. DR. VINCENT M. MUTISO,

Daktari wa Upasuaji wa Mifupa

Mhadhiri na mwenyekiti, Idara ya Mifupa, Shule ya Tiba, Chuo Kikuu cha Nairobi

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2. DR EZEKIEL OBURU

Daktari wa upasuaji wa mifupa, kitengo cha mguu na kifundo cha mguu

Mhadhiri, Idara ya mifupa,Shule ya tiba, Chuo kikuu cha Nairobi

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SEHEMU YA II: CHETI CHA KUKUBALI KUSHIRIKI KATIKA UTAFITI,

HATUA YA UKUBALI.

Mimi, …… (Jina kamili kwa herufi kubwa)

nimepeana ridhaa ya mimi kushiriki katika utafiti uliofanywa na Dkt Juma Olunga Wakhayanga, asili ya ambayo nimeelezwa na yeye / msaidizi wake wa utafiti. Nimearifiwa na nimepata kuelewa ya kwamba kushiriki kwangu ni kwa hiari yangu na nikipenda naweza kujiondoa wakati wowote katika utafiti huu bila kuadhiri na hii haitabadilisha kwa njia yoyote matibabu ninayopewa..Matokeo ya utafiti huu huenda yasinifaidi kibinasi kwa sasa lakini Habari itakayopatikana itasaidia kuwajuza wahusika kuhusu aina ya maumivu katika kazi ya mijengo na mbinu zibuniwe kuzuia maumivu hayo. Data hii itawafaidi watengeneza sera na wasimamizi wa idara wanaohusika na usalama katika kazi ya mijengo.

…… ..

Saini / Uchapaji wa kidole gumba wa (mshiriki)

Tarehe: …….

Sehemu III: Kauli ya shahidi ikiwa hiriki hajui kusoma na kuandika:

Nimeshuhudia usomaji sahihi wa fomu ya idhini kwa mshiriki, na binafsi.

Nimepata nafasi ya kuuliza maswali.

Ninathibitisha kwamba mgonjwa huyo ametoa idhini kwa hiari yake.

Jina la shahidi: …….

Saini ya shahidi: …… Tarehe: ……

Uchapishaji wa kidole gumba cha mshiriki.

……..

APPENDIX 2: SURVEY QUESTIONNAIRE

QUESTIONNAIRE SERIAL NUMBER……

INSTRUCTIONS TO RESPONDENT

- Kindly tick against your preferred choice
- Fill in where there are spaces provided

A. Personal information of the respondent

1. What is your gender?

   a) Male b) Female

2. What is your age bracket (in years)?

   a) 19-29yrs c) 30-39yrs d) 40-49yrs e) 50-59yrs f) 60 yrs and above

3. What is your job description?

   a) Unskilled casual worker ( )

   b) Skilled casual/contract worker (specify area of specialization)

   c) Permanent staff (foreman, site engineer, site contractor)

4. What is your education level?

   a) Not attended school b) Primary c) Secondary d) University/Tertiary level

5. For how many years have you worked in the construction industry?

   a) 3-8 years b) 9-14 years c) 15-20 years d) 21 and above

6. How long have you worked at the current job

   a.) Less than 3 months b) 3-6 months c.) More than 6 months

7. Is the construction site you were injured at registered by the NCA

   a.)Yes b.) No c.) I don't know

8. What are your major daily work activities? (tick all your major activities)

a) Brick laying b) Machine operator c) Masonry d) Roofing e) Concrete mixing f) Electrical installation g) Carpentry h) Plumbing i) steel fixing j) Driving j) Others (specify)

……

B. **Circumstances around the injury**

9. What accident at work did you encounter?
   i. Fall
   ii. Cut by a sharp object
   iii. Falling Objects
   iv. Equipment Related Accidents
   v. Crushed –Between and Back overs
   vi. Explosions and Fires
   vii. Collapse of Building, Trench or Wall
   viii. Heat Stroke, Repetitive Motion Injuries and other overexertion

10. What would you say was the cause of the accident?
    i. Slippery surface
    ii. Loss of concentration
    iii. Poor lighting
    iv. Fatigue
    v. Intentional maim by a fellow worker
    vi. Others (explain)

…… ……

11. What time of day did you get injured?

a) Before 8.00a.m. b) 8.00am to 10.00a.m. c) 10.00a.m. to 12.30a.m. d) 12.30p.m. to 2.00p.m. e) 2.00p.m. to 5.00p.m. f) After 5.00 p.m. and night duty

12. How long is your normal shift for a day at work?

a) 6 hrs b) 8hrs c) 12 hours d) More than 12 hours

13. Do you have provisions for overtime?

a) Yes b)No

14. Was your injury during overtime?

a)Yes b)No

B. Safety measures assessment

15. Do you have formal training in the work you were doing at the time of injury?

a) Yes b) No

16. Were you wearing any personal protective equipment at the time of injury?

a) Yes b)No

17. If the answer to 16 above is No, give a reason

a) Lack of the personal protective equipment
b) The equipment are heavy and tiring
c) They are not a requirement at the site
d) There's no strict enforcement
e) Others

18. Do you have a safety enforcement officer at the site you were working?

a) Yes b)No

19. Have you received any training on safety at workplace?

a.)Yes b) No

20. If the answer in 19 above is yes, How long ago did you receive the training?

a.) Less than 3 months ago b) 3-6 months ago c) More than 6 months ago

C. Injury Classification according to body Location (To be completed by the research assistant)- *Adopted from 'ILO-recording and notification of occupational accidents and diseases'*

1.HEAD

11. Cranium
12. Eye
13. Ear
14. Mouth
15. Nose
16. Face
17. Head-multiple locations
18. Head –unspecified location

2. NECK

3. TRUNK

31. Back
32. Chest(Ribs,sternum, internal organs of the chest)
33. Abdomen(including internal organs)
34. Pelvis
38. Trunk multiple locations
39. Trunk unspecified location

4. UPPER LIMB

41. Shoulder(including clavicle and shoulder blade)

42. Upper arm
43. Elbow
44. Forearm
45. Wrist
46. Hand (except isolated fingers)
47.Fingers
48. Upper limb, multiple locations
49. Upper limb, unspecified location

5. LOWER LIMB

75. Hip
76. Thigh
77. Knee
78. Leg
79. Ankle
80. Foot
81. Toes
82. Lower limb , multiple locations
83. Lower limb unspecified location

6. MULTIPLE LOCATIONS

61. Head and trunk and one or more limbs
62. Trunk and one or more limbs
63. One upper and one lower limb or more than two limbs
68.Other multiple locations
69. Multiple locations unspecified.

D**. Injury classification according to nature of the injury (To be filled by the research assistant)-** *Adopted from 'ILO-recording and notification of occupational accidents and diseases'*

10. Fractures
20. Dislocations
25. Sprains and strains
30. Concussions and other internal injuries
40. Amputations and enucleations
41. Other wounds
50. Superficial injuries
55. Contusions and crushings.
60. Burns
70. Acute poisonings
80. Effects of weather exposure, and related conditions
81. Asphyxia
82. Effects of electrical currents
83. Effects of radiation
90. Multiple injuries of different nature
99. Other and unspecified injuries.

THE END

THANK YOU FOR YOUR TIME.