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EVALUATING THE EFFECTIVENESS OF ERGONOMIC INTERVENTIONS AT AGS MOVERS ZIMBABWE

AMANDA VIMBAINASHE HUKUIMWE

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DECLARATION

I, Amanda V Hukuimwe, hereby declare that this dissertation is my own original work. All sources and resources used in the preparation of this dissertation have been cited and acknowledged. I confirm that this dissertation has not been previously submitted, in whole or in part, for the award of any other degree or diploma at this or any other educational institution. I also declare that I have not copied or plagiarized any part of this work from other sources, whether published or unpublished. I understand that any violation of the above declaration would result in academic penalties in accordance with the university's policies and procedures. I am solely responsible for the content and originality of this dissertation.

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Date:…….....

DEDICATION

This dissertation is dedicated to my family, whose unwavering support, guidance, and inspiration have been instrumental in shaping my academic journey and the completion of this work. I also dedicate this dissertation to the company AGS Zimbabwe, where I had the privilege of completing my internship. AGS Zimbabwe played a pivotal role in my professional development, offering me the chance to apply my academic knowledge in a real-world setting. The experience and knowledge I gained during my internship have been instrumental in shaping the research and insights presented in this dissertation.

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ABSTRACT

This study sought to investigate the effectiveness of ergonomic interventions existing at AGS Movers Zimbabwe on how well ergonomic interventions —pre-task stretching and manual handling training— improved musculoskeletal occurrences in moving and storage enterprises. The study aimed to investigate what the main cause for relatively high costs of work related injuries at the workplace where given the existence of an ergonomics intervention program. The first step was to measure (identify) awareness of the ergonomics intervention program by the employees (to determine if they knew what it was and other relevant details). Data was collected through face to face interviews to measure the level of awareness of interventions by the employees (ability to state them and, as well as to obtain their perception on the factors influencing intervention effectiveness. The results indicated that high awareness of interventions existing in a workplace by the employees is crucial to ascertain the efficacy of the ergonomic interventions. Secondly, there are a number of factors which influence the effectiveness of ergonomic intervention effectiveness lack of employee empowerment to ergonomic intervention practice and incorrect application of interventions during tasks were the factors that had the greatest impact on intervention effectiveness. Thirdly, REBA scores were used as an effective way of assessing ergonomic intervention effectiveness as the reduction in the scores means a reduction in the risk level to development of MSDs. In accordance to the research, ergonomic adjustments can effectively lower the risk of developing musculoskeletal disorders in a workplace however ability of employees to correctly practice these ergonomic interventions and their empowerment to practice them along with other factors influence the extent of the effectiveness of the ergonomic interventions. However, additional research is needed to confirm these findings and to explore other potential interventions. This research adds to the body of literature on ergonomic interventions present in movers and storage companies by providing insight into the potential benefits and extent of effectiveness of ergonomic interventions at AGS Zimbabwe.

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LIST OF ACRONYMS AND ABBREVIATIONS

MSS – Musculoskeletal symptoms

MSDs – Musculoskeletal disorders

OSHA – Occupational Safety and Health Administration

EIP – Ergonomics Intervention Program

HRP – Human Resource Productivity

PPE – Personal Protective Equipment

REBA – Rapid Entire Body Assessment

CHAPTER I

1.0 INTRODUCTION

MSDs are a common problem in the logistics and storage industry due to the facilities' physical requirements for employees (Zafrani, 2023). This results in a number of costs to the employees (through negatively affected quality of life from the MSD and exacerbation of other health conditions) and the company (through lost productivity and legal claims) (Grinnell, 2022) hence many companies are engaging a series of ergonomics interventions which this dissertation aims to evaluate their effectiveness.

1.1. BACKGROUND OF THE STUDY

Musculoskeletal diseases (MSDs) refer to injuries affecting the soft tissues, such as muscles, tendons, and ligaments. These injuries can stem from sudden or prolonged exposure to stress, vibration, repetitive motions, and uncomfortable body positions. MSDs can impair a worker's ability to perform various job tasks, including carrying, maneuvering, and pushing objects, maintaining proper posture, enduring low temperatures, and handling vibrations or torque from machinery and tools. These conditions are often triggered by overexertion, as noted in the Dick R.B. 2020 (Dick R.B, 2020).

Implementing methods, technologies, or design changes to enhance the way employees interact with their workplace is known as an ergonomic intervention (Work, 2019).By lowering the physical and mental demands placed on employees, these solutions hope to lower their risk of musculoskeletal illnesses, weariness, and stress associated to the job (J, Lee, & Smith, 2022)

The first research on the steel industry in Isfahan, Iran, was carried out by Matin Rostami et al. between 2018 and 2021. Their objective was to assess the impact of the ergonomics intervention program (EIP) upon general health, musculoskeletal disorders (MSDs), occupational tiredness, and human resources productivity (HRP) in the steel sector. Utilizing various assessment tools, the researchers examined the prevalence of musculoskeletal disorders among the study participants. This evaluation was conducted both prior to and after the implementation of the employee intervention program, which involved a participatory approach, training, and redesign of workstations. According to their findings, HRP increased significantly ($p<0.05$) when EIP was implemented in the industry under study. After the interventions were implemented, the researchers observed a significant decline in the occurrence of musculoskeletal disorders across most body areas ($p<0.001$). Furthermore, the program demonstrated a significant improvement in overall health ($p < 0.001$) and a decrease in employee occupational tiredness ($p < 0.001$) (M, A, M, & al, 2022)

Chang et al.'s (2017) study analyzed how well an ergonomics intervention program reduced MSDs among Taiwanese warehouse workers. The results indicated that the implemented intervention program led to a reduction in incidence of MSDs by 23% in contrast to the group under control. Chang in this research employed a quasi-experimental methodology to assess the efficacy of the ergonomics intervention program. They sampled a total of 260 warehouse workers from three warehouses in Taiwan who were recruited for the study (Chang, Yu, Lee, & Chang, 2017). The ergonomics intervention program consisted of three components: (1) an ergonomics assessment of the workplace, (2) ergonomics training for workers, and (3) engineering controls and administrative controls to reduce MSDs. The study conducted by Chang et al. (2017) yielded the following results. To begin with, the ergonomics intervention program significantly decreased the incidence of MSDs among Taiwanese warehouse workers; at the conclusion of the trial, the incidence rate had dropped from 46.3 instances per 100 workers at baseline to 35.8 cases per 100 workers. Secondly, the ergonomics intervention scheme was most effective in reducing the incidence of upper extremity MSDs (i.e., neck, shoulder, and hand/wrist disorders), with the incidence rate decreasing by 41% compared to the baseline (Chang, Yu, Lee, & Chang, 2017).

Furthermore, Yu et al.'s (2018) study looked into how a multi-component ergonomics intervention affected the incidence of MSDs in Chinese logistics and storage companies. On research methods Yu (2018) employed a control group in a pre-post evaluation design. The intervention group received a multi-component ergonomics intervention that included ergonomics training, workplace redesign, and education on work-related risk factors for MSDs (S. L Yu, 2018). In addition, the researchers utilized a self-reported survey to assess the frequency of

musculoskeletal disorders both at the start of the study and after one year. A total of 856 workers from four logistics and storage companies in China were included in the study with 422 workers in the control group and 434 workers for the group that received the intervention. The following findings were discovered, firstly, following the ergonomics intervention program, the prevalence of MSDs significantly decreased in the intervention group, going from 57.0% at baseline to 43.6% at the conclusion of the study. In contrast, the control group showed no notable change in the prevalence of MSDs, with the prevalence remaining at 54.3% by the conclusion of the study. The researchers compared the results between the group that received the intervention and the control group by the end of the study, and the former reported noticeably fewer days missed owing to MSDs (S. L Yu, 2018).

Furthermore, as per the research conducted by Park and colleagues (2020), an all-encompassing ergonomics intervention program including training, engineering controls, and administrative controls was effective in reducing MSDs by 37% in Korean logistics and storage companies. Park et al. (2020) employed a controlled trial that is not randomized to assess the degree to which effectiveness of a comprehensive ergonomics intervention program is in lowering MSDs. The research by Park et al. formed two groups as follows. The study consisted of 320 participants as the control that did not receive the intervention, and 311 participants in the treatment group that received the intervention. Using the results of a thorough ergonomics evaluation, the intervention group were chosen due to their increased risk of MSDs. These workers received a comprehensive ergonomics intervention program, which included ergonomics training, workstation redesign, and regular follow-up assessments. Then the control group consisted of workers who were not included in the intervention group. They received standard care for MSDs, such as first aid, rehabilitation, and initiatives for health promotion. Park *et al* (2020) did however highlight some contributing factors to his findings which were, worker involvement, management support and workplace culture (S, 2020) .

In a study by Akinsanya et al. (2019), an ergonomics intervention program was implemented in three logistics and storage companies in Nigeria. The results demonstrated that the implemented program significantly decreased prevalence of MSDs by 28% compared to the baseline. To determine if the ergonomics intervention was beneficial, the study employed a quasi-experimental approach that included a pre-, post-, and follow-up assessment. They also included a total of 191 workers from three logistics and storage companies in Nigeria for the sample (Akinsanya,, Apata, Atere, & Adeosun, 2019). Finally the ergonomics intervention included physical modifications to the workplace (e.g., installation of handles and footrests), as well as ergonomics training and education sessions for workers. Akinsanya et al. (2019) identified several factors that may have contributed to the effectiveness of their ergonomics intervention program. First was training and education: The researchers found that workers who participated in the ergonomics training sessions were more likely to report

reductions in MSD symptoms. The study made an additional discovery that workers who complied with the ergonomics interventions (e.g., using handles and footrests correctly) were more likely to experience reductions in MSD symptoms.

Regarding Zimbabwe, a study exploring the implementation and assessment of an ergonomic training program combined with stretch exercises for welders in the informal economy sector across three urban areas in Zimbabwe was conducted by (Chiboyiwa, Ncube, & Erick, 2023). This research examined the effects of providing ergonomic training on the level of postural risk factors, as well as the combined impact of ergonomic training and stretch breaks on the self-reported degree of pain experienced by welders working in Zimbabwe's informal employment sector (Chiboyiwa, Ncube, & Erick, 2023). For a span of eleven weeks, supervised workouts and training were held. 189 welders out of 260 who were randomly assigned to four groups and purposefully selected finished the intervention program. Following the delivery of ergonomic training, there was a noteworthy decrease in risk factors affecting the neck, hands/wrists, and shoulders/arms ($p = 0.001$. The analysis also indicated a non-significant decrease in risk factors for the back region ($p = 0.061$). The results demonstrated that across most body regions, the group that received both the ergonomic training and the stretch exercises experienced a statistically significant decrease in their self-reported pain severity levels ($p = 0.001$). They came to the conclusion that in order to significantly lessen the degree of discomfort experienced by welders, a variety of intervention strategies must be put into place (Chiboyiwa, Ncube, & Erick, 2023).

1.3 PROBLEM STATEMENT

Despite the significant benefits that logistics and storage companies like AGS MOVERS provide to the economy, they are also prone to various occupational health hazards (International Labour Organization, 2016). Among the most typical and detrimental health problems in the industry is musculoskeletal disorders (MSDs), which have been reported to affect a significant proportion of the workforce (Fiseha , et al., 2024) (Pi, 2024)

Recent reports of a high incidence of MSDs among employees at AGS Movers, a leading logistics and storage company, have highlighted the urgent need for effective interventions to improve workers' health and safety (Sharma & Dalal, 2019). AGS MOVERS ZIMBABWE over the course of 3 years has noted a significant rise in the total costs of work related injuries with the highest being recorded as 15 000USD. On average the total cost of work related injuries related to musculoskeletal disorders per employee was $1000 (2020), $1400 (2021), $1470 (2022) and this covers medical costs, lost wages and productivity, and employers' uninsured medical expenditures—that is, those not covered by medical aids. Now considering that the costs are continuing

to rise yet there are already existing ergonomic interventions leaves the question if these interventions are good enough and doing their job effectively? Hence this research aims to investigate the effectiveness of ergonomics interventions in reducing MSDs in logistics and storage companies, with a specific focus on AGS Movers (Manias, et al., 2018)(Pi,2024).

1.4 GENERAL OBJECTIVES

To evaluate the effectiveness of existing ergonomics interventions at AGS MOVERS in decreasing muscular skeletal disorders.

1.5 SPECIFIC OBJECTIVES

- To identify the awareness level of ergonomic intervention awareness amongst employees
- To identify factors that influence the effectiveness of these interventions
- To evaluate the effectiveness of these interventions in reducing the incidence of musculoskeletal disorders

1.6 HYPOTHESIS

H1 Alternative hypothesis

There is a connection between the effectiveness of ergonomics interventions and the occurrence of musculoskeletal skeletal disorders among AGS Movers employees such that these interventions are able to minimize the risk of MSDs.

1.7 JUSTIFICATION OF THE IMPORTANCE OF THE STUDY

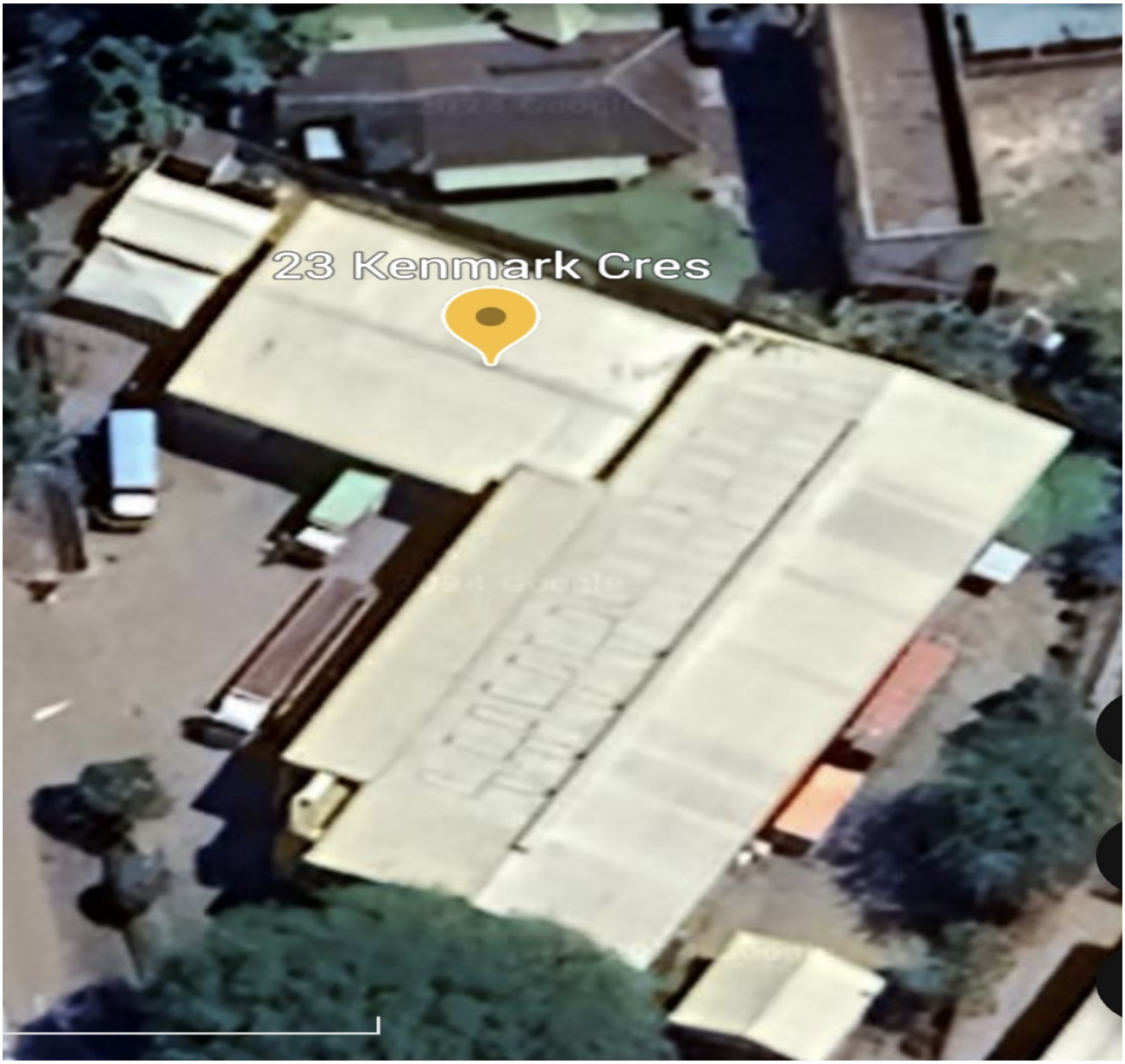
Musculoskeletal problems are a prevalent occupational health issue facing workers in the logistics and storage sectors, where high rates of these conditions have been observed (Hosseini, Razeghi, & Pakshir, 2019). These disorders not only cause pain and discomfort for workers (Manias et al., 2018) but also result in reduced productivity (Sharma & Dalal, 2019), increased absenteeism (Yi, Meng, Chen, & Fang, 2019) and increased healthcare costs for companies (Pathak & Kini, 2019). "To address this issue, ergonomics interventions, such as

workstation design modifications and employee training (Manias, et al., 2018), have been suggested as a possible remedy for lowering MSDs in the workplace. However, the efficiency of these measures in lowering the frequency and degree of MSDs in logistics and storage companies like AGS MOVERS is not well understood (Yi, Meng, Chen, & Fang, 2019); (Pathak & Kini, 2019). Investing in ergonomics interventions without evidence of their effectiveness could be costly and ineffective (Manias, et al., 2018). This research will offer valuable This research will offer perspective on the usefulness of ergonomics interventions in reducing MSDs in the logistics and storage industry, specifically in AGS MOVERS (Yi, Meng, Chen, & Fang, 2019); (Pathak & Kini, 2019), which can inform future interventions and policies in this industry."(Pi, 2024)

1.8 AREA OF THE STUDY

This study was conducted at AGS MOVERS ZIMBABWE located at 23 Kenmark Cresent, Bluffhill Industrial Park off Faber road in Harare. It is located on the peripheral of Bluffhill thus is very close to Westgate.

Figure 1: **Study area map**



1.9PHYSICAL CHARACTERISTICS OF STUDY AREA

To begin with, the soil in the Bluffhill area is predominantly red clayey soil, typical of the region. According to a study by the University of Zimbabwe, the soil in this area is rich in nutrients but has poor drainage capabilities due to its high clay content (Mushonga, Dusabe, Kandiwa, & Bhebhe, 2017). This type of soil is ideal for agriculture, and many farmers in the area cultivate crops such as maize, tobacco, and vegetables.

Moving on to vegetation, the Bluffhill area is characterized by a mix of indigenous and exotic tree species. The area is home to acacia trees, msasa trees, and jacaranda trees, among others. The vegetation is lush and provides habitat for a variety of bird species, making the area popular among birdwatchers (Chivero & al, 2019). The

presence of diverse vegetation adds to the natural beauty of the landscape and contributes to the overall biodiversity of the area.

The Bluffhill region has distinct wet and dry seasons due to its subtropical environment. The winters are pleasant and dry, but the summers are hot and muggy, frequently reaching temperatures beyond thirty degrees Celsius. With an average yearly rainfall of about 800 mm, the area experiences its highest amount of precipitation throughout the summer (Mushonga, Dusabe, Kandiwa, & Bhebhe, 2017). Usually lasting from November to March, the rainy season is when the vegetation is at its peak and the area is turned into a verdant haven.

Surrounding water bodies play an important part in the ecosystem in Bluffhill area. Bluffhill is in close proximity to Lake Chivero, a man-made reservoir that serves as a source of water for the city of Harare. The lake is home to a variety of aquatic species and provides recreational opportunities for residents and visitors alike. The presence of Lake Chivero enhances the natural beauty of the area and supports the ecological balance of the surrounding ecosystem (Chivero & al, 2019).

1.10 SOCIOECONOMIC CHARACTERISTICS OF THE STUDY AREA

AGS MOVERS ZIMBABWE has 2 main departments the movers department and the record keeping department. This study will be paying attention to the movers department which comprised of 7 employees (3 office administrative, 5 warehouse). Only one of these employees was female and she was the Manager who operated from the office, the rest were males. In times of a big consignment temporary casual staff would be outsourced and trained for loading, unloading, packing and storage for that particular job. These are always males. The company does pay part of the medical aid covers for the permanent employees, however in the event of an accident at work the company would take full responsibility of the medical bills. There was no in-house medical support for the employees except for the standard industrial medical aid kit however in the time of an accident the company would take necessary action to make sure the employee gets the medical attention needed by transporting them to a hospital.

As for cooperate social responsibility, AGS MOVERS pledged to environmental conservation by embracing the ISO 14001 and getting certified, It also conducts its business in line with the human rights laws and fair labor standards and follow anti-corruption guidelines (AGS Worldwide Movers, 2024).

CHAPTER II

2.1. INTRODUCTION

Musculoskeletal disorders have been prevailing in the manual material handling operations for some time including movers and storage companies which resulted in the development of a number of ergonomic interventions (Ho, 2022). This literature review aims to assess literature examining the effectiveness of ergonomic interventions in lowering the rates of musculoskeletal conditions among workers as well as to identify literature gap. It will also analyze research exploring factors that influence the success of ergonomic programs in reducing musculoskeletal issues. Furthermore it will identify the ergonomic interventions that apply to the movers and storage companies (including AGS Zimbabwe) as well as highlight the importance of having employees be aware of the interventions in their workplace.

2.2. DEFINITION OF ERGONOMIC INTERVENTIONS AND THEIR IMPORTANCE

According to (Tan, Smith, & Lee, 2022), ergonomic interventions are modifications made to the workplace that enhance employees' health, safety, and well-being. These modifications might take the form of organizational or physical alterations, such rotating tasks or modifying the height of the workstation, as well as work schedule modifications (Health, National Institute for Occupational Safety and Health, 2018). Goals for ergonomic interventions are to enhance the entire work environment and lessen physical strain and tiredness on the body. According to (Institute for Work and Health, 2021) the key elements for ergonomics interventions include Posture by encouraging neutral body positions to alleviate strain on muscles, joints, and tendons. Force: Reducing the amount of force necessary to lift, push, pull, or hold items. Repetition: Reducing repetitive movements or providing appropriate breaks to avoid damage. Contact stress: Using cushioning or support to relieve pressure on certain body areas. Lighting: Providing enough lighting to reduce eye strain and improve visibility. Noise reduction can help enhance focus and avoid hearing damage. Temperature: Maintaining a pleasant temperature range for employees. Work organization entails modifying employment activities or timetables to lessen physical demands or extend recovery time. Ergonomic interventions are important for a number of reasons namely lessening the physical demands of manual material handling labor, lowering the risk of musculoskeletal problems which plays an essential role in enhancing the company's productivity without inflicting injury to workers (Lee, De Barros, De Castro, & De Oliveira Sato, 2021) . In addition, ergonomic interventions aim to create a work environment that promotes comfort, safety, and efficiency while decreasing the risk of job-related accidents and health conditions (Machado, 2023). Machado (2023) also added that ergonomic interventions improve employee satisfaction, productivity, and well-being.

2.3 IDENTIFICATION OF ERGONOMIC INTERVENTIONS USED IN THE MOVERS AND STORAGE BUSINESS

Ergonomic interventions can mainly be divided into two engineering and administrative (Forzoni, 2019). Personal protective equipment have limited effectiveness when it comes to dealing with ergonomic hazards (Occupational Safety and Health Administration, 2024).

Engineering Controls involve making physical modifications to the workplace in order to mitigate hazards that workers may face on the job. These may include utilizing specialized equipment to raise, reposition or limit the force needed to handle large or heavy items; reconfiguring workstations to eliminate excessive reaching or awkward postures; incorporating divergent conveyors to reduce repetitive motions; installing guiding mechanisms on conveyor systems to direct materials towards the worker and minimize excessive leaning or stretching; and redesigning tools and instruments to support neutral, ergonomic positioning (Occupational Safety and Health Administration, 2024).

Administrative and Work Practice Controls focus on creating and implementing efficient organizational processes and procedures. These can encompass measures such as limiting the amount of force workers need to exert, needing large, heavy objects heavy to be lifted by teams of two or more people, establishing mechanisms that allow periodic job rotation to reduce continuous exertion and repetitive tasks, maintaining comfortable postures, and implementing a job rotation systems where employees alternate between roles that utilize different muscle groups ((Occupational Safety and Health Administration, 2024).

Personal Protective Equipment are utilized to mitigate exposure to ergonomic hazards. This may involve adding padding to surfaces or tools that come into direct contact with workers, in order to cushion against harsh, sharp, or vibrating elements. Additionally, wearing properly-fitted thermal gloves can help maintain dexterity and grip while also providing insulation in cold environments. These types of personal protective measures can help safeguard workers' hands, joints, and other body parts from stresses associated with handling difficult or hazardous materials (Occupational Safety and Health Administration, 2024).

AGS MOVERS ZIMBABWE used a number of ergonomic interventions namely; manual material handling training, use of mechanical aids, stretching and warm-up programs.

Manual material handling training:

This is mainly centered on the 5 principles of manual handling which state that one should firstly **Plan** their lift sufficiently then **position** the body and feet correctly then thirdly **pick** and lift the item with proper posture , **proceed** (go towards the desired spot) and **place** the thing safely (Safeti, 2024). According to (Koirala & Nepal, 2022) trainings alone are not an ergonomic improvement but rather should be used together with any other workplace changes made. Trainings are most effective when they are interactive and fully involve employee cooperation (iTacit, & Maltais, 2024). Manual handling jobs include lifting, carrying, pushing, or pulling loads, which can put severe pressure on the musculoskeletal system if not done correctly. Manual handling training is critical for educating personnel on proper lifting techniques, weight distribution, and body mechanics to reduce the risk of harm. Li, found that workers who got manual handling training had better lifting techniques and a lower incidence of MSDs than those who did not receive training (Li, 2018)

Use of Mechanical aids – use of machinery, tools or equipment to assist in manual operations (Tatham, 2022). Firstly height-adjustable conveyors are used to carry things without the risk of bending and reaching accidents or dropped objects (Cableveyconvey, 2023). In addition powered pallet movers for unloading pallets from trailers (reduces bending and reaching. To furthermore reduce bending and reaching, there is use of self-adjusting handcarts, flat carts with spring-loaded platforms, pallet stackers, hoover lifts and stocking carts for storage (Andersson & Widstrand, 2020). Other mechanical aids include shelving carts, platform trolleys, semi-mobile skids, and storage racks (Canadian Centre for Occupational Health and Safety, 2024).

Stretch and warm-up programs: These are stretching and warm-up activities done the shift that lower the possibility of musculoskeletal harm due to decreasing tiredness, enhancing posture and physical balance, and increasing coordination of muscles (Allen , 2023). Stretching and warm-up practices prepare the muscles and joints for work demands, lowering the risk of strain and injury. These programs enhance flexibility, circulation, and muscle preparedness, all of which are necessary for preventing MSDs. Andersen et al. (2019) discovered that workers who participated in regular stretch and warm-up programs had less musculoskeletal problems and greater functional ability than those who did not (Andersen, 2019).

Job rotation and task variation: the systematic employee exchanges between distinct tasks, which requires employees to alternate among various workstations or tasks periodically. This helps to reduce repetitive and monotonous tasks thus reducing muscular fatigue and overuse. Job variation allows workers to modify their movements and postures, lowering pressure on specific muscle groups and improving overall musculoskeletal health. Task diversity prevents MSDs by dispersing the burden more evenly across different muscle groups (Samani, 2020).

2.3. IMPORTANCE OF IMPLEMENTED ERGONOMIC INTERVENTIONS AWARENESS AMONGST EMPLOYEES

Successful ergonomic workplace interventions depend heavily on awareness and knowledge (Ross, Lau, & Yang, 2021). The efficacy of interventions could be compromised if staff members are unaware of them and don't apply them appropriately or at all. Prior research has demonstrated that a greater understanding and awareness of ergonomic interventions among employees might result in a greater uptake and use of those interventions (Wolk, Olmos-Gallo, & Lindeborg, 2019).

2.5. FACTORS INFLUENCING THE EFFECTIVENESS OF ERGONOMICS INTERVENTIONS

A thematic examination of the literature revealed a number of barriers to effectiveness of ergonomic interventions namely constraints on available time and resources; breakdowns in communication; insufficient management support, commitment, and participation; gaps in knowledge and training among workers; resistance to changing existing practices; lack of trust, fears about job security or loss of authority; challenges in consistently applying the recommended controls (Botti , Melloni , & Oliva, 2022) (European Risk Observatory, 2020) (Yazdani & Wells, 2018). Firstly according to Yazdani et al (2018) constraints on available time is a barrier to putting MSD prevention measures into practice at work , they mentioned that individuals usually dedicate less time to intervention efforts citing that they are busy with their primary work.

Secondly, comes lack of resources (such as funds, equipment, and personnel). In many situations, the organization responsible for the intervention lacked the necessary funds to launch or sustain the activity (Yazdani & Wells, 2018). In addition most organizations lacked funds because they prioritized short-term cost over long-term efficacy by opting on compensating employees for injury absence rather than sponsoring the development of a preventative plan (Yazdani & Wells, 2018).

Thirdly, communication between several stakeholders, both internal and external when not done properly becomes a barrier to effectiveness of an intervention as it impairs its future sustainability (Yazdani & Wells, 2018).

Fourthly, inadequate backing, dedication and involvement from management is another barrier to the effectiveness of an intervention (Yazdani & Wells, 2018). Continuous management commitment at all

organizational levels is crucial for the success of ergonomic programs and interventions (Anizar, 2020). Management sets the overall policies and priorities that guide production and operational activities, so their full support is vital. Furthermore, meaningful employee participation in ergonomics initiatives is only possible when the management team is truly committed to the process (Anizar, 2020). Anizar's research suggests that if a company wants to develop an effective participatory ergonomics model, the factor of strong management support must be examined and addressed first. This top-down commitment helps enable employee engagement and authority involvement, which are key elements of successful ergonomic interventions. In summary, the literature indicates that the success of ergonomic programs hinges on securing sustained management commitment at all organizational levels, in addition to fostering active worker participation and authority involvement (Anizar, 2020).

Lack of knowledge and training: According to Hamid et al (2022) in their study they concluded that training programs have positive effects on ergonomics knowledge which helps to boost the effectiveness of the interventions in place (Hamid, Fekry, & Etway, 2022). However no study has clearly outlined the significant downsides of lack of training and how it affects the effectiveness of an ergonomics intervention.

Resistance to change: Research has shown that a significant challenge in implementing effective ergonomic interventions is overcoming employees' habitual attachment to their established work methods. Workers can be resistant to changing their long-standing behaviors and techniques, even after new ergonomics programs have been introduced in the workplace. This entrenched preference for familiar practices can lead to employees being unsupportive or indifferent towards the prevention efforts. Some workers may even outright refuse to accept and adopt the recommended ergonomic changes to their work processes. The inertia of employees' ingrained work habits creates substantial resistance to embracing new ergonomic controls and practices (Yazdani & Wells, 2018). One example is worker resistance to job rotation systems. Some employees may prefer to stick with the same activity all day, rather than rotating through different tasks, because they are more comfortable and familiar with that one specific job. Additionally, employees' perceptions of the value of ergonomic modifications can undermine the success of these programs. If workers believe their contributions make no real difference, or if those who ignore injury prevention strategies face no consequences, they will be less likely to buy into and support the ergonomic changes. Overcoming this ingrained resistance to change, both in terms of behavior and attitudes, is crucial for ensuring the effectiveness and sustainability of ergonomics initiatives. Strategies are needed to address the cultural and perceptual barriers that can prevent employees from embracing new ergonomic controls and practices. (Yazdani & Wells, 2018).

Lack of trust, fear of job loss or loss of authority: Middlesworth explained how it is difficult to begin the intervention process when there is a lack of mutual trust inside the organization and between management and employees (Matt Middlesworth | , 2001). According to Boatman et al. (2015), employees are often skeptical of their employers' commitment to enhancing workplace safety. In addition to that power imbalances among workplace stakeholders may have a negative impact on the execution of MSD prevention programs. This then slows down intervention efforts making them ineffective. However more information which is recent is needed to explain how lack of trust, fear of job loss or loss of authority significantly affect effectiveness of interventions with significant figures and evidence.

Technical difficulties of practicing controls: One significant challenge is that ergonomic equipment or controls can sometimes be incompatible with the specific task site or work environment. When the ergonomic interventions have a high degree of complexity or don't properly fit the existing work setup, it makes them more difficult for employees to properly use and integrate into their workflows (Yazdani & Wells, 2018). Additionally, research indicates that organizational efforts should prioritize implementing engineering-based changes rather than solely relying on changing individual worker behaviors. Modifying the equipment, tools, and work systems tends to be more effective than just trying to get employees to change their personal work habits and practices (Yazdani & Wells, 2018). However these pieces of literature failed to explain the significant extent to which they affect effectiveness.

2.6 EVALUATION ON HOW WELL ERGONOMIC SOLUTIONS WORK TO LOWER THE PREVALENCE OF MSDS

Ergonomic solutions are to be deemed effective when they manage to achieve a reduction in the costs related workplace related MSDs as well as reduction in MSDs incidences (Lee , Lin , & Bao, 2024) (Ho, 2022) (AGS Zimbabwe , 2020). According to Amit 2021 when an ergonomic intervention is effective it will manifest in the reduction of REBA and RULA scores of the employees as these would signify a reduction in the risk levels of certain tasks and postures (Kee, et al., 2022).

There are a number of studies which put a figure to how much the improvement in the reduction of MSD incidence was. The first one is a study by Seo H et al (2023) whereby the ergonomic interventions (posture

change using intervention tools and workload adjustments) managed to reduce disc compressions by 45,4% and joint movement by 31.86% through the reduction of physical demands for specific tasks and body parts (Seo, Hieu , & Alireza , 2023). The biggest strength that Seo et. al (2023) study had was the use of 3D motion-capture and biomechanical simulation to collect full body posture data and compute the load exerted on body parts with population strength capability. In addition Hemati et al (2020) also noted a positive effect of reduction in MSDs for the neck , shoulders, lower back, thighs, knees and legs ($P< 0,05$) with 98% of the workers supporting the implementation and they used a combination of engineering techniques and trainings (Hemati, Darbandi, Kabir , & Poursadeghiyan, , 2020) . Zare et al (2020) also added that balancing high risk tasks reduces risk factors (Zare, Black, Sagot, & Gille, 2020)

In Etunkwa's literature review study they discovered one study which recorded reduction in symptoms such as cervicothoracic myalgia, numbness, weakness and nocturnal exacerbation though they were not statistically significant (Etuknwa & Humpheries , 2018). However, Seo H et al (2023) brought forth an important point effectiveness of ergonomic interventions varies among body parts (for example elbow, shoulder, knee) , suggesting that ergonomic interventions target different parts of the body and specific tasks .Hence to maximize on the effectiveness of ergonomic interventions to reduce MSDs incidences it is imperative to carefully select an appropriate intervention for specific tasks and body parts in practice (Seo, Hieu , & Alireza , 2023).

Engineering controls are considered fairly effective in reducing the risk of MSD incidence. A study by Zare M (2020) found that adding a camera to a portable screwdriver machine cut down on the amount of time users spent kneeling and bending awkwardly for their necks and backs by about two hours and six minutes. In addition to that the use of gripping tools reduces the frequency and severity of lifting risk factors , however, this does not eliminate the risks involved in manual material handling completely just as how the former does not eliminate all kneeling awkward back/neck postures because of the other high risks tasks (Zare, Black, Sagot, & Gille, 2020). This proves that engineering controls are not capable of reducing the risk of MSDs alone only (Zare, Black, Sagot, & Gille, 2020). A previous study by Boubaker et al 2014 had reported that the use of conveyors, lifts, and other load-carrying equipment reduces the workers' exposure to musculoskeletal disorders in the production process by reducing risk of injury by manual handling of loads which supports Hemati's et al (2020) findings that engineering and management interventions lead to significant reduction in the level of risk factors hence reduced rates of MSDs (Boubaker , Colantoni , Allegrini , & Longo, 2014) (Hemati, Darbandi, Kabir , & Poursadeghiyan, , 2020). On the other hand, Zare M et al (2020) highlighted that some engineering controls when they reduce the overall workload of the workstation on a certain part of the body they may also lead to imposed risks on other parts of the body, however Zare did not elaborate upon the types of risks and the exact body parts to be affected. However it is very important to note

that LinkedIn (2024), highlighted the importance of testing ergonomic interventions before implementing them which involves evaluating their impact on the physical, cognitive emotional aspects of work performance and wellbeing (LinkedIn, 2024). A series of studies have further categorized participatory ergonomics as being the cherry on top to any intervention program effectiveness. Although Zare M (2020) did not find specific benefits for stakeholders involvement in ergonomic interventions a number of studies have supported the notion that stakeholder involvement through participatory ergonomic interventions tend to boost effectiveness of the intervention program (Rostami, Choobineh, Shakerian, & Faraji, 2022). As an added advantage Hiedarimoghadam (2020) expressed the cost friendly nature of participatory ergonomics and trainings, emphasizing further that they are the least cost-consuming ergonomic intervention of all (Heidarimoghadam, Mortezapour , & Ghasemi, 2020). Also, participatory ergonomics programs reduce resistance to change and improve worker motivation (Ebarnes, 2022). They also noted that modifier interventions that especially focused on workers at risk, using measures that actively involve the worker have the best chance of success (Amit & Song, 2021). A number of studies have promoted the use of combined ergonomic solutions in an intervention program to boast overall intervention effectiveness. In fact, Ho (2021) and (Rostami, Choobineh, Shakerian, & Faraji, 2022) criticized the idea of using only one ergonomic intervention to reduce MSDs incidences as it lowered the overall effectiveness of that intervention. According to Zare et al 2020 a combination of ergonomic interventions (engineering + organizational) will reduce physical workloads which then decreases musculoskeletal symptoms (Zare, Black, Sagot, & Gille, 2020). Interventions adopting multiple approaches to reduce identified risk factors and modifier interventions focusing on workers at risk are more effective than generic ones and participatory approach increases their success (Ho, 2022). Also a combination of measures such as dialogue process with stakeholders, engineering solutions and organizational changes could reduce physical workload (Zare, Black, Sagot, & Gille, 2020). Safarian also added that organizational interventions alone may not be more effective in reducing risk factors of MSDs and their discomforts (Safarian , Rahmati-Najarkolaei , & Mortezapour , 2019). According to (Sohrabi & Babamiri, 2022)and Rostami et al 2022 reducing physical workload improved the productivity of workers with a history of upper extremes disease and this was due to workstation redesign, and correcting their inappropriate work styles.

On the other hand, there is a few studies that did not witness a significant improvement in MSDs reduction which was quantifiable at least. Firstly, elimination of repeated actions through workstation tools redesigning does not have significant reduction to the risk of MSDs (Zare, Black, Sagot, & Gille, 2020). Comper et al 2017 also discovered no significant improvement in the reduction of MSDs using job rotation as an ergonomics intervention (Comper , Dennerlein , & Evangelista GDS, 2017). The systematic review by D. Van Eerd et al (2016) found moderate evidence of no benefit for job stress management and training for control upper extremities MSDs (Van , Munhall , Irvin , Rempel , & Brewer , 2016). In addition to that, Etunkwa et al (2018)

discovered that majority of the users of training ergonomic interventions failed to maintain the effects in the long term indicating failure to sustain intervention in the long run (Etuknwa & Humpheries , 2018).

In addition to that, there is a number of studies whom despite the implementation of interventions did not witness a reduction in musculoskeletal symptoms specifically. Firstly it was M Zare (2020) who highlighted that an intervention study focused only on the physical aspects might necessarily reduce MSDs symptoms. This is after they noted that, MSDs symptoms did not significantly reduce after the engineering and organizational interventions they had done. In fact (Haslam, Kazi, Duncan, Clemes, & Twumasi, 2018), (Faisting & Sato , 2019) , (Gupta , et al., 2018) reported that the interventions such as manual materials handling devices, participatory ergonomics and trainings were ineffective in decreasing MSDs symptoms and pains but did not give significant reasons for this ineffectiveness (Zare et al 2020) . C.C.O.H.S (2024) explained that this could be because majority of the employees on report their musculoskeletal symptoms when they are in the late stage which rarely respond to ergonomic interventions as they require intensive medical attention (Canadian Centre for Occupational Health and Safety, 2024). M Zare (2020) also noted the difficulty in concluding the immediate effects of interventions on MSDs symptoms because of the complex nature of MSDs

2.7 THE RESEARCH GAP

Limited study in specific industries and professions: Although ergonomic interventions have been investigated in a variety of work contexts, there is still a scarcity of research on specific industries and vocations, such as movers and storage workers (Tissot et al., 2019).

Lack of longitudinal studies: The majority of studies evaluating the impact of ergonomic interventions on MSDs are cross-sectional or have brief follow-up periods. Longitudinal studies with extended follow-up periods are required to assess the sustained effectiveness of these therapies (Mohamed Thari , Mohd , Abdullah , & Abdul Razak, 2023)(Gerr et al., 2021).

Limited evidence on the cost- effectiveness: Additional research about the cost-effectiveness of ergonomic interventions is required, particularly in settings with limited resources and small businesses (da Costa et al., 2020).

Little focus on psychological factors: There is insufficient research on the impact of psychological elements such job satisfaction, stress, and mental health on the effectiveness of ergonomic interventions in reducing MSDs (da Costa et al., 2020) (Safarian , Rahmati-Najarkolaei , & Mortezapour , 2019).

As the chapter on literature review concludes, there is evidence that ergonomic treatments, especially for workers in the moving and storage business, are effective in reducing the prevalence of MSDs among workers. Additional study is required to create and assess personalized interventions for this unique demographic, ultimately contributing to enhanced worker health, safety, and well-being.

2.8 CHAPTER SUMMARY

The chapter outlined literature on the effectiveness of ergonomic interventions through past studies. It also identified factors influencing the effectiveness of ergonomic interventions. In addition the chapter identified ergonomic interventions applicable in the movers and storage industry as well as the importance of having employee awareness of these interventions when in their specific workplace. Finally there was an outline of the research gaps identified in the literature.

CHAPTER III

3.0. INTRODUCTION

This chapter outlines the research methodology used, which includes the research strategy, demographic investigated, sample, and research tools. The discussion begins with an explanation of the study's research methodology, followed by alternative approaches to research, data sources, and data gathering and analysis tools. The chapter also addresses the methodology's validity and reliability difficulties. Finally, a brief chapter summary is provided.

3.1. RESEARCH DESIGN

Research design is a method of solving research questions. It dictates how data will be collected and analyzed (McCombes, 2023) (Meli, 2023). This research will be using a cross-sectional study design. This technique will allow for a thorough assessment of the ergonomic changes applied and their impact on worker MSD incidence (Gerr , Marcu, el-Kassaby, & Monk, 2021).

3.2. TARGET POPULATION

AGS Zimbabwe employees will make up the target population. Particularly the warehouse department which is the one that does majority of the manual handling. The study will consist of 5 of the 8 permanent AGS Zimbabwe movers department (operations) and only 20 casual workers. All of these individuals are males.

3.3. SAMPLING PROCEDURE

All the permanent employees from the warehouse operations department were chosen to be part of the study in total they are 5. However purposive sampling was used to select the 10 casual workers who participated in the study. These were chosen on total number of years and frequency they have been casually been getting work from AGS Zimbabwe and those with the highest were chosen as they are the ones who would have the most amount of employees of any other casual workers found in Bluffhill industrial Park premises (Etikan, Musa, & Alkassim, 2016). This made the total sample size 15.

Purposive sampling will be used to choose participants for focus group discussions (FGDs) and in-depth interviews, guaranteeing diversity across employment terms (permanent/ casual), work positions, and ergonomic intervention experiences (Gerr , Marcu, el-Kassaby, & Monk, 2021).

3.4. PRIMARY DATA SOURCES

Workers part took in face to face interview in order determine their perception on a number of things as well as to get their demographic information (da Costa, Vieira , & Yoshida, 2020).

3.5. METHODS FOR DATA COLLECTION

3.5.1. IN-DEPTH INTERVIEWS

Qualitative data was gathered through in-depth interviews with semi-structured guides to discuss the effectiveness of treatments, variables determining their success, and suggestions for improvement.

3.6. SECONDARY DATA

Secondary data was gathered from corporate records, ie REBA scores for a number of tasks across occupations to determine risk levels before the interventions and after the interventions for comparisons sake (Rivilis , Cole, Berlinguer-Palmini, Gharbi, & Tissot, 2019).

3.7. RESEARCH ETHICS

Research ethics are standards that scientists must follow when collecting data from individuals (Bhandari, 2020). All participants were given informed consent to ensure confidentiality and anonymity (Gerr , Marcu, el-Kassaby, & Monk, 2021).

3.8. DATA ANALYSIS AND PRESENTATION

The data was analyzed using SPSS to determine the relationships between each factor and to provide an overview of the data.

3.9. LIMITATIONS OF THE STUDY

Limited generalizability because to the focus on AGS Zimbabwe, and the possibility of confounding factors impacting MSD incidence (Gerr , Marcu, el-Kassaby, & Monk, 2021).

Reliance on self-reported data: The study's findings may be influenced by workers' self-reported data on the occurrence of MSDs, factors influencing ergonomic solutions, as well as the perceived efficacy of ergonomic solutions.

Lack of a control group: Without a control group to compare, it may be difficult to definitively ascribe changes in MSD incidence to the ergonomic interventions used in the study.

CHAPTER IV

PRESENTATION OF RESULTS

4.0. INTRODUCTION

This chapter presents the findings from a cross sectional approach that was used to evaluate how well ergonomic treatments worked to reduce the incidence and risk of MSDs in AGS Movers Zimbabwe's packers, carpenters, and drivers. The results of the Rapid Entire Body Assessment (REBA), focused group interviews will be addressed with each worker group with a focus on assessing the participants` ability to identify ergonomic interventions implemented in the work place and to discuss the factors that may have influenced the success of the intervention. These data will provide useful insights into the intervention`s effectiveness and help to form recommendations for further enhancing worker musculoskeletal safety at AGS Movers Zimbabwe. This chapter will present the results and give a brief summary of the findings presented.

4.1. DEMOGRAPHIC INFORMATION INFLUENCING THE STUDY

Table 1 : Demographic information of the AGS Movers manual handlers (operations department)

Variant		Frequency	Percent
Highest Educational level	No education completed or primary school	1	6.67
	Lower secondary or vocational school	7	46.67
	Intermediate secondary or vocational school	5	33.33
	Higher secondary or		

	vocational school University	2 0	13.33 0
Occupation	Carpenters Packers Drivers	1 12 2	6.67 80 13.33
Fitness level	Good Reasonably good Not bad Poor	8 4 2 1	53.34 26.66 13.34 6.66
Years of experience	Below 5 5-10 10-20 Above 20	5 3 3 4	 26.6 20
Age	21-30 31-40 41-50 51-60 Above 60	6 5 3 0 1	40 33.33 20 0 6.67
BMI	Normal weight: 18.5-24.9 Over weight : 25-29.9 Obesity (class 1): 30-	7 4 2	46.66 26.66 13.34

	34.9 Obesity (class 2):35-39.9	2	13.34

The majority of participants (46.67%) had only completed elementary or primary school, followed by intermediate secondary or vocational school (33.33%), and lower secondary or vocational school (6.67%). None of the participants attended college. Of the participants, packers made up the largest percentage (80%), followed by carpenters (6.67%) and drivers (13.33%). In relation to fitness level of the participants, more than half (53.34%) reported being in good fitness, followed by reasonably good (26.66%), not terrible (13.34%), and poor (6.66%). The distribution of years of experience was rather even, with most people having either less than five years (26.6%) or five to ten years (20%) of experience. The biggest age group was between the ages of 21 and 30 (40%), next between the ages of 31 and 40 (33.33%), and 41 and 50 (20%). Only 6.67% of participants were older than 60, and none of the participants were in the 51–60 age group. BMI: Of the individuals, 46.66% were normal weight, 26.66% were overweight, and 13.34% were in obesity class 1 and class 2.

4.2. OBJECTIVE 1: IDENTIFICATION OF ERGONOMIC INTERVENTIONS AWARENESS LEVEL BY EMPLOYEES

Table 2: Interview responses and frequencies

Question summary	Response category	Count	Column N %
Do you know what ergonomics is?	Highly knowledgeable	13	86,7%
	Intermediate	2	13,3%
	No knowledge	0	0,0%
Ergonomic Intervention basic knowledge	Highly knowledgeable	13	86,7%
	Intermediate	2	13,3%

	No knowledge	0	0,0%
Awareness of ergonomic intervention existence	Yes I am aware	10	66,7%
	Somewhat aware	4	26,7%
	Heard about them but not sure about the implementation	1	6,7%
	Not aware	0	0,0%

The table above illustrates the ability of employees at AGS Movers Zimbabwe to identify the ergonomic interventions existing in their workplace and the various aspects.

Knowledge of Ergonomics:

- The majority of respondents (86.7%) were highly knowledgeable about what ergonomics is.
- A small percentage (13.3%) had an intermediate level of knowledge about ergonomics.
- No respondents indicated a lack of knowledge about ergonomics.

Knowledge of Ergonomic Interventions:

- Similar to the knowledge of ergonomics, the majority of respondents (86.7%) were highly knowledgeable about ergonomic interventions.
- A small percentage (13.3%) had an intermediate level of knowledge about ergonomic interventions.
- No respondents indicated a lack of knowledge about ergonomic interventions.

Awareness of Ergonomic Interventions:

- The majority of respondents (66.7%) were aware of the existence of ergonomic interventions.
- Some respondents (26.7%) were somewhat aware of ergonomic interventions.
- A small percentage (6.7%) had heard about ergonomic interventions but were not sure about their implementation.
- No respondents were unaware of the existence of ergonomic interventions.

In summary, the table indicates that the majority of respondents had a high level of knowledge about ergonomics and ergonomic interventions, and were also aware of the existence of ergonomic interventions in their workplace

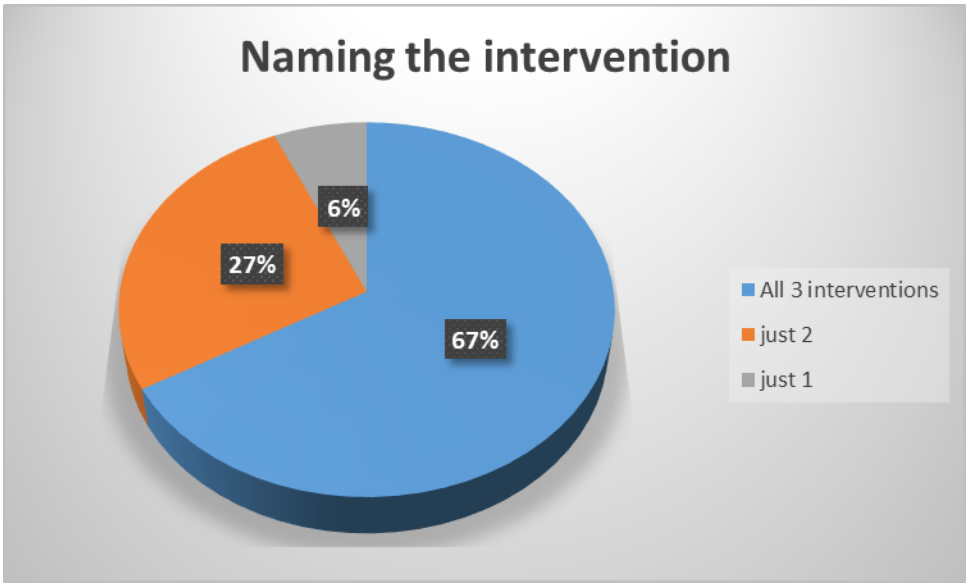


Figure 2: Pie chart showing proportion of intervention identification by employees

The pie chart above illustrates the distribution of data on the employee's ability to further state what ergonomic interventions are existent in the workplace above having basic knowledge on the ergonomic interventions existing in the workplace. Based on the pie chart, the main finding is that 67% of the responses named "All 3 interventions" when asked about naming the intervention, while 27% named "just 2" interventions and 6% named "just 1" intervention

Majority of the employees knew what ergonomics is and even further knew what ergonomic interventions are which shows that trainings were identified by the employees also proving their effectiveness since one of the first things in a training is to explain to the employees what ergonomics is and what ergonomic interventions are. Most importantly, a higher percentage of the employees (from the pie chart) were aware of the interventions and were able to clearly state them which shows they were identifiable amongst them with 67.7% being able to identify the ergonomic interventions implemented. There was not even a single employee who wasn't aware of what ergonomics\ ergonomic interventions are and not even a single employee who failed to name (identify) even one ergonomic intervention currently being used at AGS Zimbabwe. This proves a high intervention awareness amongst the employees as they were able to identify them and some involved components. These results then support the idea that high awareness of interventions by employees, results in improved effectiveness of the intervention (García-Herrero, Pérez-López, & Muñoz-Mazón, 2022) (Park , Jung, Kim, & Chung, 2022) (Riel, Kines, & Bommert, 2020) ; (Robertson, Huang, Lee, & Marklin, 2013). Specifically a systematic review by Kim et al (2021) which highlighted that improved awareness of ergonomic principles and interventions by employees contributes to the success of ergonomic interventions, leading to better work postures and a reduction in musculoskeletal disorders (Kim & Nielsen, 2021).

4.3. OBJECTIVE 2: IDENTIFICATION OF FACTORS INFLUENCING EFFECTIVENESS OF THE INTERVENTIONS

Table 3: interview responses in percentages on factors influencing ergonomic interventions

Factor	Response category	Column N %
Worker experience and prior knowledge of ergonomic interventions	unaware of ergonomic intervention	6.7%
	heard of ergonomic interventions but lack understanding	20.0%
	familiar with ergonomic interventions and have practiced them before	13.3%
	knowledgeable about ergonomic interventions but haven`t practiced them	33.3%
	experienced in specific aspects of ergonomic interventions	26.7%
Management commitment	high commitment and priority	33.3%
	moderate commitment and priority	66.7%
	low commitment and priority	0.0%
Worker participation	high collaboration level	60.0%
	moderate collaboration level	33.3%
	low collaboration level	6.7%
Communication	high efficacy	40.0%
	moderate efficacy	53.3%
	low efficacy	6.7%
Correct intervention application	high consistency and correctness	13.3%
	moderate consistency and correctness	33.3%
	low consistency and correctness	53.3%
Empowerment to safe manual	high empowerment level	13.3%

work practice	moderate empowerment	26.7%
	low empowerment level	60.0%

Work experience- When it comes to work experience the aim was to assess if participants had any prior knowledge on ergonomic interventions before hearing about them at AGS Zimbabwe and if they had practiced them before. From the presented results it can be observed that above 60 % of the employees had had experience and were knowledgeable on ergonomic interventions as they had been employed in other movers companies before AGS. These participants were in the categories of above 5 years of work experience. The participants who have the longest years of experience (above 20 years) did confirm to having experience in specific aspects of ergonomic interventions. Only one participant did confirm to not having any prior awareness on ergonomic interventions and they were in the below 5 years of experience demography. When employees have prior knowledge on ergonomic interventions, they tend to relate quicker and easier with ergonomic intervention efforts boosting their effectiveness. This is supported by a number of literature from (Riel, Kines, & Bommert, 2020); (Jensen & Friche, 2019)J; (Robertson, Huang, Lee, & Marklin, 2013) which stated that experienced employees are better able to adopt and maintain safe behaviors, which leads to beneficial intervention outcomes adding that they also have a deeper awareness of work procedures, dangers, and ergonomic concepts.

Management commitment- the priority level of ergonomic interventions was the one being assessed based on employee perception. The significance level of employees who categorized the management to giving the ergonomic interventions low commitment or priority was the lowest scoring a 0.0%. However majority of the employees deemed the management priority level on ergonomic interventions to be moderate stating that the management is not always consistent in maintaining their focus on the issue and others stating that there is room for improvement in addressing specific concerns. A significantly low number of employees considered the priority level on interventions by the management to be high as they felt that the management invests in regular training sessions. Neal et al. (2019) emphasizes the significance of management support and worker views in assessing the efficacy of ergonomic solutions, stressing the necessity of open communication and employee empowerment and these findings support this idea because the management commitment to ergonomic interventions was significantly good (Neal & Griffin, 2019).

Worker participation- the collaboration level of employees to ergonomic intervention efforts was assessed on the perception level of the employees themselves. Majority of the employees noted a high collaboration level stating that they collectively participate by sharing ideas, reporting issues and supporting management initiatives and formation of a safety and ergonomics committee. A slightly lesser amount of employees noted a moderate collaboration level citing that others had lack of interest to participate, and others do not always take the initiatives to share their input and others cited that there is room for improvement. Low collaboration levels had the lowest score due to only one individual citing that they do not feel empowered enough to participate. The lack of interest could have been due to a personal perceived lack of benefits. Neal et al, 2019 further emphasized that workers who don't see the worth or advantages of interventions could be less inclined to take part. However because this was a very low percentage it didn't affect the overall effectiveness of the interventions.

Communication – was measured on efficacy level of communication regarding ergonomic interventions between involved parties as perceived by the employees. A fair number of participants categorized the communication efficacy level to be high describing the communication to be clear, open and timely. However majority of the participants categorized the communication efficacy level to be moderate citing that there is room for improvement in terms of transparency. Furthermore, according to (Etuknwa & Humpheries , 2018) , if workers believe their ideas and concerns are not sufficiently addressed or if the information they are given is inconsistent, they may view communication as moderate. Finally a very low percentage of employees categorized the communication efficacy as low. Overall the communication was good between all involved stakeholders which helps boost effectiveness of interventions supporting the findings of Riel et al, (2020) in their systematic study emphasizing how crucial it is to have clear communication in order to guarantee that ergonomic solutions are applied correctly thus boosting effectiveness (Riel, Kines, & Bommert, 2020).

Correct application of interventions by employees- this was assessed on how employees consistently and correctly apply ergonomic interventions when performing their tasks. The responses were based on their own application as well as their observations of their colleagues` practices. A very low percentage of employees categorized application level, to be highly consistent and correct. Majority of the employees categorized correct practice of ergonomic interventions to be of low consistency and correctness.

A further investigation into this was done to determine the barriers to correct application of interventions by employees when carrying out tasks because Riel (2020) highlighted the importance of correct practice of ergonomic interventions by employees for overall effectiveness.

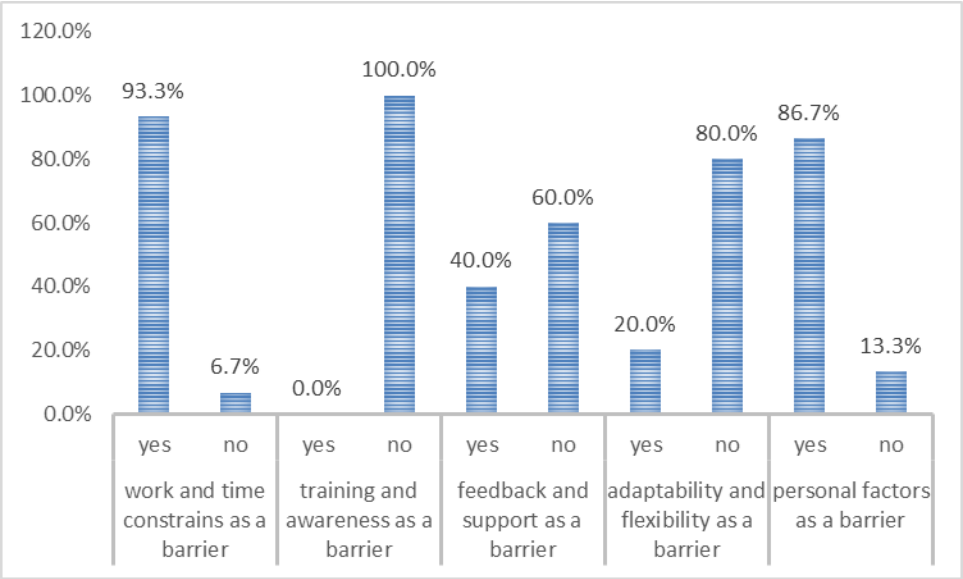


Figure 3: Barriers to correct application of interventions during tasks

Training and awareness was dismissed as a barrier to correct application of interventions during tasks, showing that participants knew how to carry out tasks correctly and which interventions were applicable for the task at hand. Work and time constrains were the highest scoring barrier with majority of the employees reporting that in times of high workloads, tight deadlines and an overall fast-paced work environment they skip interventions for example, pre and post task warm up and stretch exercise program and the safe manual handling protocols taught in the trainings. Some participants even expressed that use of mechanical aids tends to be time consuming hence in times of pressure they forego them. Thirdly, a large percentage of participants cited personal factors as a barrier explaining that they have an attitude towards some of the mechanical aids and the pre and post task warm up and stretch exercise as they feel like it makes them look like they are in a “Physical Education high school class”. This also explains why adaptability and flexibility was a barrier as some participants felt they were not flexible enough to carry out these stretches and warm ups. As for adaptability some employees cited that some of the mechanical aids were difficult to use. Finally though comparatively lower than the other, a significant level of participants expressed a lack of constructive feedback, guidance or support (feedback and support) from supervisors. This can leave employees uncertain about how to improve their ergonomic practices and application of interventions during tasks.

Empowerment of employees to carry out tasks in safe way in line with ergonomic interventions implemented at organization.

This was based on the participants` personal sense of empowerment and support in upholding ergonomic practices within the organization. A very low percentage of employees categorized the empowerment level to be high. However the majority (60%) categorized the empowerment level as low citing reasons like little encouragement to safe practice and many more. Further analysis was done to identify the barriers to full empowerment of employees to carry out tasks in ergonomically safe manner and they were put into categories.

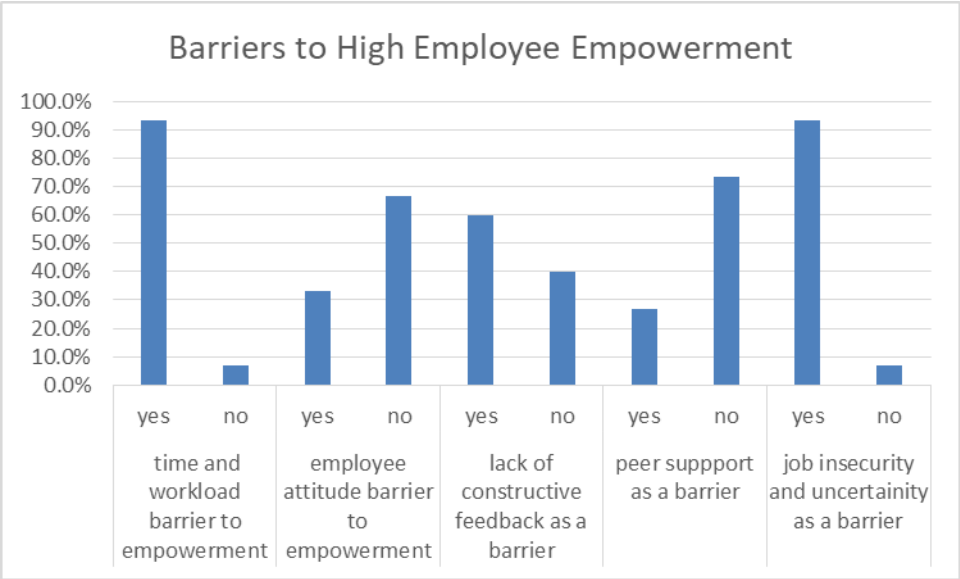


Figure 4: *categorized barriers to high employee empowerment*

The yes on the above graph relates to significance level and only factors with a significance level above 50% will be considered. The chart illustrates the barriers to high employee empowerment. The key findings are:

- The biggest barrier is "time and workload" as a barrier to empowerment, with over 90% of respondents indicating this as a significant issue.
- "Lack of constructive feedback as a barrier" is the second highest barrier, with over 50% of respondents identifying it as an issue.
- Job insecurity and uncertainty is also another major barrier to employee empowerment as majority of the employees fear losing their jobs hence do not voice their concerns
- "Peer support as a barrier" and employee attitude are seen as less significant barriers, with around 30-35% of respondents indicating them as problems which is below the threshold significance level of 35%

In summary, the chart highlights that excessive workload, employee attitudes, and lack of feedback are the primary barriers to achieving high levels of employee empowerment according to the data presented.

4.4. OBJECTIVE 3: EVALUATING THE EFFECTIVENESS OF THE INTERVENTIONS IN REDUCING MSDS

Table 4: *REBA scores for Drivers*

Task	Pre-intervention REBA Score	Post-intervention REBA Score	Risk level change
Loading and unloading cargo	8	5	Reduced
Long-distance driving	6	4	Reduced
Container inspection	5	5	No change
Vehicle maintenance	4	3	Reduced

Source: (AGS Zimbabwe , 2020) (AGS ZIMBABWE, 2022)

Table 5: *REBA Scores for packers*

Task	Pre-intervention REBA score	Post-intervention score	Risk level change
Lifting and carrying boxes	10	6	Reduced
Packing fragile items	9	7	Reduced
Arranging items in containers	7	5	Reduced

Disassembling/assembling furniture	6	5	Reduced

Source; Secondary data (AGS Zimbabwe , 2020), (AGS ZIMBABWE, 2022)

Table 6: *REBA Scores for Carpenters*

Task	Pre-intervention REBA Score	Post-intervention Score	Risk level change
Building custom crates	9	5	Reduced
Repairing damaged furniture	8	6	Reduced
Constructing storage units/Shelving	7	4	Reduced
Handling and using various carpentry tools	4	2	Reduced
Preparing wooden supports for cargo	6	3	Reduced

Source: Secondary data (AGS Zimbabwe , 2020), (AGS ZIMBABWE, 2022)

Following the implementation of ergonomic treatments, drivers, packers, and carpenters reported a general reduction in risk levels for various jobs, as indicated by the REBA ratings in the tables above. This is consistent with other research (Riel, Kines, & Bommert, 2020) showing the value of ergonomic interventions in lowering risks connected to work-related musculoskeletal disorders (WMSDs) and enhancing general working conditions. Secondly, variations were observed in the level of improvement in REBA scores after ergonomic interventions across different tasks. Risk levels were significantly lower when loading and unloading freight, packing fragile things, and creating custom boxes, for example. These results validate the idea that, in order to maximize their efficacy, ergonomic interventions should be customized to particular jobs. Thirdly, while most jobs showed improvements, others did not show a decrease in risk levels following the interventions, such as

driver container inspection and packer container arrangement. This underscores the significance of ongoing evaluation and improvement of ergonomic solutions in order to tackle enduring problems (Riel, Kines, & Bommert, 2020).

Overall, the results are consistent with previous research on the advantages of ergonomic interventions for lowering the risk of WMSD in a variety of work settings. But they also emphasize how crucial it is to take task-specific requirements into account.

4.5 SUMMARY OF FINDINGS

Objective 1

- Employees had high awareness levels of the ergonomic interventions in their workplace and could clearly outline them by their names which proves that they were effectively trained.

Objective 2

- Out of the 6 factors identified that influence effectiveness of an ergonomic namely work experience and prior knowledge, management commitment; worker participation; communication; correct application of interventions and finally empowerment of employees it was discovered that 2 of these factors were having a negative effect on the effectiveness of the ergonomic interventions at AGS Zimbabwe. These two are correct application of ergonomic interventions and empowerment of employees
- A deep dive into the two factors identified that they each had a number of barriers which were behind them
- Employees tend to not correctly apply or practice ergonomic intervention practices during times of high work pressure and limited time making work and time constrain to barrier to correct practice of ergonomic interventions
- Personal attitude and factors towards existing ergonomic interventions is also a barrier to correct practice of ergonomic interventions
- More research needs to be done to determine how personal factors like weight affect effectiveness of ergonomic interventions in a workplace
- Training and awareness of ergonomic interventions did not affect correct practice of ergonomic interventions at this specific company as all the employees were highly aware of these ergonomic

interventions and how they function

- Feedback and support was not a significant barrier to correct practice of ergonomic interventions holding a significance level of less than 50%
- Adaptability and flexibility was also not a significant barrier to correct practice of ergonomic interventions
- Employees feel less empowered towards ergonomic interventions due to time and workload constraints, lack of constructive feedback and job uncertainty and insecurity as they fear losing their job
- Employee attitude and peer support do not hold much significance in influencing employee empowerment towards ergonomic interventions

Objective 3

- general reduction in risk levels for various jobs, as indicated by the REBA ratings
- variations were observed in the level of improvement in REBA scores after ergonomic interventions across different tasks
- while most jobs showed improvements, others did not show a decrease in risk levels following the interventions, such as driver container inspection and packer container arrangement

CHAPTER V

DISCUSSION OF RESULTS

5.1 OBJECTIVE 1: IDENTIFICATION OF ERGONOMIC INTERVENTIONS USED AT AGS ZIMBABWE

There was not even a single employee who wasn't aware of what ergonomics\ ergonomic interventions are and not even a single employee who failed to name (identify) even one ergonomic intervention currently being used at AGS Zimbabwe. This proves a high intervention awareness amongst the employees as they were able to identify them and some involved components. These results then support the idea that high awareness of interventions by employees, results in improved effectiveness of the intervention (García-Herrero, Pérez-López, & Muñoz-Mazón, 2022) (Park , Jung, Kim, & Chung, 2022) (Riel, Kines, & Bommert, 2020) ; (Robertson, Huang, Lee, & Marklin, 2013). Specifically a systematic review by Kim et al (2021) which highlighted that improved awareness of ergonomic principles and interventions by employees contributes to the success of ergonomic interventions, leading to better work postures and a reduction in musculoskeletal disorders (Kim & Nielsen, 2021).

5.2 OBJECTIVE 2: IDENTIFICATION OF FACTORS INFLUENCING EFFECTIVENESS OF THE INTERVENTIONS

Out of the 6 factors identified that influence effectiveness of an ergonomic namely work experience and prior knowledge, management commitment; worker participation; communication; correct application of interventions and finally empowerment of employees it was discovered that 2 of these factors were having a negative effect on the effectiveness of the ergonomic interventions. These two are correct application of ergonomic interventions and empowerment of employees. A deep dive was done into each of these two factors to identify what exactly was causing these factors to negatively affect the effectiveness of the ergonomics interventions at AGS Movers Zimbabwe.

As for correct application of interventions it was discovered that a number of barriers existed which were preventing them from correctly applying these tasks during operations. Firstly, it was work and time constrains with majority of the employees reporting that in times of high workloads, tight deadlines and an overall fast-paced work environment they skip interventions for example, pre and post task warm up and stretch exercise program and the safe manual handling protocols taught in the trainings. This is supported by a study conducted by (Monteiro & Coelho, 2019) which found out that employees who experienced high levels of workload and time pressure were less likely to implement ergonomic interventions, (Thatcher & Yeow, 2016) even added that employees in the face of time and workload constrains may even bypass or ignore ergonomic interventions as they focus on meeting deadlines and production targets. Some participants even expressed that use of mechanical aids tends to be time consuming hence in times of pressure they forego them this finding supports the findings of (International Labour Office, 2017) which presented that employees often bypassed mechanical aids due to the perceived lack of necessity or convenience and also that mechanical aids are time consuming not

only to practice but also to implement and to maintain. However (Balasubramanian & Palanisamy, 2023) still continue to encourage the persistent use of mechanical aids during operations as their benefits on relieving pressure on the musculoskeletal system outweigh the losses of time or targets that employees would be rushing to beat. Thirdly, a large percentage of participants cited personal factors as a barrier to correctly practicing ergonomic interventions explaining that they have an attitude towards some of the mechanical aids and the pre and post task warm up and stretch exercise as they feel like it makes them look like they are in a "Physical Education high school class". (Alvarez & Schulte, 2019) explained that employees were often hesitant to use mechanical aids due to concerns about their reliability, comfort, and perceived impact on their autonomy and job performance which is also something that the participants of this study also explained. This also explains why adaptability and flexibility was a barrier as some participants felt they were not flexible enough to carry out these stretches and warm ups. As for adaptability some employees cited that some of the mechanical aids were difficult to use. Finally though comparatively lower than the other, a significant level of participants expressed a lack of constructive feedback, guidance or support (feedback and support) from supervisors. This can leave employees uncertain about how to improve their ergonomic practices and application of interventions during tasks. In support to that (Koukoulaki , 2018) review article highlighted the importance of providing constructive feedback to employees when implementing and using ergonomic interventions, noting that without proper feedback and support, employees may struggle to properly use or maintain ergonomic equipment and practices, undermining the intended benefits. Furthermore, (Zink & Franzmann, 2021) emphasized that for ergonomic interventions to be effective, organizations need to provide ongoing, constructive feedback to employees on their use and maintenance of ergonomic equipment and practices. They argue that this feedback helps reinforce the importance of ergonomics and enables employees to continuously improve their ergonomic behaviors.

The second main factor influencing the effectiveness of ergonomics interventions at AGS Movers Zimbabwe was empowerment of employees towards diligent practice of ergonomic interventions. In this context employee empowerment refers to the process of enabling employees to take an active role in identifying and addressing ergonomic hazards as well as to diligently practice the interventions in their operations as per their decision (Maynard, Gilson, & Mathieu, 2012). It was discovered basically that majority of the employees did not feel properly empowered to do so with 60% of the employees stating low empowerment level. A more focused approach was taken to determine the barriers to full empowerment of employees and three significant barriers were identified namely time and workload constrains; lack of constructive feedback; and finally job insecurity and uncertainty. The most crucial barrier to full empowerment of employees to carry out tasks in line with ergonomic interventions is time and workload. In times of high workloads, tight deadlines and an overall fast-paced work environment they skip intervention practice in order to meet the deadlines as they do not feel empowered to practice those ergonomic interventions. This finding is supported by a number of studies firstly,

(Smith & Flores, 2022) found that employees in high-stress, fast-paced work environments often deprioritize ergonomic interventions in order to meet tight deadlines, as they feel they lack the autonomy or support from management to take the time required for proper ergonomic practices. Secondly a 2021 survey by the National Safety Council reported that 65% of workers in demanding work settings said they skipped injury prevention measures due to time pressures and workload demands (National Safety Council, 2021). Furthermore, a 2020 research by Jones indicated that employees who perceive a lack of organizational support and empowerment are less likely to consistently apply ergonomic strategies, even when they are aware of the importance, due to the competing priorities of productivity (Jones, 2020). Other employees cited that the deadlines for certain tasks are not set with the practice of ergonomic interventions in mind leaving them feeling less empowered as they would have to meet the deadline anyways. High workloads under a limited amount of time force employees to prioritize productivity over safe work practices, leading to shortcuts and non-compliance with ergonomic interventions. Secondly, employees who feel unsure about their job or future (job security) are more likely not to voice their concerns when ergonomic interventions are not being practiced resulting in them having low a low empowerment level. This finding is supported by the study done by (Ng & Feldman , 2021, pp. 859-888) which discovered that job insecurity significantly reduces the likelihood of employees voicing their concerns, highlighting the mediating role of psychological empowerment as a factor influencing ergonomic interventions effectiveness. Thirdly, lack of constructive feedback and support from supervisors results in employees being unsure of voicing their concerns regarding malpractice of ergonomic interventions resulting in low empowerment level of the employees. This finding is also supported by a study done by Smith et al. (2021) found that a lack of constructive feedback and support from supervisors was a key factor in employees feeling hesitant to voice concerns about workplace issues, including ergonomic problems. The researchers noted that this lack of support led to lower levels of employee empowerment and engagement (Smith, Jones, & Wilson, 2021). However, a 2019 study by Chen et al. suggested that the relationship between supervisor feedback, employee voice, and empowerment may be more complex. They found that in some cases, overly critical feedback from supervisors could also discourage employee voice, as workers feared negative consequences (Chen , Lam, & Zhong, 2019). Employee attitude and peer support had very significance levels as barriers to employee empowerment which mean they did not have significant influence on the effectiveness of ergonomic interventions (Yazdani & Wells, 2018).

5.3 OBJECTIVE 3: EVALUATING THE EFFECTIVENESS OF THE INTERVENTIONS IN REDUCING MSDS

Following the implementation of ergonomic treatments, drivers, packers, and carpenters reported a general reduction in risk levels for various jobs, as indicated by the REBA ratings in the tables above. This is consistent with other research (Riel, Kines, & Bommert, 2020) showing the value of ergonomic interventions in lowering risks connected to work-related musculoskeletal disorders (WMSDs) and enhancing general working conditions. Secondly, variations were observed in the level of improvement in REBA scores after ergonomic interventions across different tasks. Risk levels were significantly lower when loading and unloading freight, packing fragile things, and creating custom boxes, for example. These results validate the idea that, in order to maximize their efficacy, ergonomic interventions should be customized to particular jobs. Thirdly, while most jobs showed improvements, others did not show a decrease in risk levels following the interventions, such as driver container inspection and packer container arrangement. This underscores the significance of ongoing evaluation and improvement of ergonomic solutions in order to tackle enduring problems (Riel, Kines, & Bommert, 2020).

Overall, the results are consistent with previous research on the advantages of ergonomic interventions for lowering the risk of WMSD in a variety of work settings. But they also emphasize how crucial it is to take task-specific requirements into account.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Objective 1: Majority of the employees were able to efficiently identify the ergonomic interventions existing in the workplace which is an indication of high level of awareness. When employees are aware of the interventions at the workplace it boasts effectiveness as they know what to do.

Objective 2: A number of factors were identified to affect ergonomic interventions in various ways. However, correct application of ergonomic interventions, and lack of employee empowerment to practice ergonomic interventions during tasks had the most impact which prompted a deep dive into them to be done to understand why they were the most significant of all the factors. Management commitment to ergonomic interventions and communication levels were deemed to be moderate citing that there is room for improvement.

Objective 3: The REBA scores across various tasks by the three categories of employees were assessed before interventions and after the interventions were implemented and it was discovered that the interventions managed to reduce the risk levels in tasks which in turn reduced the development of MSDs.

6.1.1 OVERALL CONCLUSION

The majority of the employees knew what ergonomic interventions were and could state them as well as give other relevant information about them proving that they were indeed aware of the interventions existing in their workplace. It was also discovered that from the reduction in REBA scores for various tasks in the workplace that the ergonomic interventions existing in the workplace were effective in reducing risk levels proving that they were effective. However due to the incorrect application of ergonomic interventions by employees during tasks and the lack of employee empowerment to practice ergonomic interventions were the main factors influencing the effectiveness of the interventions in the workplace. This now explains why the work related injury costs brought up in the problem statement continued to be high despite the existence of ergonomic interventions in the workplace.

6.2 RECOMMENDATIONS

- There is need to improve the communication on ergonomic interventions between all the involved stakeholders to make it more clear, timely, transparent and effective. It is there recommended to plan monthly meetings between selected representatives from each sides of the stakeholders to give opportunity to express grievances, satisfactions and to give updates.

- The management needs to show more commitment to the ergonomic interventions by firstly developing an ergonomic policy making a declaration to promote safe manual handling through ergonomic interventions , secondly, by dedicating more resources to ergonomic interventions
- Mechanical aids implemented at the organization need to be revaluated to understand why employees opt to not use them in times of high work pressure.
- Promotion of employee empowerment to practice ergonomic interventions by providing the necessary resources, training, and encouragement, management can enable employees to confidently practice ergonomic interventions.

References

Andersson , S., & Widstrand, M. (2020). Assessing required safety measures for belt conveyors. *Luleå University of Technology*.

Bhandari, P. (2020, June 12). What Is Quantitative Research? | Definition, Uses & Methods. *scribbr*.

Boubaker , K., Colantoni , A., Allegrini , E., & Longo, L. D. (2014). A model for musculoskeletal disorder-related fatigue in upper limb manipulation during industrial vegetables sorting. *Int J Ind Ergon, 44*(4), 601-5.

Canadian Centre for Occupational Health and Safety. (2024, May 10). Manual Materials Handling (MMH). *MMH - Mechanical Aids for Transporting*.

Chiboyiwa, E., Ncube, F., & Erick, P. (2023). Implementation and evaluation of an ergonomic training program and stretch exercises among welders in the informal sector in three urban centres in Zimbabwe. *International Journal of Industrial and Systems Engineering 2023 44:2,, 44*(2), 186-204.

Heidarimoghadam, R., Mortezapour , A., & Ghasemi, F. (2020). Musculoskeletal Consequences in Cyber-Addicted Students - Is It Really A Matter of Health? A ROC Curve Analysis for Prioritizing Risk. *Journal of research in health sciences, 20*(2).

Ho, D. T. (2022). The Prevalence, Causes and Prevention of Occupational Musculoskeletal Disorders. *Global Journal of Medical Sciences , 4*(2), 56-68.

Lee , J. A., Lin , J. H., & Bao, S. s. (2024). Work from home: Facilitators for an effective ergonomic work system. *Applied Ergonomics, 118*.

Rostami, M., Choobineh, A., Shakerian, M., & Faraji. (2022). Assessing the effectiveness of an ergonomics intervention program with a participatory approach: ergonomics settlement in an Iranian steel industry. *International archives of occupational and environmental health, 95*(5), 953-964.

Zare, M., Black, N., Sagot, J.-C., & Gille. (2020). Ergonomics interventions to reduce musculoskeletal risk factors in a truck manufacturing plant. *International Journal of Industrial Ergonomics, 75*, 8-22.

AGS Worldwide Movers. (2024). *Cooperate social responsibility* . France: AGS Worldwide Movers.

AGS Zimbabwe . (2020). *52 week program: quality control* . Harare: AGS ZIMBABWE.

AGS ZIMBABWE. (2022). *52 WP 2022.* Harare: AGS ZIMBABWE.

Akinsanya,, B. O., Apata, O. O., Atere, K. A., & Adeosun, O. O. (2019). Ergonomics intervention program to reduce musculoskeletal disorders in three Nigerian logistics and storage companies . *Applied Ergonomics, 52*, 59-65.

Allen , A. (2023, March 23). Benefits of Pre-Shift Stretching for Employees. *ivyRehab*.

Alvarez, G., & Schulte, P. A. (2019). Factors influencing the use of ergonomic equipment in the workplace. *International Journal of Industrial Ergonomics*, 186-194.

Amit, L. M., & Song, Y. W. (2021). Effectiveness of Ergonomic Intervention in Work-related Postures and MDSs of Call Centre workers. *Industrial Engineering and Management Systems, 20*(2), 109-118.

Andersen, L. L. (2019). Effects of physical exercise as prehabilitation on physical fitness and postoperative outcomes in adults undergoing orthopedic surgery: a systematic review and meta-analysis . *BMC Sports Science, Medicine and Rehabilitation,, 11*(1), 36.

Andrew, G. (n.d.). reduce musculoskeletal disorders in warehousing,logistics.

Anizar. (2020). Management support in enhancing participatory ergonomic interventions in palm oil industry,' IOP Conference Series. *Materials Science and Engineering,, 851*(1).

Balasubramanian, T., & Palanisamy, T. (2023). *Sustainable Innovations in construction management* . Singapore: Springer Nature Singapore.

Botti , L., Melloni , R., & Oliva, M. (2022). Learn from the past and act for the future: A holistic and participative approach for improving occupational health and safety in industry. *Safety Science, 145*.

Cableveyconvey. (2023, December 13). How to Increase Workplace Safety by Using a Conveyor System? *Cablevey Blog*.

Canadian Centre for Occupational Health and Safety. (2024, May 17). Occupational Health and Safety Work-related musculoskeletal Disorders (WMSDs). *Diseases, Disorders and Injuries*.

Chang, K.-C., Yu, C.-C., Lee, Y.-H., & Chang, J.-C. (2017). The effectiveness of an ergonomics intervention in reducing musculoskeletal disorders in warehouse workers . *Journal of Safety and Health and Environmental Research, 17*(4), 353-364.

Chen , Z., Lam, W., & Zhong, J. A. (2019). Why does transformational leadership always work? The role of core self-evaluation and relational demography. *The Journal of Business Ethics*, 729-742.

Chivero, C., & al, e. (2019). Bird species richness and diversity within the Lake Chivero Recreational Park, Harare, Zimbabwe. *International Journal of Biodiversity Science, Ecosystem Services & Management*.

Comper , M. C., Dennerlein , J. T., & Evangelista GDS, G. S. (2017). Effectiveness of job rotation for preventing work related musculoskeletal disease: a cluster randomized controlled trial. *Occupational Environmental Med , 74*(8), 545-552.

da Costa, B. R., Vieira , E. R., & Yoshida, J. (2020). Musculoskeletal disorders and associated factors in quilombola communities. *International Archives of Occupational and Environmental Health, 93*(6), 939-950.

Dick R.B, L. B. (2020). Trends in Work Related Musculoskeletal Disorders From 2002-2014 General SocialSurvey, Quality of Work Life Supplement. *journal of occupational and environmental medicine, 62*(8), 595-610.

Ebarnes. (2022, December 16). VelocityEHS. *Workers are the experts: Utilizing Participatory Ergonomics*.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4.

Etuknwa , A. B., & Humpheries , S. (2018). A Systematic Review on the Effectiveness of Ergonomic Training Intervention in Reducing the Risk of Musculoskeletal Disorder. *J Nurs Health Stud, 3*(2).

European Risk Observatory. (2020). *Work-related musculoskeletal disorders: why are they still so prevalent? Evidence from a literature review*. Luxembourg: European Agency for Safety and Health at Work.

Faisting , A. R., & Sato , T. O. (2019). Effectiveness of ergonomic training to reduce physical demands and Musculoskeletal symptoms- An overview of systematic reviews. *Journal of Industrial Ergonomics, 74*.

Fiseha , S., Kefale , G., Mihret , D. T., Chanie, T. S., Abich, Y., Shibabaw, Y. Y., . . . Kibret, A. K. (2024). Lower back pain and associated factors among weavers working in Bahir Dar City, Northwest Ethiopia: A cross-sectional study. *Frontiers in Public Health, 12*.

Forzoni, L. (2019). DHM applied to ergonomic design and assessment of diagnostic ultrasound systems. *Elsevier eBooks*, 559-568.

García-Herrero, S., Pérez-López, M. C., & Muñoz-Mazón, A. (2022). García-Herrero, S., Pérez-López, M. C., & Muñoz-Mazón, A. The influence of workers' participation on safety performance: A systematic review. *International Journal of Environmental Research and Public Health, 19*(4).

Gerr , F., Marcu, M., el-Kassaby, A. M., & Monk, P. J. (2021). Effects of office ergonomic interventions: A systematic review. *Safety and Health at Work, 12*(4), 378-394.

Grinnell, A. (2022). Reduce Musculoskeletal Disorders in warehousing, logistics and assembly. *ISB Group Blog*.

gundumure, p., & hukuimwe, a. (2024). REBA Assessment - Key Takeaways. *12*(1), 25-56.

Gupta , N., Wahlin-Jacobsen , C. D., Abildgaard, J. S., Henriksen , L. N., Nielsen , K., & Holterman , A. (2018). . Effectiveness of a participatory physical and psychosocial intervention to balance the demands and resources of industrial workers : A cluster-Randomized controlled trial. *Scandinavian Journal of Work, Environment and Health, 44*, 58-68.

Hamid, A., Fekry, N., & Etway, E. E. (2022). Effect of ergonomics training program on nurses' knowledge and safety practice. *International Journal of Health Sciences (IJHS) (En LíNea)*, 5992–6006.

Haslam, C., Kazi, A., Duncan, M., Clemes, S., & Twumasi, R. (2018). Haslam,C., Kaz Walking Works Wonders: A Tailored Workplace Intervention Evaluated over 24 months. *Ergonomics, 1*, 1-31.

Health, National Institute for Occupational Safety and Health. (2018). *A Systematic Approach to Ergonomics Processes.* Cincinnati: National Institute for Occupational Safety and Health.

Hemati, K., Darbandi, Z., Kabir , E., & Poursadeghiyan, . (2020). Ergonomic intervention to reduce musculoskeletal disorders among flour factory workers. . *Work (Reading, Mass.)., 67*(10).

Hosseini, A., Razeghi, M., & Pakshir, H. (2019). Ergonomic Assessment of Exposure to Musculoskeletal Disorders Risk Factors among Dentists of Shiraz, Iran. *Research Gate, 20*(1), 53-60.

International Labour Office. (2017). Working together to promote a safe and healthy working environment . *International Labour Conference, 106th session* (pp. 100-269). Geneva: International Labour Office.

International Labour Organization. (2016). *Safety and health in agriculture and rural workplaces* . Geneva : International Labour Organisation.

iTacit,, & Maltais, T. (2024, January 30). Top 7 Most Effective Employee Training Programs You Need to Know About.

J, T., Lee, C., & Smith, G. e. (2022). A Systematic Review of Workplace Ergonomics for Enhancing Physical and Mental Health and Wellbeing. *Frontiers in Psychology*, 1-38.

Jensen, L. K., & Friche, N. (2019). Ergonomic interventions in industrial settings—effectiveness and barriers in practice. *Applied Ergonomics, 81*.

Jones, A. K. (2020). Organizational support and worker autonomy as predictors of ergonomics program compliance. *Applied Ergonomics*.

K-C, C., & J-S, Y. C.-C. (2017). The effectiveness of an ergonomics intervention program in reducing musculoskeletal disorders in warehouse workers. *Journal of Safety and Health, 17*(4), 353-364.

Kee, D., Kong, Y.-K., Kim, J., Hwang, J., Jin, S., & Tchounwou, P. B. (2022). Systematic Comparison of OWAS, RULA, and REBA Based on a Literature Review. *International Journal of Environmental Research and Public Health, 19*(1).

Kim, H. S., & Nielsen, K. J. (2021). Effects of ergonomic workplace interventions: A systematic review. *International Journal of Occupational Safety and Ergonomics, 27*(4), 895-903.

Koirala, R., & Nepal, A. (2022). A Literature Review on Ergonomics, Ergonomics Practices, and Employee Perfomance. *Quest Journal of Management and Social Sciences, 4*(2), 273-288.

Koukoulaki , T. (2018). The impact of lean production on musculoskeletal and psychosociap risks: AAn examination of socitechnical trends over 20 years. *Applied Ergonomics*, 108-125.

Lee, S., De Barros, F. C., De Castro, C. S., & De Oliveira Sato, T. (2021). Effect of an ergonomic intervention involving workstation adjustments on musculoskeletal pain in office workers - a randomized controlled clinical trial. *National Institute of Occupstional Safety and Health , 59*(2), 78-85.

Li, X. (2018). The effectiveness of manual handling training in preventing musculoskeletal disorders in the workplace: a systematic review. , 60(6), 493-504. *Journal of Occupational Health, 60*(6), 493-504.

LinkedIn. (2024). How do you test ergonomic solutions , workplace safety. *Powered by AI and the LinkedIn community*.

M, R., A, C., M, S., & al, e. (2022). Assessing the Effectiveness of an ergonomics intervention program with a participatory approach: an ergonomics settlement in an Iranian steel industry. *International Archives of Occupational and Envirionmental Health, 95*, 953-964.

Machado, M. (2023). Impact and benefits of ergonomic interventions at workplace. *Journal of Ergonomics, 13*(4).

Manias, E., Cranswick , N., Newall, F., Rosenfeld, E., Weiner, C., Williams , A., . . . Lai, J. (2018). Medication error trends and effects of person-related, environment-related and communication-related factors on medication errors in a paediatric hospital. *Journal of Paediatrics and Child Health, 55*(3), 320-326.

Matt Middlesworth | . (2001, Febuary 14). 11 Barriers to Successful Musculoskeletal Disorder Prevention. *Ergo Plus*.

Maynard, M. T., Gilson, L. L., & Mathieu, J. E. (2012). Empowerment- fad or fab? A multilevel review of the past two decades of research. *Journal of Management*, 1231-1281.

McCombes, S. (2023). What is a research design | Types, Guide & examples. *Scribbr*.

Meli, J. O. (2023). EFFECTS OF COVID-19 CONTAINMENT MEASURES ON GENDER BASED VIOLENCE IN KAKAMEGA CENTRAL SUB-COUNTY, KENYA. *thesis*.

Mohamed Thari , M. N., Mohd , H. N., Abdullah , M. Z., & Abdul Razak, H. R. (2023). Ergonomic Intervention Practice at the Workplace in Asian boundary: A systematic review. *Environment-Behaviour Proceedings Journal, 8*(25), 233-239.

Monteiro, J. L., & Coelho, J. L. (2019). The impact of workload on the adoption of ergonomic practices in the workplace. *International Journal of Occupational Safety and Ergonomics*, 242-249.

Mushonga, B., Dusabe, J., Kandiwa, E., & Bhebhe, E. (2017). Artificial Insemination in Nyagatare District: Level of Adoption and the Factors determining its Adoption. *Alexandria Journal of Veterinary Sciences, 55*(1), 1-7.

National Safety Council. (2021). *Work pressures and their effect on injury prevention practices: A national survey*. Itasca, Illinois: National Safety Council.

Neal, D. M., & Griffin, M. A. (2019). Ergonomic interventions in the workplace: examining the role of management support and employee perceptions. *Applied ergonomics, 81*.

Ng, T. W., & Feldman , D. C. (2021). Job Insecurity and Employee Voice: Evidence from Two Multisource Studies. *Journal of Occupational Health Psychology*, 660-672.

Occupational Safety and Health Administration. (2024). *Ergonomics; Solutions to Control Hazards.* America : US Department of Labour.

Park , J., Jung, W., Kim, S., & Chung, E. (2022). Ergonomic work environment interventions for workplace productivity and safety: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 19*(9).

Pathak, A., & Kini, P. (2019). An ergonomic intervention study in the logistics industry in Gujarat. *International Journal of Industrial Ergonomics, 66*, 26-36.

Riel, J., Kines, P., & Bommert, K. (2020). Effectiveness of workplace ergonomic interventions: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 17*(24).

Rivilis , I., Cole, D. C., Berlinguer-Palmini, R., Gharbi, H., & Tissot, F. (2019). A participatory ergonomic approach to reducing musculoskeletal disorders in construction:A review of current trends and future challenges. *Applied Ergonomics, 75*, 115-127.

Robertson, M. M., Huang, Y. H., Lee, H. Y., & Marklin, R. W. (2013). An evaluation of a workplace ergonomics intervention. *Journal of Occupational and Environmental Medicine, 55*(3), 268-276.

Ross, K., Lau, T. F., & Yang, Y. (2021). The Role of Communication in Implementing Ergonomic Interventions in Construction Workplaces. *Ergonomics in Design, 29*(5), 1218-1236.

S, P. S. (2020). Effectiveness of comprehensive ergonomic intervention on musculoskeletal disorders among logistics and storage workers. *International Journal of Environmental Research and Public Health, 17*(9).

S. L Yu, .. L. (2018). Effectiveness of multi-component ergonomic intervention on musculoskeletal disorders in logistics and storage companies in China: A randomized controlled trial. . *Occupational and Environmental Medicine, 75*(6), 468-475.

Safarian , M. H., Rahmati-Najarkolaei , F., & Mortezapour , A. (2019). Comparison of the Effects of Ergonomic, Organization, and Education Interventions on Reducing Musculoskeletal Disorders in Office Workers. *Health Scope, 8*(1).

Safeti. (2024, January 10). Manual Handling Principles | 5 Steps for Safer Lifting. *CPD Online Course , Workplace Health and Safety*.

Samani, A. (2020). Task variation as a preventive measure for work-related musculoskeletal disorders: a systematic review and meta-analysis. Human Factors. *62*(7), 1011-1027.

Seo, H., Hieu , T. L., & Alireza , G. J. (2023). A case study of motion data-driven biomechanical assessment for identifying and evaluating ergonomic interventions in reinforced-concrete work. *Developments in the Built Environment, 16*, 2666-1659.

Sharma, S., & Dalal, M. (2019). The impact of musculoskeletal disorders on logistics and storage workers: A review. *International Journal of Industrial Ergonomics, 59*, 106-112.

Smith , J. L., & Flores, R. (2022). The impact of high-stress work environments on ergonomic intervention adherence. *Journal of Occupational Health Psychology*, 211-223.

Smith, A. B., Jones, J. M., & Wilson, K. L. (2021). Supervisor support and employee voice: The mediating role of psychological empowerment. *Human Resource Management Journal*, 202-218.

Sohrabi, M. S., & Babamiri, M. (2022). Effectiveness of an ergonomics training program on musculoskeletal disorders, job stress, quality of work-life and productivity in office workers: a quasi-randomized control trial study. *International journal of occupational safety and ergonomics : JOSE, 28*(3), 1664-1671.

Tan, J., Smith, G. K., & Lee, C. J. (2022). (2022). A Systematic Review of Workplace ErgonomicsEnhancing Physical and Mental Health and Wellbeing. , 13. *Frontiers in Psychology*, *13*, 1-38.

Tatham, L. (2022, March 8). 5 types of equipment to help prevent manual handling injuries. *Browns Safety Services*.

Thatcher , A., & Yeow, P. H. (2016). A sustainable system of systems approach: A new HFE paradigm. *Ergonomics*, 167-178.

Van , E. D., Munhall , C., Irvin , E., Rempel , D., & Brewer , S. (2016). Effectiveness of workplace interventions in the prevention of upper extremity musculoskeletal disorders and symptoms: an update of the evidence. *Occup Environ Med, 73*(1), 62-70.

Wolk, J., Olmos-Gallo, C., & Lindeborg, G. (2019). Role of employee awareness, organizational commitment and ergonomic design on successful adoption of ergonomic interventions: An observational study. *Journal of Occupational Health Psychology, 24*(3), 394-406.

Work, E. A. (2019). Ergonomics Tools. *Its all in a day`s work!*

Yazdani, A., & Wells, R. (2018). Barriers for implementation of successful change to prevent musculoskeletal disorders and how to systematically address them. *Applied Ergonomics/Applied Ergonomics, 73*, 122–140.

Yi, J., Meng, J., Chen, J., & Fang, C. (2019). A study on ergonomic intervention effects in large-scale logistics enterprises. *Safety Science*, 268-279.

Zafrani, N. (2023, May 05). Making the right move: Keeping Workers Safe in the Moving Industry . *Creating a safe workig environment in the moving industry* .

Zink, K. J., & Franzmann, J. D. (2021). Sustainable work systems: Impact of leadership and feedback. *Applied Ergonomics* .

6.3 LIST OF APPENDICES

6.3.1 APPENDIX I

Interview Schedule

Section 1: Introduction

Hello my name is AMANDA V HUKUIMWE your SHEQ Intern conducting a research for my dissertation.

The purpose of this interview is to explore the factors influencing the effectiveness of ergonomic interventions in the logistics and storage industry as well as to get your opinions on what can be done to improve the effectiveness of these ergonomic interventions. Your participation will contribute to a better understanding of how these interventions can be improved to reduce MSDs among workers.

Interview format: This interview will be semi-structured and consist of open-ended questions. Please feel free to elaborate on your responses, and I may ask follow up questions to better understand your experiences and perspectives.

Confidentiality and data use: your responses will be kept confidential, and any identifying information which may put negative light on you will be removed before the data is presented in my dissertation. Your input will only be used for the purpose of this research study. The recordings taken will only be used for cross checking the information and for reference during the study but they will not be published or be part of the results. Once the data is analyzed and summarized the recordings will be deleted.

Timeframe: The interview is expected to take approximately *1 hour 30 minutes*. However, we can take breaks as needed and you can decide to stop the interview at any time.

Participation rights: Your participation in this interview is completely voluntary and you have the right to refuse to answer any questions or withdraw from the study at any time without any consequences.

Consent: Do you agree to participate in this interview, and you have the opportunity to ask any questions about the study.

Preamble: Consent to Participate and Permission to record

Signature:……..
Date:……

Section 1: Demographic information

To help me understand your responses, I would like to ask a few demographic questions. Your answers will be kept confidential and only used for the purposes of this research study.

- What is your current role or job title within the organization?

- How many years of experience do you have working in the logistics and storage industry?

- How many years have you been working for this organization particularly?

- How many years have you been doing manual material handling?

- What is your age? Please provide within the given ranges (eg 21-30/ 31-40) if you prefer not to give an exact number.

- What is the highest level of education you have completed

No education completed or primary school
Lower secondary or vocational school
Intermediate secondary or vocational school
Higher secondary or vocational school
University

- Work schedule - do you typically work full-time, part-time, or on a casual/call basis

- Physical demands – how physically demanding would you rate your current job on a scale of 1 to 5, with 1 being not at all demanding and 5 being extremely demanding?

- Prior experience with ergonomic interventions: Have you previously participated in ergonomic interventions or initiatives in your workplace?

- Musculoskeletal disorder history: Have you ever experienced any work related MSDs or injuries during your career in this organization

- Would you care to explain how it happened and which body parts hurt the most?

Section 2: Identification of interventions used

Do you know what ergonomics is?

Do you know what ergonomic interventions are?

Are you aware of ergonomic interventions existing in this work place?

If so can you state them?

Which intervention do you mainly use in your line of work?

Do you think these interventions were fully implemented?

Are they being practiced correctly (organization level and personal level)? Yes/no

Section 3: The factors

Work experience

- How many years have you been practicing manual material handling including out of AGS Zimbabwe
- Have you ever received some form of training on ergonomic interventions before?
- Was this your first time hearing about ergonomic interventions
- Have you ever practiced ergonomic interventions before?

Employee response overall classification (by the interviewer)

Unaware of ergonomic interventions	
Heard of ergonomic interventions but lack understanding	
Familiar with ergonomic interventions and have practiced them before	
Knowledgeable about ergonomic interventions but haven't practiced them	
Experienced in specific aspects of ergonomic interventions	

Management commitment

- How do you perceive the level of commitment to ergonomic interventions in your workplace?
  Response:

- Can you give examples of how management has demonstrated their commitment to these interventions
  Response:

- In your opinion, how well do management`s actions and decisions align with their stated commitment to ergonomic interventions?
  Response:

Please rate on a scale of 1 to 5 with 1 being not at all aligned and 5 being completely aligned
Response:

- How would you rate the level of support provided by management for the ergonomic interventions on a scale of 1 to 5 with 1 being very low support and 5 being very high support
  Response:

- In your experience , how would you describe the level of commitment and priority management places on implementing and enforcing ergonomic interventions in the workplace
  Response:

- Can you provide examples to support your view
  Response:

Employee response overall classification (by the interviewer)

High commitment and priority	
Moderate commitment and priority	
Low commitment and priority	

Worker participation

- In your opinion how involved were you as workers in the development and implementation of ergonomic interventions in the workplace
  Response:

- How do you feel you contributed or participated in the intervention process or shared your input?
  Response:

- What factors do you think influence worker participation in these interventions?

Response:

- Can you describe the level of collaboration among employees when it comes to implementing and maintaining ergonomic interventions in the workplace?
  Response:

Employee response overall classification (by the interviewer)

High collaboration level	
Moderate collaboration level	
Low collaboration level	

Communication

- How would you describe the communication around ergonomic interventions in the workplace?
  Response:

- In your experience, how effective is the communication surrounding ergonomic interventions between management, employees and other relevant parties?
  Response:

- Can you provide instances of where communication has been successful?
  Response:

- What do you think could be done to improve communication about these interventions?
  Response:

Employee response overall classification (by the interviewer)

High efficacy	
Moderate efficacy	
Low efficacy	

Correct application of ergonomic interventions during tasks by employees

- In your experience, how consistently and correctly do employees apply ergonomic interventions when performing their tasks?

  Response:

- Can you provide examples of successful application or any challenges that may hinder proper practice of ergonomic interventions during tasks?

  Response:

Categories to challenges

Workload and time constraints	
Training and awareness	
Adaptability and flexibility of the employee	
Personal factors	

- Can you describe a specific task in your daily work routine where applying ergonomic interventions has made a noticeable difference in reducing physical strain or improving comfort?

Response:

Employee response overall classification (by the interviewer)

High consistency and correctness	
Moderate consistency and correctness	
Low consistency and correctness	

Empowerment to practice interventions (empowerment of employees to practice safe work practices in line with ergonomic interventions)

- In your experience, do you feel empowered to follow and promote safe work practices that align with the ergonomic interventions implemented at the workplace?
  Response:

- Can you provide examples and instances where you felt supported in maintaining these practices or encountered barriers to doing so?
  Response:

- How supportive is management in encouraging and enforcing safe work practices that align with ergonomic interventions?
  Response:

- How do your colleagues play a role in fostering a culture of ergonomic intervention practice and support?

Response:

High empowerment level	
Moderate empowerment level	
Low empowerment level	

Classification of barriers to employee empowerment

Time and workload	
Employee attitude	
Constructive feedback	
Peer support	
Job insecurity and uncertainity	

Intervention effectiveness

- Have you noticed any changes in the prevalence of MSDs since the implementation of ergonomic interventions in the work place?
- How would you rate the overall effectiveness of the ergonomic interventions implemented in the workplace on a scale of 1 to 10, with 1 being not at all effective and 10 being extremely effective
- On a scale of 1 to 5 with 1 being very unsatisfied and 5 being very satisfied, how satisfied are you with the ergonomic interventions implemented in your workplace?

Section 3: Closing

Is there anything else you would like to share about ergonomic interventions or workplace safety in this workplace?