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ERGONOMIC RISK FACTORS FOR WORK-RELATED MUSCULOSKELETAL DISORDERS AT A BUILDING CONSTRUCTION SITE (FOUR LIONS BUILDERS) IN ZIMBABWE.

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS DEGREE IN SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT.

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DECLARATION

To be compiled by the student

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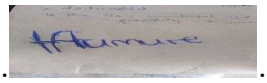
I, Faith Humure, declare that all of the information in this report is entirely original and has not been copied from any other work, and all the information gathered from other sources is shown.

Student's signature…..  … Date……

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This dissertation has been thoroughly reviewed and verified to conform to the faculty's guidelines and requirements, making it suitable for submission.

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DEDICATION

I dedicate this research to my parents, who provided me with the amazing upbringing life that I currently have.

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ABSTRACT

Construction workers face significant risks of developing musculoskeletal disorders, largely due to different risk factors which include physically demanding nature of work, and lack of proper ergonomic designs. The study aimed to: determine musculoskeletal disorders that are related to workers and to determine ergonomic risk factors among workers at Four Lions Builders. A cross-sectional survey was undertaken with 60 Four Lions Builders workers in Bindura, Zimbabwe using Nordic questionnaires. The participants were chosen using stratified random sampling from different departments. RULA model was used to assess ergonomic risks for MSDs and postural loading focusing on the neck, trunks and upper limbs. Data was analysed using SPSS version 27, as frequencies and percentages and Microsoft Excel for data presentation. The study found that most common pains were lower back pains with 78.3% followed by shoulder pains (73.3%), wrist pains (58.3%) and lastly upper back pains (50%). The risk factors were (age, gender, weight, and awkward postures) and were measured using RULA showing 63% of them had high prevalence of these risk factors and mostly females were affected with 55.6%. However, working hours were not associated with contributing as a risk factor. In conclusion, the study recommends all stakeholders take part in ways to reduce ergonomic factors that lead to musculoskeletal pains.

Key Words: work-related musculoskeletal disorders, ergonomics risk factors.

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ACRONYMS AND ABBREVIATIONS

RULA= Rapid Upper Limb Assessment

MSP= Musculoskeletal Pains

WMSDs= Work-related Musculoskeletal Disorders

CTS= Carpel Tunnel Syndrome

NSSA= National Social Security Authority

GBD= Global Burden of Diseases

ZIMSTATES= Zimbabwe National Statistics Agency

TDI= Texas Department of Insurance

LBP= Lower Back Pains

CCOHS= Canadian Centre for Occupational Health and Safety

BMI= Body Mass Index

CHAPTER 1: INTRODUCTION

1.1 RESEARCH BACKGROUND

Construction is one of the jobs with the greatest risk of accidents resulting in fatalities and injuries worldwide, with numerous hazardous outcomes possible (Birhane et al., 2020). Bricklaying, concreting, paving, plastering, and steel fastening are all part of the construction process. These tasks expose employees to risks associated with poor posture, vibrations throughout the body, repetitive actions, and heavy lifting regularly (Lop et al., 2019). Because of the physical demands of their profession, construction workers have a higher-than-average risk of having musculoskeletal problems. In both industrialised and developing nations, work-related injuries are a major cause of disability and potentially fatal circumstances. Workers in the construction industry may be at risk for musculoskeletal problems, which are a major occupational health and safety concern worldwide (Chung et al., 2019).

According to Anagha, (2020), overexertion, repetitive labour activities, and awkward postures by workers were the main causes of injuries, stress, and strains on construction sites. Ergonomics can be a useful tool for helping workers feel less fatigued and stop exerting unnecessary effort. However, as a weapon against musculoskeletal problems in the construction industry and other sectors, the world community has established policies and guidelines. The U.S. indicates that the percentage of cases involving emergency room visits only for repetition motion involving microtasks and for musculoskeletal pain was 7.6% and 16.1%, respectively, and musculoskeletal disorders cases were up to 47,280. Ijaz et al., (2020) conducted an evaluation of musculoskeletal disorders among brick workers in the Pakistan industry. About 96% of the workers who were involved in mixing and moulding reported feeling fatigued at the end of the day.

According to research conducted in Africa, the highest work-related injury rate among construction workers in a year was 84.7%, while the lowest prevalence was 32.6% in Dessie Town and Addis Ababa, Ethiopia. According to Ashuro et al., (2021), this resulted from a lack of occupational training, long working hours, and personal protection equipment. In Zimbabwe,

ergonomics comes under Occupational Health and Safety. The National Social Security Authority (NSSA), oversees matters of safety and health. In Freda Rebecca Gold Mine in Bindura, Zimbabwe, statistics revealed that 77.8% of the 140 participants had lower back pains. These results were associated with demographic variables such as gender and age (Dube & Chiluba, 2021). In the study, which was conducted among waste collectors in Zimbabwe's Harare District, generally, all of those who participated indicated that they were exposed to musculoskeletal disorders (Chireshe et al., 2023). Mhlanga, (2020) reports that in 2020 there was a sharp rise in occupational mishap figures of workers who were injured. These records and studies show that in Zimbabwe, ergonomic challenges are ever present in different sectors including the construction industry.

The occupational health and safety in Zimbabwe as a whole on ergonomic issues is less effective, and improvement is required. Therefore, the study seeks to assess the ergonomic risk factors for work-related musculoskeletal disorders in the construction company at Four Lions Builders in Zimbabwe.

1.2 PROBLEM STATEMENT

Construction workers at Four Lions Builders are prone to develop musculoskeletal disorders like back and shoulder pain. This is due to the high-intensity work environment and the lack of proper ergonomic design in their workplace. These musculoskeletal disorders result in fatigue, physical pain and reduced productivity among workers, which can have negative effects on their health and well-being. In order to address this problem, this study seeks to identify risk factors at Four Lions Builders that led to musculoskeletal disorders and find ways to improve ergonomic design and reduce physical demands in the workplace.

1.3 JUSTIFICATION

A major concern in construction industry is safety, this is due to its significant impact on the industry. The research may benefit different stakeholders, such as construction workers, government officials, contractors, and suppliers.

1.3.1 CONSTRUCTION WORKERS

Workers from different departments on a construction site are exposed to different musculoskeletal injuries. However, ergonomics helps construction workers in their health status and high levels of worker productivity by complying with regulatory requirements mandated by contractors.

1.3.2 GOVERNMENT OFFICIALS

They enforce laws and regulations that are in line with worker health maintenance. They also audit the activities of stakeholders to enhance health and safety at the construction site.

1.3.3 CONTRACTORS

They provide ergonomic training and other training to workers to protect them from occupational injuries. They also comply with regulatory authorities and policymakers to protect their workers. They also conduct investigations into accidents.

1.3.4 SUPPLIER

Suppliers must provide safety-relevant information with their deliveries to ensure safe site use. However, lack of education on equipment and materials supplied causes musculoskeletal injuries and accidents; therefore there is a need for education on the materials and equipment provided.

1.4 MAIN OBJECTIVE

- To assess ergonomic risk factors for musculoskeletal disorders among workers at 4 Lions Builders.

  SPECIFIC OBJECTIVES

- To determine musculoskeletal disorders that are related to construction workers at Four Lions Builders.
    - To determine ergonomic risk factors among workers at Four Lions Builders different departments.

1.5 RESEARCH QUESTIONS

1. What are musculoskeletal disorders for workers at a construction site?
2. What are ergonomic risk factors among workers at a construction site?

1.6 LIMITATIONS OF THE STUDY.

The study is limited to building construction only rather than rail, road and bridge construction projects. It is also based on individual reports from workers, which makes it difficult to verify. The study is limited to a useful employee's medical report, which can help identify musculoskeletal injuries among workers. Limited experienced workers who worked in the same company for a long time provide vital information for musculoskeletal injuries. Through observations during data collection, the researcher could not observe workers' behaviours.

CHAPTER 2: LITERATURE REVIEW

2.0. INTRODUCTION: THE ZIMBABWE CONSTRUCTION INDUSTRY

Building and construction are important economic sectors and one of the key sectors that primarily deal with infrastructure development. This is so because, as reported by a business reporter, (2024) in the Sunday Mail News, there was an engagement in property development by the private sector mainly housing and shopping. According to the Government of Zimbabwe, (2021), the industry's primary focus is on the design and construction of buildings, roads, railways, tracks, and dams. Every organisation involved in the building and construction industry should monitor safety and health issues. For example, in Hong Kong, the construction industry accounted for 62% of all industrial fatalities from 1996 up to 2008 (Kineber et al., 2023). Because of the industry's general ability to create jobs, the construction sector in Zimbabwe is crucial to the nation's economic growth (Boadu et al., 2020). The Chief Executive of the Construction Industry Federation of Zimbabwe (CIFOZ), Chingaira Martin, said that the number of jobs created by the government's massive infrastructure projects has increased from 10,000 to 17,000 ("The construction industry employment figures spike to 17k.," 2023). Workplace illnesses, fatalities, and injuries are caused in part by the industry. This section discusses the construction industry's organisation, the issues surrounding health and safety in Zimbabwe, and their management.

2.1. STRUCTURE OR COMPOSITION OF THE INDUSTRY

The term "construction industry" describes the industrial sector of commerce and manufacturing that is involved in creating, restoring, and upholding infrastructure (Hassan et al., 2022). It is under the jurisdiction of the Ministry of Transport and Infrastructure Development of Zimbabwe. All businesses engaged in the production or distribution of building supplies and services are included in the building and construction sector.

While building and construction enterprises and service providers are broadly dispersed throughout the nation, there is a stronger concentration in Harare, Bulawayo, and a few other cities and towns (Saungweme, 2011). The product, service, or activity under consideration mostly determines how widely distributed it is geographically. Based on a statistical examination of the enterprises currently listed in the database, 67% of them are based in Harare, 22% are in Bulawayo, and 11% are in other towns and cities (excluding cement and timber companies). The Government of Zimbabwe, (2021) reports that the country's construction GDP growth rate for 2023 was anticipated in 2019 to be 1.3%.

2.2. MUSCULOSKELETAL DISORDERS

They are marked by severe discomfort and sudden muscle spasms, resulting from awkward work positions and repetitive physical movements in occupational settings. Musculoskeletal disorders fall under the category of occupational health hazards and have the potential to reduce workplace productivity. According to several studies, including (Kisi and Kayastha, 2024), manual handling activities are the cause of the prevalence of musculoskeletal illnesses (Qureshi et al., 2019).

Construction workers in different departments are prone to different types of musculoskeletal disorders (Kisi & Kayastha, 2024). This is dependent on the activities that construction workers perform, since different physical motions are required for each of these tasks. Performing tasks in awkward positions can put a strain on the body, leading to injuries or permanent damage. Construction workers are prone to musculoskeletal disorders affecting key areas, including hands and wrists, shoulders, neck, and upper back, lower back, hips, and knees. They can occur due to repetitive movements, overexertion, vibrations, and temperatures (Lop et al., 2019). Thus, ergonomics plays a crucial role in boosting and sustaining worker productivity at high levels.

Musculoskeletal disorders, if not properly managed and handled, cause long-term damage to muscles and increase the risk of muscular injury. Implementing preventive and control measures on construction sites is vital to minimise risks among workers and reduce the occurrence of related symptoms (Lop et al., 2019). According to Mbada et al., (2022) musculoskeletal disorders can lead

to chronic pain and permanent physical impairment among many people worldwide, including construction workers. Studies highlighted that high rates of musculoskeletal disorders at work are among occupational groups that rely on manual methods (Oluka et al., 2020), especially workers in the construction sector. A recent examination of data from 2019's Global Burden of Disease showed that billions people worldwide suffer from musculoskeletal diseases such as carpal tunnel syndrome, tendonitis, lower back pain, shoulder and neck disorders, and more (Cieza et al., 2021). Due to exposure to daily work dangers, workers in the construction industry frequently suffer from musculoskeletal problems related to their jobs (Oluka et al., 2020).

2.2.1. CARPAL TUNNEL SYNDROME

This syndrome is prevalent among those who work in construction. The carpal tunnel discomfort leads to excessive pressure on the median nerve and the swollen wrist, which compresses the nerve (Hassan et al., 2022). It can also be described as a condition affecting the nerves in the hand and wrist, brought on by frequent wrist bending, gripping objects or tools tightly, and continuously forcing the wrist up against a hard surface. According to Genova, (2020), the illness is characterised by numbness, burning, and pain. The study done by Hassan et al., (2022) found that there was strong evidence for the relationship between carpal tunnel syndrome and more exposure to repetition, showing that repetitive use of vibrating tools such as power drills or jackhammers in construction sites can lead to compression of the median nerve in wrists. Iqbal et al., (2022) reviewed that carpel tunnel syndrome is caused by different risk factors, which include repetitive motions, long working hours, age of a worker, gender, and awkward postures in informal sector workers.

2.2.2. TENDONITIS

It is linked to work that involves repetitive tasks or movements, for example, the use of rotating or twisting motions during screw drilling. (Occupational Safety and Health Administration, 2012) describes it as inflammation and pain in tendons, caused by repeated motion on a joint. It also refers to tendon inflammation, which is usually brought on by overuse or repetitive motions. Depending on where the injury occurs, different names are assigned. For example, De Quervain's

disease (which affects the tendons in the thumb) and tenosynovitis, which typically affects the wrist, According to the study done by Emuze, (2020) the study aimed to assess whether contractors address tendonitis, using the central region of South Africa as a case example. The study examined that hip and shoulder tendonitis leads to minimum performance of work due to body pains. The study recommends tendonitis awareness programmes on construction sites.

2.2.3. CHRONIC BACK PAIN

Lower back pains are caused by repetitive lifting (Kisi & Kayastha, 2024) and bending and twisting motions involved in construction work, and this can lead to strains and injuries in the lower back. The risk of lower back pain is increased by using heavy equipment and incorrect lifting techniques. Most workers with lower back discomfort never pursue medical attention, according to research by (Adhikari et al., 2021), because of time and budgetary restrictions. According to Kisi & Kayastha, (2024), back pain ranked second among worker disorders among Hispanic construction workers. These studies demonstrate that workers in the construction sector have a high risk of developing lower back pain, which is a common problem.

2.2.4. SHOULDER AND NECK DISORDERS

Construction workers often engage in overhead work such as ceiling installation or scaffolding, which can lead to shoulder and neck disorders. Prolonged override work led to an increased risk of developing shoulder impingement syndrome and neck pain among construction workers. The repetitive nature of these tasks, combined with poor ergonomics and inadequate rest breaks, contributes to the development of these disorders. According to Anwer et al., (2021) among the construction workers surveyed, neck disorders came in third and shoulder pains in second place. Long work hours were the source of neck difficulties, while overhead work, manual handling, and repeated hand labour were the causes of shoulder pains. However, the study claims that working overhead increases the risk of problems. (Mengistu et al., 2021) also evaluated a study carried out in Ethiopia that revealed a minimum of one-third of study participants had suffered from the same pains connected to their jobs in the year before the study's conduct. Shoulder pain ranked second among the five most prevalent pain sites, according to (Chung et al., 2019), and it was most often

caused by excessive lifting. These studies demonstrated how common shoulder and neck problems are among construction workers.

2.2.5. KNEE DISORDERS

Construction workers install pipelines and lay flooring, among other jobs that require them to bend over and squat. Osteoarthritis and other knee diseases might result from these repetitive actions. The frequency of kneeling and squatting tasks among construction workers was associated with a higher incidence of knee diseases. Knee pads must be used, lifting skills must be well-trained, and regular exercise is required. Out of the five main pain locations that were examined, the Chung et al., (2019) study revealed that knee issues were the most common pain site.

2.3 ERGONOMIC RISK FACTORS FOR MUSCULOSKELETAL DISORDERS

Various construction roles and tasks are linked to specific types of injuries, with each activity carrying its unique risk profile (Enano, 2023); for instance, workers in occupations that involve overhead activities are more prone to experiencing shoulder and neck issues due to the repetitive strain and awkward postures associated with these tasks. According to (Ispasoiu et al., 2023) ergonomic risk factors are those that can lead to the development of disorders in the workplace, and these include awkward postures, physical strength demand, and the duration of movements. These risk factors for musculoskeletal disorders are classified into individual, physical and psychological factors (Nimje et al., 2020). According to (Lop et al., 2019) some of these risk factors are difficult to control, especially among construction workers and might be harmful to their health and well-being.

PHYSICAL FACTORS

2.3.1 AWKWARD POSTURES

When workers adopt non-neutral postures, it puts additional strain on their joints, muscles, tendons, nerves, and blood vessels, leading to increased stress and potential damage to these tissues. The amount of muscle effort also increases, and the risk of fatigue and injury also increases. Joints can absorb force more easily than other parts of the body. Maintaining awkward or extreme postures increases the risk of injury, as they can put excessive strain on joint components and restrict blood flow, potentially leading to damage and discomfort. Prolonged maintenance of any position can lead to discomfort and fatigue, highlighting the importance of regular breaks and position changes to reduce muscle strain and discomfort. According to (Anagha R, 2020), physical exposures such as awkward postures are the major hazardous conditions that lead to work-related musculoskeletal injuries, which include strain in the joints and limbs of the worker. (Barthelme et al., 2021) reviewed that 12.7% of the workers in certain sectors, such as agriculture and manual occupations, frequently adopt awkward postures, posing a notable risk to their musculoskeletal health, which may include the construction sector if the work is done manually.

2.3.2 REPETITIVE WORK

Repeated movements can be hazardous when they overload joints and muscles through excessive repetition, leading to increased injury risk. Repetitive tasks involve repeatedly using the same muscle, whether large or small, with insufficient time for rest and recovery, leading to potential fatigue, strain, and injury. According to the study done by Mustapha et al., (2022), repetitive work was ranked third with 83% of the workers. This shows that doing repetitive work contributes much to the development work-related injuries.

2.3.3 VIBRATION FROM HAND TOOLS

It is generally when workers have a chance of developing work disorders in their upper limbs when using electric or pneumatic tools, which can expose them to hazardous vibrations. It affects tendons, muscles and joints and also damages the blood vessels and nerves (Texas Department of Insurance (TDI) in 2024) in hands and fingers, resulting from prolonged use of powered hand tools. Workers can be exposed to whole body vibrations, which can be caused by truck drivers, or

localised vibrations which are caused by power tools such as jackhammers moving through their hands. The risk to such conditions includes Raynaud's syndrome (Enano, 2023) from powered hand tools.

INDIVIDUALS' FACTORS

Individual characteristics have also been identified as contributing factors to musculoskeletal problems among workers. According to Nimje et al., (2020), these individual characteristics include gender and age.

2.3.4 AGE

When compared to younger workers (16–30 years old), older workers (45–64 years old) report more complaints of musculoskeletal disorders. According to a study by Norheim et al., (2019), there was a propensity for the acute pain group to exhibit the opposite tendency, although the younger group of both chronic pain patients demonstrated less force complexity than the older group. These results imply that the pattern of force variability in manual labourers varies depending on age and musculoskeletal discomfort, with older workers only tending to be weaker than to younger workers. According to a different study by Lee et al., (2023), employees over 40 had a higher risk of developing musculoskeletal pains than employees under 25. This is because as people age, their biological structures, particularly those on bone and muscle, degenerate. This results in a decline in connective tissue's functional ability and muscle strength, which increases the likelihood of experiencing pain. Because of their worsening physical and mental conditions, older workers experience accidents more frequently than younger workers (Ranasinghe et al., 2023).

2.3.5 GENDER

Regarding gender, women may be more prone to musculoskeletal problems than men because of variations in body size and composition, especially for female labourers. In addition to facing particular obstacles at work, women in construction may also have greater physical demands and limited access to ergonomic equipment, which raises their risk of developing diseases. According

to a review by Lee et al., (2023), gender has an impact, with women being affected more frequently (65.1%) than men (57%). According to (Chung et al., 2019); (Ashuro et al., 2021); (Amissah et al., 2019) and (Martin, 2019) these studies found that men appear to have a greater pain threshold than women.

PSYCHOLOGICAL FACTORS

Stress and job satisfaction are psychological factors associated with musculoskeletal illnesses and musculoskeletal aches in the construction industry.

2.3.6 STRESS

Stress plays a part in that; it can raise the likelihood of discomfort, inflammation, and muscular tension, all of which can aggravate conditions like back pain. Many things, including pressed deadlines and unfavourable working conditions, can lead to stress in the construction industry. According to Jeong & Lee, (2024), among the population they looked at, those with musculoskeletal diseases had higher levels of work stress than those without such conditions.

2.3.7 JOB SATISFACTION

Conversely, in construction workers, musculoskeletal pain may be influenced by work pleasure. Contented workers have positive attitudes about their work and are less prone to stress, anxiety, and depression, all of which can exacerbate musculoskeletal illnesses. As contented employees are more likely to take the time and care required to do activities correctly and safely, it can also have an impact on the calibre of the work. However, a study conducted by Choi et al., (2022) assessed job stress and job satisfaction levels of managers. The research found that in the construction industry, job satisfaction is influenced by job stress and tenure, with a notable discovery that workers with shorter tenure tend to have higher job satisfaction, suggesting that newer employees are more positive about their jobs. (Miyanda et al., 2024) also reviewed that the factors most linked to stress are work duration, followed by employment status, suggesting that long work hours, job insecurity, and limited career growth are key contributors to workplace distress. This research highlights the need for construction industries to prioritise workers' mental health by

implementing reasonable working hours, offering stable employment opportunities, and fostering career growth in order to mitigate the risks of work-related distress and promote overall well-being.

CHAPTER 3: METHODOLOGY

3.1 STUDY SETTINGS

The study was conducted in Bindura, a town situated in the Mashonaland Central Province of Zimbabwe. Bindura is located in the Mazowe Valley, approximately about 88 km northeast of Harare, and its area is about 19.97 km^2. According to the census, which was conducted in 2022, its population size was around 51.394 people. Cotton and maize are grown intensively in the region.

Four Lions Builders P/L Company started its operations in 1995 as To-Ryo Gumi Construction and was registered in terms of the Companies Act chapter 24:03 of Zimbabwe. It is located in the New CBD of Bindura, and the site comprises 100 workers. Its service package envisages building construction and civil engineering. It involves many activities, which include groundwork, concrete work, brickwork, carpentry, roofing, plastering, joinery partitioning, and drain lying.

STUDY AREA MAP

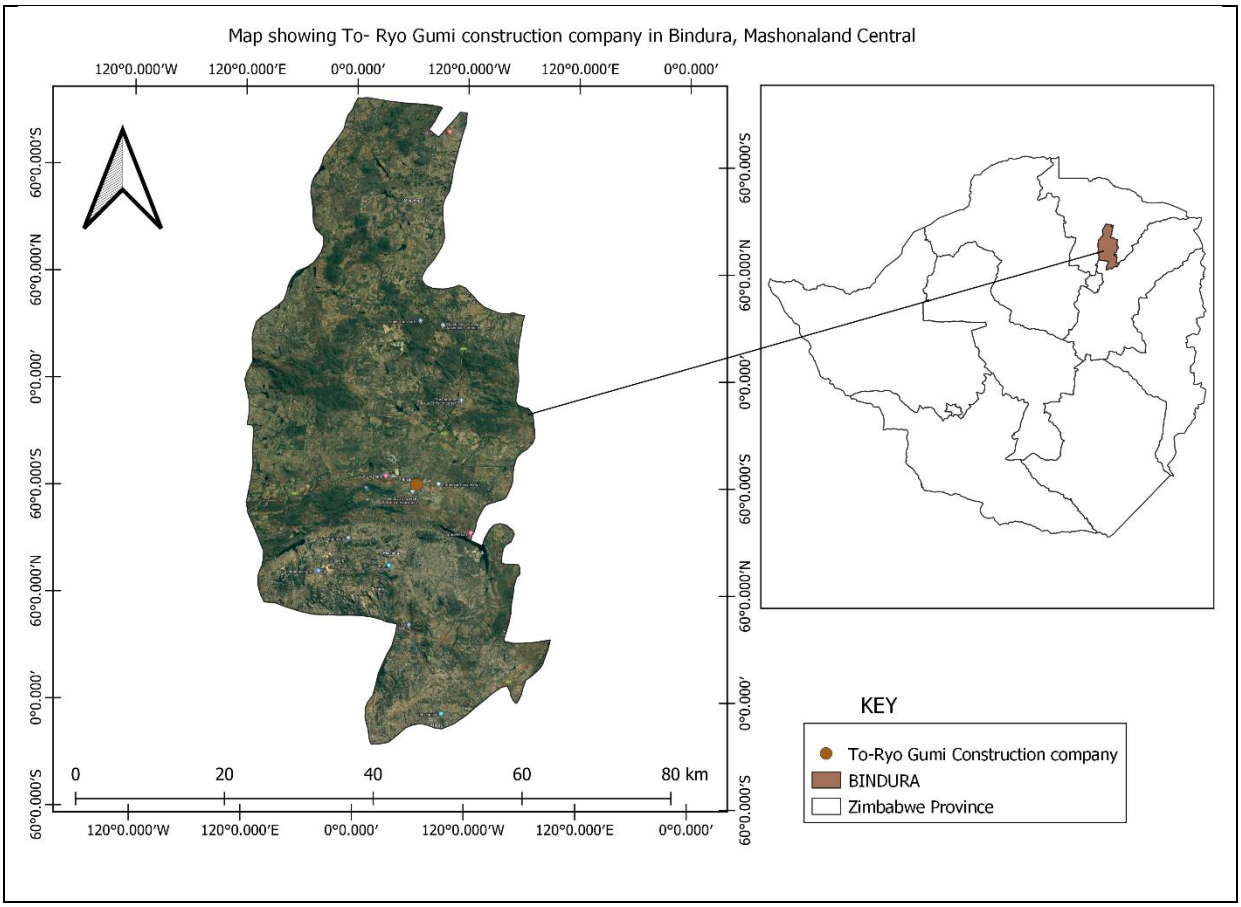

Fig 3.1: study map area

3.2 STUDY DESIGN

The research study utilised a cross-sectional design, which involved gathering data from sample of participants at a specific moment in time. Primary data was collected through structured questionnaires and direct observations. Secondary data, on the other hand, was obtained from existing literature and relevant references pertaining to the topics discussed. The research approach employed was quantitative in nature, focusing on data analysis.

3.3 SAMPLE AND SAMPLING PROCEDURES

The study used 60 out of 100 workers: 11 were brick workers, 9 were carpenters, 8 were steel fixers, 18 were concrete workers, 5 were plasterers, and 9 were roofers. Stratified random sampling was employed because it involves choosing the sample according to the division of a population

into smaller subgroups called strata. In this research, workers were put into strata of different departments, and they were randomly selected from those departments. Each and every one of those departments had a chance of being equally selected.

Table 3.1 Number of participants within departments

Strata	**Description**	**No. Of Employees**
1	Brickwork	11
2	Carpentry	9
3	Steel fixing	8
4	Concrete works	18
5	Plastering	5
6	Roofing	9

3.4 DATA COLLECTION INSTRUMENTS

Nordic questionnaires were used and they consisted of short questions that required them to tick to avoid chances of bias. A Nordic picture, which was labelled, was inserted into the questionnaire to help workers understand body regions that could cause discomfort.

Pictures of respondents were also captured whilst working for different postures to detect working postures with a RULA worksheet to come up with a RULA score with results between 1 and 7, 1-2 showing acceptable postures with no risk, 3-4 showing low risk, 5-6 showing medium risk, and more than 7 showing high risk.

3.5 ETHICAL CONSIDERATIONS

They include;

Formal approval: The researcher sought approval for data collection from the company's owners and was given it in the form of a stamped letter as evidence of the approval.

Informed consent: it refers to the subjects" consent to engage in a study after being informed that they will be the subjects and given an explanation of the nature of the investigation. The researcher explained to every participant what the questionnaires were for, and how they were to be used in terms of helping the researcher, and how to answer them.

Privacy and confidentiality. Information about participants that is sensitive should not be revealed to unaffiliated parties. To safeguard the privacy of participants, it is essential to implement measures that maintain data confidentiality, such as anonymising data by removing identifying information and restricting access to authorised personnel, for example, medical information, to prevent harm. The researcher did not take the names, contacts, and addresses of the respondents as a sign of protecting their privacy and confidentiality. Only the researcher used the questionnaires and no third parties were involved.

3.6 DATA ANALYSIS

The statistical analysis was performed using SPSS (Statistical Package for the Social Sciences), a software tool commonly used for statistical analysis. The results were presented in terms of frequencies and percentages for categorical data, while means and standard deviations were used for continuous data. Data was classified and presented using Microsoft Excel and was also analysed using Rapid Upper Limb Assessment. This tool was designed to evaluate ergonomic risk factors that individual workers are exposed to, which can contribute to musculoskeletal disorders affecting the upper extremities. RULA is a simple, accessible tool for evaluating ergonomic risks; no expertise or special equipment is needed.

CHAPTER 4: RESULTS

4.1. DEMOGRAPHIC DETAILS OF STUDY PARTICIPANTS

The table below shows the results of workers at Four Lions Builders, the majority of workers were concrete workers with a frequency of 18 and a percentage of 30 which is the highest percentage level of other workers, followed by brick workers who had 11 (18.3%), followed by carpenters and roofers with 9 (15%), followed by steel fixers with 8 (13.3%) and lastly with plasterers who had 5 (8.3%). The results show that males were the majority with a frequency of 51 out of 60 (85%). Findings indicate that the majority of workers at Four Lions Builders were (21-40) years of age with a percentage of 71.7% and a frequency of 43. Results also show 18-20 years had 4 (6.7%), and >40 had 13 (21.7%). Results show that 1-1.5m had 18 (30%) and >1.6m had 42 (70%). The results show that 50-60kgs had 15 (25%) and >61kgs had 45 (75%). Findings also indicate that workers who had work experience of 1-4 years had 34 (56.7%) and those with work experience >5 years had 26 (43.3). Results show that all workers had 60 (100%) working hours.

Variable	**Frequency**	**Percentage**
Job: Steel fixing	8	13.3
Plastering	5	8.3
Brickwork	11	18.3
Concrete work	18	30
Carpentry	9	15
Roofing	9	15
Gender: Male	51	85
Female	9	15

Age: 18-20	4	6.7
21-40	43	71.7
>40	13	2.7
Height: 1-1.5m	18	30
>1.5m	42	70
Weight: 50-60kgs	15	25
>60kgs	45	75
Work experience: 1-4years	34	56.7
>5years	26	43.3
Working hours	60	100

Table 4.1 shows the results of demographic details of workers at Four Lions Builders Construction Company

4.2. DETERMINING MUSCULOSKELETAL DISORDERS THAT ARE RELATED TO CONSTRUCTION WORKERS.

Results below shows body complains of workers at Four Lions Builders, a construction company. The majority of workers complains from lower back pains with 47(78.3%), shoulder disorders with 44(73.3%), Wrist disorders with frequency of 35 out of 60 (58.3), and Upper back disorders 30 (50%). Fewer workers complains from ankles and knee disorders with 14(23.3%) and 12(20%) respectively.

PREVALENCE OF MSDS AMONG CONSTRUCTION WORKERS BY DIFFERENT BODY PARTS.

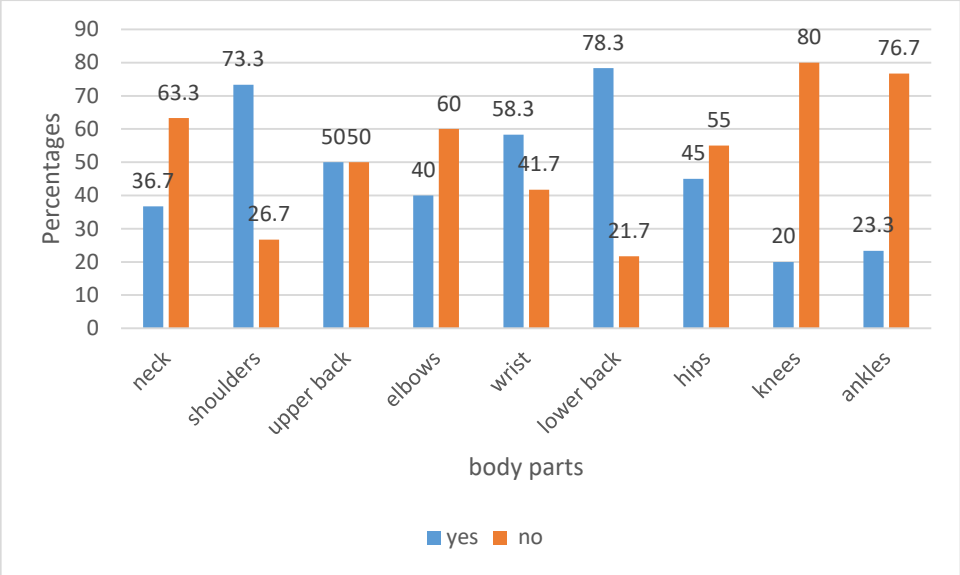

Fig 4.1 shows the prevalence of MSDs by different body parts

DESCRIPTIVE ANALYSIS OF MSD INJURIES AND TRADE OR PROFESSION.

The below figure shows the MSD pain of the construction profession in different body regions. Concrete workers sustain more injuries in different body parts compared to other trades with the highest injury being lower back pains with 83.3% of workers. Following concrete workers are brick workers with the highest injury being lower back pains with 90.9% of workers, followed by carpenters with the highest injury being shoulders and lower back with 77.8% of workers. Steel fixers had the highest injury in the lower back with 87.5% of workers, followed by roofers with their highest injuries in the wrist with 77.8% of workers. Lastly, plasterers had their highest injuries in elbows and shoulders with 100% workers.

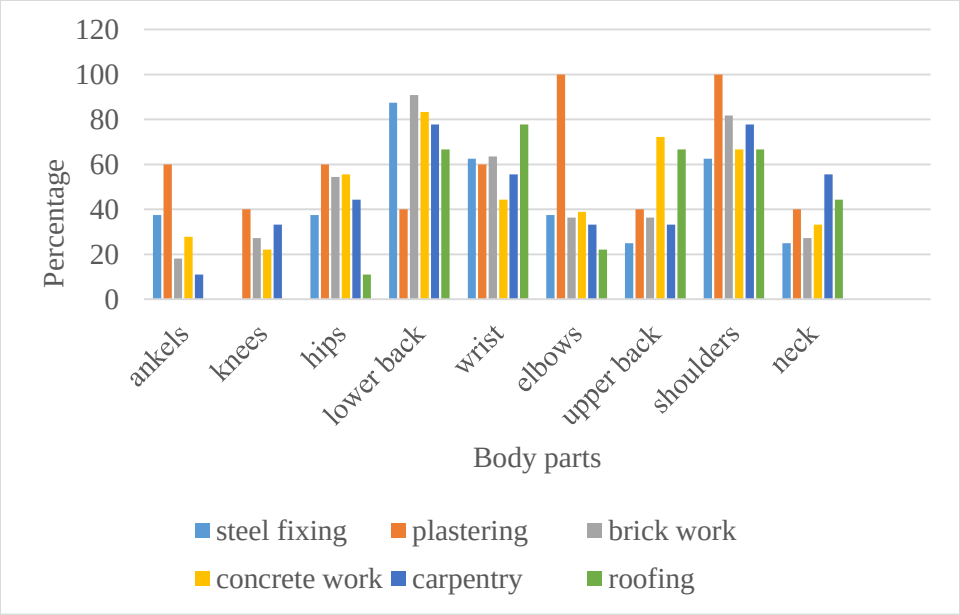

Figure 4.2: Descriptive analysis of MSD injuries and profession/ trades

4.3. DETERMINING ERGONOMIC RISK FACTORS CONTRIBUTING TO MSDS AMONG WORKERS

The above figure shows that the majority of workers were working at a posture that has a high risk with results showing 38 (63%) and fewer workers were working at a posture that has a medium risk of 21 (35%). Workers working at a posture with low risk were 1 (2%) and none of the workers were working at an acceptable posture.

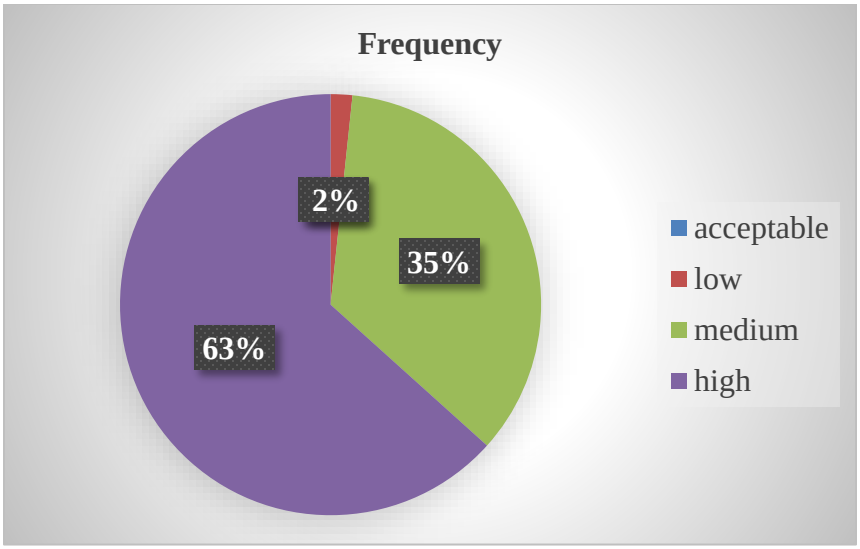

Figure 4.3 RULA score of working postures for workers at Four Lions Builder

GENDER AND AGE AS RISK FACTORS

Table 4.2 shows results of males who had pain were 24 (47%) and females were 5 (56%). Those between the ages of 18-20 who experienced pain were 2 (50%), 21-40 years were 22 (51%) and above 40 were 5 (38%).

Characteristics	**Had pain**	**No pain**
Gender: Male	**24**	**27**
Female	**5**	**4**
Age: 18-20	**2**	**2**
21-40	**22**	**21**
>40	**5**	**8**

Table 4.2 Investigating gender and age as risk factors contributing to MSD

BODY MASS AS A RISK FACTOR

The above table shows the body mass index of participants, it shows that none of the participants had underweight, while 9 (15%) had recommended weight, 36 (60%) had overweight and 15 (25%) had extreme weight.

Body mass index	**Frequency**	**Percentage**	**BMI classification**
Bellow 18.5kg/m^2	0	0	Underweight
18.5 – 25kg/m^2	9	15	Recommended weight
26 – 29kg/m^2	36	60	overweight
Above 30kg/m^2	15	25	extreme overweight

Table 4.3 Body mass index of construction workers as a risk factor.

CHAPTER 5: DISCUSSION

5.1. DISCUSSION ON MUSCULOSKELETAL DISORDERS THAT ARE RELATED TO CONSTRUCTION WORKERS

The study showed the most common musculoskeletal pains among Four Lions workers, they were lower back pains, shoulder pains, wrist pains, upper back pains, and very little pain in other parts of the body. This study focuses on musculoskeletal pains that are related to activities of construction workers, examining the hazards that lead to work-related pain and discomfort. Other studies indicate that in construction workers, lower back pain is predominant, and these studies include (Chung et al., 2019) and (Kisi and Kayastha, 2024). Similarly, the study shows that lower back pain was the first common, showing that there was an association between this current study and that of other studies. This may be because construction activities involve a lot of manual labour, heavy lifting of materials, and bending motions (Kisi & Kayastha, 2024), as stated earlier in this current study. Other industries like mining also indicate that lower back pains are the most common pains, according to Dube and Chiluba, (2021), a study of Freda Rebecca Gold Mine in Bindura, showed statistics of 77.8% respondents out of 140 suffered lower back pains. However, these studies showed that lower back pain is dominant in workers who are involved in most activities.

Besides lower back pains, as indicated as the most common pain at the site in this current study, the top four musculoskeletal pains were back pains, shoulder pains, wrist pains, and upper back pains, respectively, showing some differences in the most common body pains with some studies, such as the study done by Kisi and Kayastha, (2024) showing that the most common pains were their feet, back pain, head, hip, and shoulder, respectively, and that by Chung et al., (2019), most common pains were lower back pains, followed by shoulders and knees. These studies are different in terms of most pains in different body parts from the current study of Four Lions Builders in that work activities differ from one site to another. Feet pains were most common in the study done by Kisi and Kayastha, (2024). This was because of prolonged standing, walking, and working on uneven surfaces rather than a lot of manual, heavy lifting. However, this current study found that

knee and ankle pains were the least; this may be because of less walking and standing. This is so because workers at Four Lions Builders were given enough and regular breaks.

This current study indicates that concrete work, brick work, and carpentry are the most common construction trades that experience more pain or injuries than other trades. However, the study done by Chung et al., (2019) indicates that general labourers had more pain, followed by electrical fitters and plant and equipment operators, and these two show some differences in how pain is distributed in different trades. This is due to the type of activities performed and the time of exposure.

5.2 DISCUSSION ON ERGONOMIC RISK FACTORS ASSOCIATED WITH WMSDS AMONG CONSTRUCTION WORKERS.

Current study has revealed that, using the RULA method, the majority of workers at the construction site at Four Lions Builders are working in positions that result in high risks. These positions had awkward postures; this may be due to neglecting the improvement of the health and safety conditions at the work site. According to study done by Barthelme et al., (2021), exposure to awkward postures increases the risk of getting shoulder and arm pains, hence causing musculoskeletal disorders. Based on Table 4.1, the main activities of construction workers include concrete work and bricklaying, and these are closely related to awkward postures as they are physically demanding. According to the study done by Lop et al., (2019), concrete work was among the tasks that require awkward posture and repetitive work, causing higher musculoskeletal disorders. However, awkward postures as a risk factor are associated with different activities leading to musculoskeletal disorders.

This current study shows that young workers between the ages of 18 and 40 are mostly affected by pain in construction activities, thereby showing that age is a risk factor that contributes to pain. This may be because most workers are youths compared to older workers, and they work more physically than older workers. According to Amissah et al., (2019), his study, which was conducted in Ghana, reviewed that risks of injuries increased with old age, hence showing differences with the current study. Psychological changes make it difficult for the elderly to perform jobs, leading to more pain for them than for young people. According to Chung et al.,

(2019), the study states that people between 45 and 54 years' experience more pain than others because in Hong Kong, the construction industry experienced an ageing workforce. However, different construction sites have different ageing forces, hence differences in age groups that are mostly affected.

The results also showed that females are mostly affected by pain more than males, potentially attributed to the physically demanding nature of the job, resulting in fewer female workers. Similarly, other studies, also show that in Hong Kong, workers who were registered had a female-to-male ratio of 9.65% to 90.35%, respectively, in 2019 (Chung et al., 2019), showing that in construction sites there are more males than females. In Ethiopia, Addis Ababa, and Dessie town, it shows that males were at high risk (Ashuro et al., 2021) and also with the study done by Chung et al., (2019) in Hong Kong and by Amissah et al., (2019) in Ghana, which gave the reason that it was due to socio-cultural factors that restricted males to construction activities, showing the difference with the current study. This shows that construction activities and operations are physically demanding (Lop et al., 2019), putting construction workers at significant risk of developing musculoskeletal disorders, as stated previously in the study, and male workers are more vulnerable due to differences in tasks.

The study shows more workers are overweight, which leads to the development of musculoskeletal disorders at workplaces. Workers at Four Lions Builders develop disorders due to weight, maybe because of eating habits and, in some cases, stress. The research I am conducting shares similarities with a study conducted by Iqbal et al., (2022) in the way that weight is a risk factor that causes certain disorders. Two studies out of four stated that there was a relationship between BMI and the incidence of carpal tunnel syndrome. The research done by Chung et al., (2019) showed that those with a normal weight experienced more pain than others.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

This research updated the prevalence of risks causing musculoskeletal disorders in construction workers. Results revealed strong evidence of many physical factors affecting workers. Even though workers were suffering from musculoskeletal pains due to the nature of work, the study showed that these workers were given enough rest to reduce pain, and they were educated to take rest days.

6.2 RECOMMENDATIONS

TO EMPLOYER

1. Training of workers so that they will be aware of the dangers associated in construction work-related activities.

TO WORKERS

- Should use protection to minimise ergonomic-related risk factors which include;
    i. Wearing well-fitting thermal gloves can help workers cope with cold conditions while still allowing them to grip items securely.
    ii. Using padding can help cushions against hard, sharp, or vibrating surfaces, reducing direct contact and minimizing discomfort.

TO SUPPLIERS

- Should provide tools and equipment that are ergonomically designed. For example tools with better grip or adjustable height platforms which can reduce the strain on the hands and arms of workers

- Should offer training and education on ergonomic principles, such as proper lifting techniques to construction workers. This can help to prevent injuries and reduce strain on the body.

TO GOVERNMENT OFFICIALS

- Should implement and enforce regulations such as Occupational Safety and Health Administration standards. These regulations can ensure that construction companies are held accountable for providing safe and healthy working conditions for their employees.
- Should provide funding for research and development in ergonomics, which can lead to the creation of better tools and equipment for construction workers.

TO CONTRACTORS

- Make sure that equipment and machinery are appropriately maintained and are in good working condition. This can help prevent accidents and injuries that can lead to ergonomic problems.

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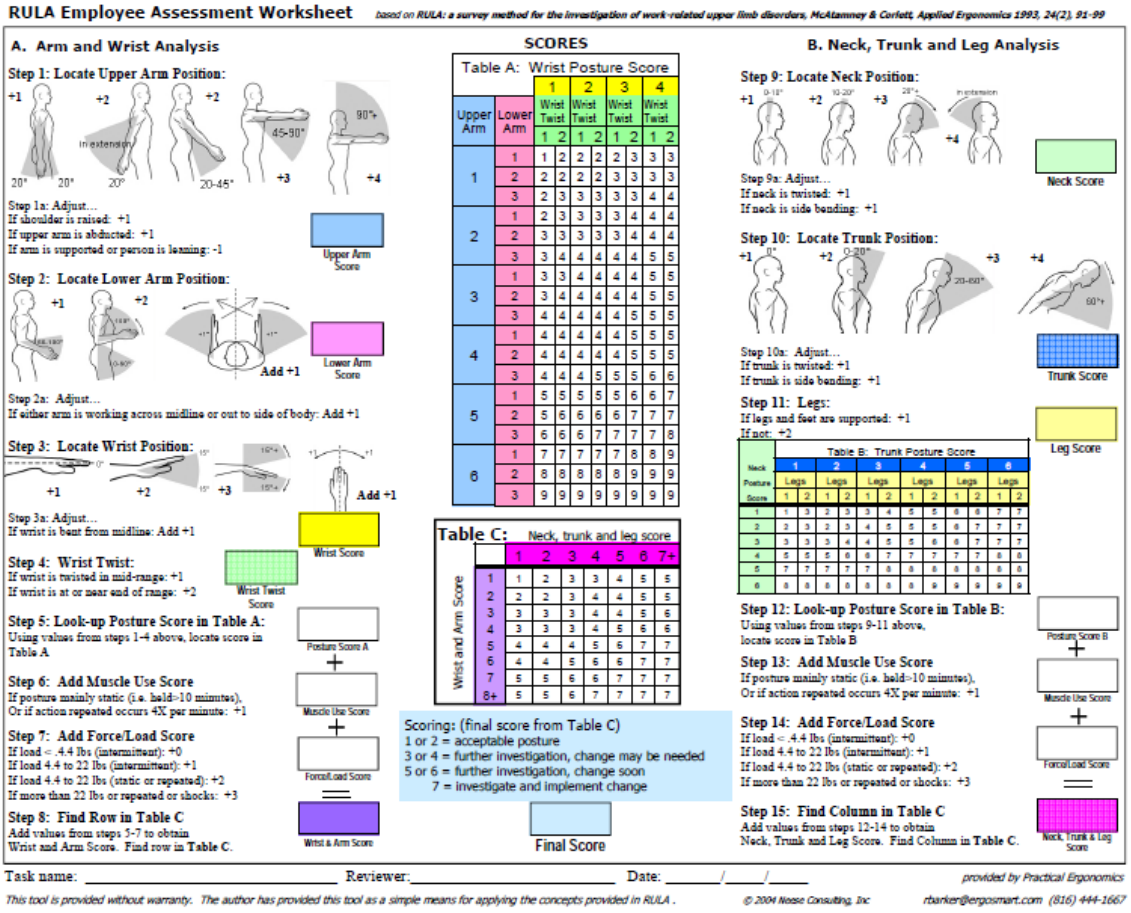
APPENDICES

APPENDIX 1: RULA WORKSHEET USED IN THE STUDY



APPENDIX 2: NORDIC QUESTIONNAIRE

NORDIC QUESTIONNAIRE FOR CONSTRUCTION WORKERS

PART 1: INTRODUCTION

Dear Participants

I am Faith Humure, a student enrolled at Bindura University of Science Education. My current research focuses on identifying the risk factors associated with musculoskeletal disorders among construction workers. I kindly request your participation in this study and assure you that all the information obtained will be treated with the utmost confidentiality and used solely for academic purposes.

PART 2: DEMOGRAPHIC INFORMATION

Job type_____ Gender: M. F.

Age: 0-20 21-40 >40

Height_____. Weight _____

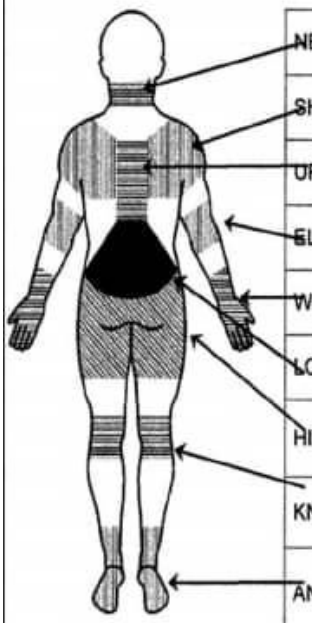
Work experience? _____ Years _____ months.

Working hours per day? _____.

PART 3: NORDIC PICTURE

Use one tick for each question. You may be in doubt but please try to answer and do your best. The first column is to be answered by everyone and the other 3 columns is to be answered by those who had any trouble. You should decide for yourself in which part you have or have had your trouble (if any).

NB: Please answer by using the tick boxes



	Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) in:	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble in:	During the last 12 months have you seen a physician for this condition:	During the last 7 days have you had trouble in:
NECK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
SHOULDERS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
UPPER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ELBOWS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
WRISTS/ HANDS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
LOWER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
HIPS/ THIGHS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
KNEES	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ANKLES/ FEET	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

APPENDIX 3: Photographs of working postures

Figure 1

Figure 2

APPENDIX 4: LETTER OF PERMISSION TO CONDUCT THE STUDY

FOUR LIONS BUILDER(PVT)LTD

FOUR LIONS BUILDERS
PRIVATE LIMITED

LETTER OF CONSENT

Four Lions Builders Pvt Ltd
Stand Number 763
Hillview
BINDURA

13 February 2024

Dear Sir/Madam

TO WHOM IT MAY CONCERN:

We, as Four Lions Builders Pvt Ltd Construction Company do hereby give our consent that Faith Humure Student Number B200701B, ID number 84-069268 N75 perceived ergonomic risk factors for work related musculoskeletal disorders at a building Construction Site Case Study of Four Lions Builders Pvt Ltd.

Feel free to contact us if you require any further information.

Yours Faithfully

Mr E Nyangani
MANAGING DIRECTOR
CONTACT: 0777 405 445

FOUR LIONS BUILDERS P/L
13 FEB 2024
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