

**ASSESSMENT OF THE OCCUPATIONAL SAFETY AND HEALTH PRACTICES IN
VEHICLE BODY MANUFACTURING INDUSTRY IN NAIROBI COUNTY, KENYA**

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**A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements for
the Degree of Doctor of Philosophy in Environmental and Occupational Health of Egerton
University**


EGERTON UNIVERSITY

MAY, 2025

DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and it has not, wholly or in part been presented for an award of a Degree, Diploma or other awards in this or any other university.

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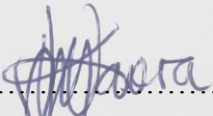
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DEDICATION

This thesis is dedicated to my dear wife Martha and children Shadrach, Eliam and Shiphrah for their prayer and support throughout the completion of this study.

ACKNOWLEDGEMENTS

First, sincerely appreciation goes to Egerton University administration for supporting my study by providing tuition. Second, I wish to thank the Department of Environmental Science for offering me an opportunity to undertake my Doctorate in Environmental and Occupational Health. Thirdly, I would like to profoundly thank the TAGDev Programme at Egerton University for financial support during the data collection. Fourthly, I also wish to extend my appreciation for the cooperation I was accorded while carrying the study at the vehicle body manufacturing companies of Banbros Ltd, Lab Singh Harman Singh Ltd, Master Body Builders Ltd, Choda Body Fabricators Ltd, Kenya Coach Industries Ltd and Central Farmers Garage Ltd. Finally, I would like to express my deepest gratitude to my supervisors, Prof. Wilkister Nyaora Moturi of Egerton University and Prof. Stanley Maingi Makindi of Machakos University, for their invaluable time and unwavering patience. I am also immensely grateful to my family for their constant support, encouragement, patience, and understanding throughout my study

ABSTRACT

The manufacturing sector employs more than 1.5 billion people globally and Kenya more than 300,000 are engaged in this industry. Vehicle body manufacturing is a section of this sector and involves the fabrication of buses and truck bodies that are used to transport passenger and goods. The growing need for transporting passengers, schoolchildren, and goods has increased vehicle production demands, often compromising worker safety and health in the process. The vehicle body manufacturing process involves metal fabrication of the frames, cutting and moulding of metal sheet, welding of the metal panels onto the chassis frames, spray painting, developing upholstery, fitting of electrical system and final finish. This study focused on assessment of OSH practices in the vehicle body manufacturing companies in Nairobi and identified interventions. It examined the hazards, the effects of these on employees, their knowledge and attitude, the workers' awareness to OSH regulations, factors that influence compliance and challenges faced in implementing OSH regulations. The study was done by sampling of vehicle body manufacturing firms based in Nairobi. Data was gathered from 260 workers across four companies using questionnaires, which captured both qualitative and quantitative information. The responses were then analyzed in terms of frequencies, percentages, and chi-square tests. Additionally, a hazard analysis checklist was employed. All statistical processing was conducted using the Statistical Package for the Social Sciences (SPSS) software. The hazards identified were physical, chemical, electrical, biological and psychosocial. Results indicated physical hazards (53.9%) which are arc welding glare, noise from cutting and grinding machines, falling objects and oil spillage, chemical hazards (17.1%) that consists of paint spraying, thinners and body filler. Workers were affected by injuries on their hands (69%), knowledge on OSH practices (76.9%). On factors influencing compliance to OSH regulations education level, hazard presence, involvement in accident, training on OSH and prevention measures had a positive significant correlation. Challenges that hindered implementation of OSH regulations were lack of and limited use of PPE (37.3%), inadequate supervision (32.5%). Policy recommendations drawn from the study were that vehicle body manufacturing firms mitigate on the hazards by implementing administrative and engineering controls, isolation and substitution, use of adequate and appropriate PPE as well as enhance supervision on OSH practices. In addition the companies availability and ease of access to OSH procedures, policy development, use of signage and provide continuous training.

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LIST OF ABBREVIATIONS AND ACRONYMS

ALARP	As Low As Reasonably Practical
ATSDR	Agency for Toxic Substances and Disease Registry
CCOHS	Canadian Centre for Occupational Health and Safety
CDPH	California Department of Public Health
COPD	Chronic Obstructive Pulmonary Disease
CO	Carbon Monoxide
CSR	Corporate Social Responsibility
DOSH	Directorate of Occupational Safety and Health
EPA	Environmental Protection Agency
HAVS	Hand Arm Vibration Syndrome
HBM	Health Belief Model
HICs	High Income Countries
HSE	Health and Safety Executive
ILO	International Labour Organization
JDCS	Job Demand Control Support
LEV	Local Exhaust Ventilation
LMICs	Low and Middle Income Countries
MSI	Musculoskeletal Injury
MSDS	Material Safety Data Sheet
NIHL	Noise Induced Hearing Loss
NIOSH	National Institute of Safety and Health
OA	Occupational Asthma
OSHA	Occupational Safety and Health Act
PSV	Public Service Vehicle
RR	Relative Risk
RSI	Repetitive Strain Injury
STFs	Slips, Trips and Falls
VWF	Vibration White Fingers
WHO	World Health Organization
WRMSI	Work Related Muscular Skeletal Injuries

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Motor vehicles have become an essential mode of transportation worldwide. Both individuals and organizations seek efficient, cost-effective, and dependable vehicles, prompting automakers to expand production. According to WARDS AUTO (2011), global vehicle registrations surged from 980 million in 2009 to 1.015 billion in 2010—excluding off-road and heavy construction equipment. In Kenya, registered vehicles per 100 people nearly doubled from 1.4 in 1985 to 2.7 in 2007 (Abdulgafloor *et al.*, 2012). This growth has been further fuelled by advancements in automotive technology and rising consumer demand, leading to more vehicles on roads today than ever before. Automobiles convert the latent energy in fuel into motion, enabling the effortless transport of people and goods (Read & Reid, 2007). A road motor vehicle is defined as a wheeled, engine-powered machine designed primarily for road use, serving to carry passengers or cargo. Common examples include buses, coaches, freight trucks, and passenger cars.

Majority of motor vehicles in Kenya are imported as completely built units. However, commercial vehicles which include buses are imported when partially built or are locally assembled as chassis units. Such automobiles are purchased and taken to the vehicle body manufacturers, where they are built to suit the customers' needs and specifications. Goods carrying vehicles are usually built with a cargo box either with enclosed body or open depending on the customer's requirements. Passenger carrying vehicles are built into buses or minibuses according to the vehicle size.

The manufacturing sector employs 300,000 people in Kenya Economic Survey (2016). Vehicle body manufacturing falls under this sector, though the available statistics does not quantify the number employed in this sector. From 49,560 in 2020 to 55,355 in 2021, there were more Public Service Vehicles (PSV) licenses issued as a whole, an increase of 11.7%. From 36,323 in 2020 to 31,737 in 2021, the number of PSV permits granted to public service vehicles decreased by 12.6%. During the time period under consideration, there was a 58.1% increase in the number of PSV bus permits issued, while the number of mini bus licenses issued doubled Economic Survey (2022). The companies that manufacture vehicle bodies are specialized either for goods truck or buses and coaches. The workers who are involved in the activities are welders,

auto electricians, panel beaters, painters, upholstery craftsmen, mechanics, sign writers, drivers and administrative staff.

The manufacturing sector accounts for over 10% of all work-related fatalities in the United States, with an annual rate of 4.4 deaths per 100,000 workers. Notably, machinery-related incidents contribute to nearly 20% of these manufacturing fatalities (NIOSH, 1993). The motor vehicle manufacturing industry, characterized by diverse operations, complex work environments, and varied workforce demographics, exposes employees to numerous hazards. Alarmingly, a 1991 report revealed that among United Auto Workers (UAW) members, one in three workers suffers job-related injuries or illnesses annually, while one in ten becomes disabled - placing them in high-risk categories. The same report estimated that one in every 500 workers would likely suffer fatal injuries during their career (UAW, 1991). In Kenya, the manufacturing sector is responsible for 87.5% of all occupational accidents (DOSHS, 2016), though available data doesn't specify how many occur specifically in vehicle manufacturing

Research suggests that the direct and indirect costs of occupational diseases and injuries as a result of unhealthy working conditions account for between 1.8% and 6.0% (\$2.8 trillion) of the global GDP loss (Takala *et al.*, 2014). Yet, Africa has a higher prevalence of occupational illnesses and injuries. Exposure to occupational hazards frequently results in work-related illnesses and injuries that have a financial cost (Fayad *et al.*, 2003). Research suggests that occupational illnesses, injuries, and fatalities cost employers, as well as the community and the individual (Safe Work Australia, 2015; Shalini, 2009).

According to a 2015 report by Safe Work Australia, the expense of work-related occupational diseases and injuries is split roughly evenly between employees, employers, and the community at 77%, 5%, and 18%, respectively. According to Shalini (2009), medical expenses for a workplace injury in Mauritius cost businesses anything from US\$11,287 to US\$132,749 in total. Thus, depending on the amount of lost man-days from work owing to industrial injuries and diseases, the state pays between US\$259,000 and US\$718,574 in medical expenses for occupational accidents, while the employee only loses up to US\$185,358. According to data from the Department of Factories Inspection in Ghana, workplace accidents cost employers 60 USD each case and roughly 60,000 USD yearly (Oppong, 2014).

In order to prevent early retirement, unemployment, and poverty, it is crucial to calculate the cost of occupational accidents on fair work, health, and well-being. The expense of

workplace health and safety has, however, received little attention from studies on this topic (Adei *et al.*, 2019; Kim *et al.*, 2016; Niu, 2010).

Economic liberalization has led to significant imports of used vehicles from developed nations to developing countries. These vehicles, primarily owned by individuals, have spurred the growth of maintenance workshops to service them. Meanwhile, automakers continue introducing newer models with enhanced fuel efficiency, better performance, and reduced emissions. This competitive environment drives innovation but simultaneously creates health and safety challenges in vehicle manufacturing processes (Crouse & Anglin, 2007). The growing need for local transport solutions has expanded operations in vehicle body manufacturing. However, without proper safety measures, this bustling industry can become hazardous (Read & Reid, 2007).

For East African region most buses bodies are manufactured by firms in Nairobi. Some of the most renowned vehicle body manufacturing firms in Kenya include Choda Fabricators, Master Fabricators Limited, Kenya Coach Industries (KCI), Banbros Limited, Kenya Vehicle Manufacturers (KVM) and Labh Singh Harman Singh Ltd. Easy access of raw materials, availability of skilled labour, location of main motor vehicle distributors and improved infrastructure explain why most of these body manufacturing firms operate in Nairobi.

Vehicle body manufacturing presents multiple workplace hazards, including fire risks, trips and falls, slips, welding glare, excessive noise, toxic paint fumes, heavy component lifting, cuts, and forklift-related dangers. Given their direct impact on worker well-being, this study specifically examines these occupational risks. The Occupational Safety and Health Act (GoK, 2007) provides regulatory frameworks to address such workplace hazards. Existing research has documented challenges in implementing occupational health and safety (OHS) regulations in developing countries (Adeyemo & Smallwood, 2017; Choudry *et al.*, 2008; Umeokafor *et al.*, 2014; Umeokafor & Isaac, 2015). Notably, Choudry *et al.* (2008) analyzed OHS enforcement strategies in low-income nations, identifying critical success factors: safety culture, organizational safety systems, training programs, personal protective equipment initiatives, research and development investments, toolbox safety discussions, and site-specific safety cycles.

These have shed light on the overall issues with OHS enforcement in underdeveloped nations. The difficulties that OHS implementation institutions face, however, have not received

enough attention. So, in order for these organizations to successfully carry out their implementation duties, substantial study is required to methodically analyze all potential challenges that they may face. The study sought therefore to provide information on how safe practices in bus body building workshop operations contribute to the welfare of workers, productivity and profitability of the organization and improved corporate image mind tense (Fuller & Vassie, 2004).

1.2 Statement of the Problem

The increasing reliance on public transportation due to Kenya's population growth has spurred greater demand for buses and minibuses, consequently driving significant expansion in the country's motor vehicle body manufacturing industry. This growth has positioned the sector as a crucial employment generator within Kenya's manufacturing landscape. However, despite its economic contribution, there remains a critical knowledge gap regarding the occupational health and safety hazards inherent in this labor-intensive industry. The problem is particularly pressing given that Kenya's manufacturing sector accounts for 87.5% of all occupational accidents (DOSHS, 2016), though existing data fails to distinguish vehicle body manufacturing from other manufacturing subsectors.

While previous studies have examined hazards in vehicle repair shops (Azuike *et al.*, 2016; Ishola *et al.*, 2017; Williams, 2019), these findings have limited applicability to manufacturing environments where processes, equipment, and associated risks differ substantially. Furthermore, research focusing specifically on occupational hazards in developing country manufacturing contexts, and particularly Kenya's vehicle body fabrication sector, remains conspicuously absent. This study therefore sought to systematically identify workplace hazards in vehicle body manufacturing, evaluate their impacts on workers' safety and health, examine implementation challenges for occupational safety measures, and determine key factors influencing regulatory compliance. By generating sector-specific safety data, the research aimed to inform evidence-based policy interventions that can enhance worker protection in this growing yet understudied industry.

1.3 Objectives

1.3.1 General Objective

To establish the occupational safety and health practices in vehicle body manufacturing firms and contribute to the necessary interventions in Nairobi County, Kenya.

1.3.2 Specific Objectives

- i. To identify and characterize the hazards in the vehicle body manufacturing.
- ii. To evaluate the relationship of the hazards with the workers' safety and health in vehicle body manufacturing.
- iii. To investigate knowledge and attitude on practices of occupational safety and health in vehicle body manufacturing.
- iv. To determine factors that influence compliance to occupational and safety regulations in the vehicle body manufacturing.
- v. To identify the challenges of implementing occupational safety and health practices in vehicle body manufacturing

1.4 Research Questions

- i. What are the hazards in the vehicle body manufacturing workplace?
- ii. How do the hazards relate to the safety and health of the workers?
- iii. What is the knowledge and attitude of workers on safety and health?
- iv. What are the factors that influence compliance to occupational and safety regulations in the vehicle body manufacturing industry?
- v. What are the factors that hinder occupational safety and health practices?

1.5 Justification for the Study

Occupational safety and health (OSH) represents a critical concern at both global and national levels. Internationally, OSH aligns with the United Nations Sustainable Development Goals (SDGs), particularly those targeting effective institutions and the reduction of work-related deaths and illnesses from hazardous exposures. Addressing workplace safety gaps is essential for fostering a healthier workforce, enhancing productivity, and sustaining long-term economic growth. Companies that prioritize OSH not only strengthen their market competitiveness but also contribute to broader sustainable development objectives.

Nationally, Kenya's Vision 2030 framework emphasizes the promotion of occupational safety and health through its National Occupational Safety and Health Policy. Key initiatives include establishing a comprehensive OSH database, integrating safety training into educational curricula, and cultivating a culture of workplace safety. The forthcoming National OSH Institute will further advance research and training to address emerging challenges, including those in high-growth sectors like oil and natural resources. Additionally, the Occupational Safety and

Health Act (OSHA 2007) provides a legal foundation for safeguarding workers and third parties from workplace hazards, reinforcing Kenya's commitment to safer labor environments.

This study's focus on vehicle body manufacturing aligns with Kenya's National Automotive Policy (2019), which seeks to harness the sector's potential as a driver of industrialization, employment, and technological advancement. The policy outlines strategies to boost local vehicle assembly, standardize regulations, and enhance innovation—all while emphasizing workplace safety as integral to sustainable growth. Furthermore, Kenya's industrialization agenda, including the "Big Four" manufacturing pillar and the Kenya Industrial Transformation Programme, identifies automotive manufacturing as a priority sector. By examining OSH challenges in this strategic industry, this study supports policy formulation and institutional frameworks aimed at ensuring worker safety and sectoral resilience.

Ultimately, this research fills a critical gap by generating evidence-based insights to guide OSH improvements in Kenya's vehicle manufacturing sector, contributing to both national development goals and global workplace safety standards.

1.6 Scope of the Study

This study was conducted among workers from four major vehicle body manufacturing firms operating in Nairobi, with particular focus on employees directly involved in production activities to identify prevalent safety and health hazards in their work environment. The research encompassed multiple dimensions of occupational safety, including an assessment of workers' knowledge regarding occupational safety and health regulations, interviews with supervisors and managers about implementation challenges and OSHA compliance issues, and an examination of both individual risk factors (such as age and gender) and organizational risk factors affecting workplace safety.

Through systematic observation, the study evaluated how occupational safety and health practices were integrated into the daily operations of the surveyed organizations. However, it is important to note that the scope did not extend to medical examinations or diagnosis of specific health conditions among workers that might have resulted from occupational exposures, as such assessments would have required specialized medical personnel and diagnostic equipment beyond the study's capacity. The research thus maintained its focus on identifying workplace hazards, evaluating existing safety protocols, and analyzing compliance challenges within Kenya's vehicle manufacturing sector, while deliberately excluding clinical health assessments of individual workers.

1.7 Assumption of the Study

It was assumed that the vehicle body manufacturing companies in Nairobi are similar to other firms that carry out the same operations and the study will be representative of others in different locations. Since the study sought information on matters concerning safety and work place hazards, it was assumed that the answers were forthright as they were perceived to be confidential information. Additionally, it was assumed that the management and staff would cooperate in availing the time to enable success of the survey in view of their busy production schedule.

1.8 Limitations of the Study

Time for conducting interviews with employees posed a limitation to the study. This is because most employees in vehicle body manufacturing firms work in a production line and in shifts. Thus there was the risk of employees being unwilling to participate in the survey because it may have hindered them from conducting their duties and reduced the man hours worked. To

overcome this limitation, the research team liaised with the senior management to ensure proper scheduling to account for the time to be spent during the survey. Another limitation was that interviews on work safety and health required some privacy because of confidentiality, hence this posed as a limitation due to the risk of victimization. To overcome this limitation, the respondents' identities were kept anonymous and were not referenced in the development of the research results. In addition, the COVID 19 pandemic contributed to the limitation of the study since the disease arose at a time that data was to be collected and majority of workers were sent home due to the Government directive to minimize movement and contact of persons. However, this was overcome by re scheduling data collection at a later date when the virus had subsided. The study did not measure the medical health exposure effects as there was a limitation in use of medical specialists, equipment and time.

1.9 Operational Definition of Terms

Accident: An unplanned workplace event causing injury or death, resulting from unsafe conditions (such as machinery operation) or actions (such as falling objects), disrupting normal work processes and requiring immediate response.

Attitude: A worker's persistent psychological tendency – positive or negative – toward safety practices, influencing their compliance with protocols and risk-taking behaviors during job tasks.

Ergonomics: The scientific discipline optimizing workspaces, tools, and systems to match workers' physical capabilities, reducing fatigue and injury while enhancing productivity (Stevens, 2015).

Fire Hazard: Any material, condition, or process that may ignite or accelerate fire spread, generating toxic fumes, explosions, or thermal injuries in manufacturing settings.

Hazard: A workplace element (physical, chemical, biological) with inherent potential to cause harm through direct exposure or cumulative effects during manufacturing processes.

Health: Complete physical, mental and social wellness (WHO, 1948), encompassing workers' capacity to perform duties without impairment from occupational exposures or stressors.

Injury: Physical damage from workplace incidents ranging from minor cuts to fatal trauma, requiring first aid, medical treatment, or resulting in lost workdays.

Knowledge: Workers' acquired understanding of hazards and safety measures through formal training, experience, and workplace safety communications for accident prevention.

OSH Regulations: Mandatory standards prescribing safe work conditions, hazard controls, and worker protections under Kenya's Occupational Safety and Health Act (2007).

PPE: Protective gear (helmets, gloves, respirators) creating physical barriers against workplace hazards when engineering controls are insufficient.

Risk Factors: Variables (individual, equipment-related, environmental) increasing injury probability during vehicle fabrication tasks like welding or heavy lifting.

Risk: Calculated probability of harm occurring, considering hazard exposure frequency and potential severity of consequences in manufacturing operations.

Safety: Controlled work conditions where hazards are eliminated or mitigated below harmful thresholds through systematic risk management approaches.

Vehicle Body Manufacturing: Industrial process involving chassis mounting, metalwork assembly, painting, and interior fitting to produce complete bus/truck bodies.

Work Environment: Physical workspace conditions (layout, ventilation) and organizational factors (work schedules, safety culture) affecting worker health and performance.

Musculoskeletal Injuries: Damage to muscles, joints or nerves from repetitive motions, forceful exertions, or awkward postures during manufacturing tasks.

Work Tasks: Defined production activities with specific methods, durations, and equipment requirements to achieve manufacturing objectives.

CHAPTER TWO

LITERATURE REVIEW

2.1 Occupational safety and health status globally

The International Labour Organization (ILO) and World Health Organization (WHO) established a comprehensive definition of occupational safety and health (OSH) in 1995, emphasizing: (1) optimal physical, mental and social wellbeing for all workers; (2) prevention of work-related health deterioration; (3) protection from occupational hazards; and (4) adaptation of work environments to workers' physiological and psychological needs (Alli, 2009). This holistic approach represents a paradigm shift from previous risk-focused models, now encompassing workers' overall health and development. Modern OSH management systems aim to safeguard worker welfare while optimizing work environments, organizational cultures, and operational efficiency to enhance productivity (Stellman, 1998).

The global economic impact of workplace accidents is staggering, costing approximately 4% of worldwide GDP (US\$2.8 trillion annually) through direct and indirect losses (ILO, 2014). While occupational diseases account for 85% of work-related deaths, only 50% of nations maintain official statistics, with developing countries particularly affected by underreporting, limited resources, and inadequate compensation systems - creating a persistent "cycle of neglect." These occupational hazards impose severe human, financial and social burdens, justifying ongoing workforce protection initiatives (Amir *et al.*, 2017; Schlaich *et al.*, 2009).

Contemporary workers face diverse hazards including physical, chemical, biological, ergonomic and psychological risks (ILO, 2013a). Annual global estimates indicate 234 million work-related deaths, 317 million non-fatal accidents, and 160 million occupational illnesses. Alarmingly, only 5-10% of workers in developing nations have access to OSH services (Zewdie *et al.*, 2011). Regional studies reveal particularly high injury rates, such as 122.8 cases per 1,000 workers in Iran's automotive sector (Nasir *et al.*, 2015), while sub-Saharan Africa suffers from critical data gaps (ILO, 2014). The U.S. Bureau of Labor Statistics (2011) documents similarly concerning injury patterns in vehicle manufacturing.

Table 2.1: Total Recordable injury cases per 100 Full Time Workers in United States

Year	Motor Vehicle Manufacturing	General Manufacturing
2003	10.2	6
2004	8.7	5.9
2005	8.9	5.6
2006	8.2	5.5
2007	6.8	5.1
2008	5.9	4.6
2009	5.7	3.9

Source: Bureau of Labour Statistics of United States of America Department of Labour (2011).

From the statistics more workers are injured in motor vehicle manufacturing sector compared to all other manufacturing sectors. However, this study report is general to motor vehicle manufacturing and thus does not give specific statistics on vehicle body manufacturing.

Table 2.2: Acute Traumatic Injuries among Hourly Employees in 54 Motor Vehicle

Manufacturing Facilities by Body Part, July 1 1989 to June 30 1992 (United States)

Body part	Sprain/strain	Laceration	Contusion	Foreign body	Burn	Fracture	Other	All types
Head, neck	616	1,028	504	38	134	22	169	2,511
Eye	2	30	45	1,783	217	0	670	2,747
Back	5,802	9	255	0	20	8	129	6,223
Finger	442	3,674	1,078	189	269	624	842	7,118
Hand, wrist	1,392	1,137	710	66	244	117	382	4,048
Forearm, elbow	798	1,461	535	28	321	38	181	3,362
Upper shoulder	1,995	208	207	4	50	9	127	2,600
Toe, foot, ankle	918	84	714	15	95	388	163	2,377
Leg, knee	1,113	256	745	5	34	33	275	2,461
Thigh, hip	203	59	144	2	18	4	38	468
Front Body	725	28	299	9	57	69	381	715
Whole body	14,006	7,974	5,236	2,139	1,459	1,312	3,357	35,483

Source: Bureau of Labour Statistics of United States of America Department of Labour (2011)

During the three-year period, 35,483 recordable injuries occurred among the hourly workers at all 54 plants. The most common area of injury was the finger, involved in 20% of all

the injuries, including 46% of all lacerations and 48% of all fracture. The fingers, hand and wrist comprised 31% of all injuries and 60% of all lacerations (Warner *et al.*, 1998). While the study provided details of body parts affected by auto manufacturing activity, the specific operations that led to the injuries were not covered by the study. Moreover, the study in 54 auto manufacturing plants is diverse and covers different models of vehicles. The study above also dwelt on injuries with little attention to existing challenges to the implementation of OSHA, and describing the underlying hazards.

The global manufacturing sector encompasses diverse industries, yet most production processes remain labor-intensive. Workers involved in material transformation face multiple occupational hazards including: machinery-related injuries, physical strain, extended work hours, shift rotations, slip/trip/fall incidents, and stressors from new production methods. Despite employing only about 10% of workforces in both the UK and US, manufacturing accounts for disproportionately high injury rates. UK data reveals the sector contributes to 18% of serious non-fatal injuries (requiring >7 days' absence) and 17% of major injuries. The primary causes include: same-level slips/trips/falls (29%), machinery contact (14%), and being struck by objects (13%) (HSE, 2014).

From the above studies it is clear that many people worldwide are injured due to their work with the higher number being in the manufacturing sector. The low and middle income countries include the African countries that Kenya is among. In these countries the studies have shown that there is a steady rise in occupational injuries although there are no studies that have identified the number of injuries that take place in bus body manufacturing. The manufacturing sector in Kenya employs 300,000 people (Economic Survey, 2016), however this report does not categorize how many or what percentage are employed in the vehicle body building industry. In Kenya 87.5% of all occupational accidents occur in the manufacturing sector (DOSH, 2016). The manufacturing sector consists of many diversified industries and the motor vehicle manufacturing is perhaps a very small fraction. No studies or statistics are available that show how many are affected by occupational injuries in this area.

2.2 Importance of the Automotive Industry in Kenya

Motor vehicles have transformed modern society by revolutionizing transportation of people and goods, effectively eliminating geographical barriers. This growing dependence has spurred unprecedented demand, driving expansion in vehicle manufacturing and assembly

operations (Autoparts EA, 2019) while catalyzing the emergence of a robust global automotive sector. Recognized as an economic cornerstone, the automobile industry plays a pivotal role in technological progress and macroeconomic stability across both developed and developing nations (Kerney, 2014). In Kenya, the sector serves as a critical enabler for national development objectives, particularly in advancing the government's Big Four Agenda (KAM, 2020).

The automotive sector serves as a cornerstone of global economic development, driving technological progress and macroeconomic stability across nations. In Kenya, this industry has demonstrated growing economic significance, with its GDP contribution rising from 1.3% in 2019 to 1.5% in 2020 (KNBS, 2021). The sector's expansive value chain - encompassing vehicle assembly, parts manufacturing, and maintenance services - generates substantial employment opportunities, tax revenues, and ancillary business activities. According to ILO (2020), the industry's extensive upstream and downstream linkages create powerful multiplier effects that stimulate broader economic growth and development.

The automotive sector serves as a major employment generator, supporting millions of livelihoods worldwide. Globally, the industry provided direct employment to approximately 14 million workers by 2017 (ILO, 2020). In Kenya, it created over 10,000 direct and 50,000 indirect jobs by 2018 (KAM, 2018), significantly contributing to reducing the nation's 7.4% unemployment rate (KNBS, 2021). Beyond direct manufacturing roles, the sector stimulates employment across supporting industries including finance, insurance, and marketing. Its economic impact extends further through substantial government revenue generation, workforce skill development, and technological innovation (KAM, 2020; Kerney, 2014). The industry's extensive value chain connections with both upstream suppliers and downstream markets cement its position as a vital economic pillar.

The motor vehicle manufacturing process consists of two primary assembly lines: body manufacturing and chassis assembly. The body manufacturing line is particularly crucial, involving welding body panels, installing doors/windows, and completing painting and trimming before final chassis integration. Alongside formal manufacturers, informal sector auto body repairers play a vital role in vehicle maintenance and performance optimization (Thumbi *et al.*, 2019). Kenya's automotive industry drives technological innovation, particularly in sustainable mobility solutions. The country shows strong potential for electric vehicle (EV) development, which could significantly reduce carbon emissions and fossil fuel dependence while creating new

economic opportunities (UNIDO, 2019). Despite its economic importance, the automotive industry generates environmental pollutants hazardous to human health (William et al., 2011) and presents numerous workplace risks (Bismark *et al.*, 2014). Comprehensive documentation of these hazards in vehicle body manufacturing is essential to improve worker safety awareness and implement effective mitigation strategies (Azuike *et al.*, 2017; Liu, 2008).

2.3 Automotive Sector and Vehicle Body Manufacturing Occupational Hazards and Risks

The automotive sector in Kenya plays a critical role in the country's economic development, yet it presents numerous occupational safety and health hazards that expose workers to significant risks. These hazards include exposure to harmful chemicals, excessive noise levels, mechanical injuries, and ergonomic challenges, making the industry one of the most hazardous in the country according to ILO reports. Studies such as those by Mwinzi *et al.* (2017) have identified common health impacts including hearing loss, skin irritation, and musculoskeletal disorders among workers.

While vehicle body manufacturing has become increasingly automated, workers still face dangers from hazardous materials and processes like welding, painting, and metal fabrication, particularly in informal garage settings where manual labor predominates (Azuike *et al.*, 2016; Ishola *et al.*, 2017; Williams, 2019). The risks are especially prevalent in developing countries, where workplace fatalities and non-fatal accidents occur at higher rates than in developed nations (ILO, 2019; Hamalainen *et al.*, 2017). Specific hazards in body manufacturing operations include exposure to engine emissions and paint chemicals, unsafe operation of forklifts, fire risks from welding, noise and vibration from grinding operations, ergonomic strains from lifting components, and movement hazards from transferring unfinished vehicles.

These widespread risks highlight the urgent need for comprehensive safety policies and proper implementation of occupational health measures to reduce accidents, protect worker wellbeing, and enhance productivity in this vital economic sector. The development and enforcement of effective safety protocols could significantly mitigate these occupational hazards while supporting the industry's continued growth and contribution to Kenya's economy.

2.3.1 Engine Emissions

Vehicle manufacturing exposes workers to multiple engine emissions, each posing distinct health hazards. Crankcase emissions, consisting of unburnt hydrocarbons (13–25% of total emissions), occur when fuel bypasses piston rings into the crankcase, minimal in diesel

engines due to air-only compression (Pundir, 2001). Evaporative emissions, accounting for 20–32% of emissions, arise from fuel volatility, with hydrocarbons escaping from fuel systems, especially during hot engine shutdowns (Shivaji, 2013). Exhaust emissions, contributing 60% of total pollutants, contain lethal compounds like carbon monoxide (CO), nitrogen oxides (NO_x), and carcinogenic polyaromatic hydrocarbons (PAHs) (Shivaji, 2013). Workers in proximity to exhaust fumes face acute respiratory and cardiovascular risks, exacerbated by prolonged exposure (Srinivasan, 2008).

CO, a colorless, odorless byproduct of incomplete combustion, persists for months in the atmosphere. Chronic exposure can prove fatal, particularly for workers with preexisting cardiopulmonary conditions (Pulkrabek, 2003). Diesel exhaust particulates, carbon soot adsorbed with hydrocarbons, pose lung infiltration risks, potentially triggering heart disease, reduced lung function, and premature death in susceptible individuals (Valavanidis *et al.*, 2008). Non-methane hydrocarbons (NMHCs) and sulfur dioxide (SO₂) further endanger workers; SO₂ exposure causes pulmonary edema, chronic asthma, and respiratory distress (Reno *et al.*, 2015).

Nitrogen oxides (NO_x), primarily NO and NO₂, form photochemical smog and nitric acid aerosols, with transport sectors contributing 49% of emissions in developing nations (Pundir, 1994). Heavy metals like lead (Pb), chromium (Cr), and cadmium (Cd), sourced from fuel additives and engine wear—are linked to occupational cancers, dermatitis, and bronchitis (Roig-Navarro *et al.*, 1997). Despite leaded fuel phase-outs, residual Pb persists in airborne particulates (Vassilakos *et al.*, 2007). Proactive measures, including emission monitoring, workplace ventilation, and stringent vehicle inspections, are critical to mitigate these occupational hazards and safeguard worker health in the automotive sector.

2.3.2 The Vehicle Risk

Motor vehicles, as self-propelled mechanical systems comprising approximately 15,000 integrated components (Cruise & Anglin, 2007), present multiple occupational hazards during manufacturing and maintenance operations. The jacking process poses significant risks, including vehicle rollover that may crush workers or damage equipment, and sudden jack failure that endangers technicians working beneath elevated vehicles (Read & Reid, 2000). Electrical systems present dual threats through high-voltage ignition components capable of inducing dangerous shocks and capacitive systems that retain lethal charges for over 24 hours' post-deactivation. Thermal hazards emerge from exhaust systems reaching temperatures of 2000°C,

particularly at manifold and front pipe locations, creating severe burn risks during immediate post-operation servicing. Mechanical dangers are equally prevalent, with drive belts and cooling fans operating at rotational speeds approaching 30,000 RPM, where loose clothing can rapidly become entangled in moving components. These compounded risks necessitate comprehensive safety protocols including lockout-tagout systems, thermal guards, and rotational equipment shielding to mitigate traumatic injury potential in vehicle manufacturing environments (Cruise & Anglin, 2007). The integration of such protective measures proves essential given the multiple interacting hazard modalities inherent in automotive production systems.

2.3.3 Hazards Associated with Tools, Equipment, and Work Practices in Vehicle Manufacturing

The automotive repair and manufacturing industry relies heavily on both hand tools and power tools to perform tasks efficiently. While proper tool use enhances productivity, improper handling poses significant risks. Common hand tools like hammers, screwdrivers, and pliers can cause injuries if damaged or misused—for instance, a worn screwdriver may slip and damage both the workpiece and the worker, while pliers used incorrectly can round off bolt heads and lead to hand injuries (Landsbergis, 2003). Cutting tools such as chisels and drills present additional hazards, particularly if they have mushroomed heads or are improperly secured, as flying metal fragments can cause severe injuries (Clarke, 2006).

Compressed gas cylinders, essential for welding and painting, introduce explosion risks if stored near heat sources or improperly secured. Compressed air, often used for cleaning, can propel debris at dangerous speeds, potentially penetrating skin or eyes, and even causing fatal air embolisms if directed at open wounds (CCOHS, 1985). Work practices in vehicle manufacturing further compound these risks. Physically demanding tasks, such as lifting heavy components like engines or transmissions, frequently result in musculoskeletal injuries if performed with improper technique (Read & Reid, 2000). Repetitive motions and prolonged awkward postures, common in assembly and servicing—increase the likelihood of strains, sprains, and chronic pain (Azila *et al.*, 2015; ILO, 2015). Poor workshop housekeeping, including cluttered floors, oil spills, and improperly stored tools, heightens the risk of slips, trips, and falls, which can lead to both minor and severe injuries (Monney *et al.*, 2014; Thumbi *et al.*, 2019). Elevated work surfaces introduce fall hazards, while accumulated waste and debris create additional dangers if not disposed of properly (Williams, 2019).

Effective risk mitigation requires a combination of proper tool maintenance, safe handling protocols, and disciplined workplace organization. Thoughtful plant layout and equipment design can significantly reduce hazards, ensuring that both machinery and work environments adhere to safety standards (Gupta, 2008). By addressing these risks, workshops can enhance worker safety while maintaining operational efficiency.

2.3.4 Fire and Combustion Hazards in Vehicle Manufacturing

Vehicle manufacturing and repair workshops face significant fire and combustion hazards stemming from multiple sources. Flammable liquids like gasoline, diesel, and paint thinners present explosion risks, with gasoline vapors being particularly dangerous as even minor sparks from electrical equipment can trigger catastrophic explosions (Asfal, 2004). Welding operations introduce additional dangers through extreme heat application, with processes categorized into gas welding (oxyacetylene), arc welding, and resistance welding - each carrying unique risks. The oxyacetylene process involves pressurized cylinders storing acetylene and oxygen at 2,000 psi, where valve failures can lead to devastating explosions, while arc welding generates intense light emissions harmful to vision (Chaudhary *et al.*, 2013; Hewitt, 1996).

Secondary hazards include combustible dust from grinding and sanding operations containing silica and heavy metals that pose inhalation risks (EPA, 2011), and toxic fumes from welding, painting, and engine exhaust containing carbon monoxide, nitrogen oxides, and hydrocarbons that threaten respiratory health (Abanga, 2016; Safe Work SA, 2017). The workshop environment also harbors less obvious dangers like spontaneous combustion of oily rags and flying sparks from grinding operations that can ignite fires unexpectedly (CCOHS, 1985). These compounded risks necessitate comprehensive safety measures including proper ventilation systems, rigorous flammable material storage protocols, and strict personal protective equipment requirements to mitigate both immediate explosion dangers and long-term health consequences for automotive workers.

2.3.5 Noise Hazards in Vehicle Manufacturing

Noise in automotive workshops extends beyond mere annoyance, posing significant risks to worker safety, productivity, and long-term health. When sound becomes undesirable or disruptive, it transitions from an environmental factor to a hazardous noise pollutant (Beyea, 2007). This industrial noise, characterized by excessive loudness (amplitude) and pitch (frequency), interferes with communication, concentration, and rest. Regulatory standards

mandate that when noise exceeds permissible limits, workplaces must first implement engineering or administrative controls before resorting to personal protective equipment (Hammad *et al.*, 2016).

In vehicle manufacturing and repair settings, noise and vibration exposure is inevitable. Power tools (grinders, sanders, cutters), heavy machinery, engines, and compressed air systems generate hazardous noise levels during routine operations (Ahmed *et al.*, 2018; HSE, 2013). These vibrations not only contribute to noise pollution but also transmit through workers' hands and bodies, potentially causing vascular or neurological disorders (Williams, 2019). Without proper hearing protection, chronic exposure leads to irreversible noise-induced hearing loss, as high decibel levels damage the cochlea's hair cells in the inner ear (Azuike, 2016).

Industrial noise originates primarily from four activities: fabrication, assembly, power generation, and processing (Gupta, 2008). Metal fabrication processes—cutting, pressing, riveting, are particularly noisy in bus body manufacturing. Similarly, molding operations utilizing high-pressure air systems contribute significantly to ambient noise pollution. While extreme noise exposure causes direct physiological harm like hearing impairment, chronic lower-level exposure degrades quality of life by disrupting communication and increasing stress (WHO, 1995). This underscores the necessity for comprehensive noise control measures in automotive workspaces to protect both worker health and operational efficiency.

2.3.6 Motor Vehicle Manufacturing

The motor vehicle manufacturing industry presents numerous occupational hazards due to its diverse operations, varied work environments, and workforce composition. Research by Warner (1996) and Falck *et al.* (2010) reveals that workers commonly suffer sprains/strains (39%), lacerations (22%), and contusions (15%), with sprains alone accounting for 65% of lost workdays. These injuries typically result from repetitive motions, falls, overexertion during lifting, being struck by objects, slips, machinery entrapment, and falls from heights. The economic impact of such workplace injuries is substantial, affecting both company profits through lost productivity and workers through lost wages, while also burdening healthcare systems and insurers (GoK, 2007).

Alarming injury statistics from Auto Parts Manufacturing Inc. (2005) recorded 450 cases between 1993-1994, including severe injuries like amputations, fractures, and flash burns. Safety inspections identified critical deficiencies such as unguarded machinery, lack of fall protection,

inadequate training, improperly secured equipment, and electrical hazards. Additional shortcomings included missing safety documentation, improper chemical labeling, insufficient personal protective equipment (PPE), and inadequate hearing conservation measures for noise levels exceeding 85dBA.

The automotive manufacturing sector reports exceptionally high workers' compensation claims, with 71% of employees experiencing work-related injuries (Hurnyak, 2012). Rising healthcare costs have prompted industry leaders to implement preventive measures, exemplified by the collaboration between major automakers and Ohio State University to establish the Center for Occupational Health in Automobile Manufacturing. This initiative addresses the staggering healthcare expenses that now approach \$2,000 per vehicle produced, surpassing even steel costs (Center for Occupational Health in Automotive Manufacturing, 2011). The partnership focuses on injury prevention research and production process improvements to enhance workplace safety while reducing both physical harm to workers and financial losses to companies.

2.3.7 Chemical Hazards in Vehicle Manufacturing and Spray Painting Operations

The vehicle manufacturing process exposes workers to numerous hazardous chemicals at various production stages, creating significant occupational health challenges (Ahmed et al., 2018). These toxic substances—including heavy metals in brake fluids, degreasers, and lubricants, as well as benzene, solvents, and welding fumes—pose severe health risks through inhalation or skin contact (Adejumo *et al.*, 2017; Saliu *et al.*, 2015). Common workplace chemicals like asbestos, manganese, toluene, and xylene negatively impact worker health (Huang et al., 2013), necessitating strict safety protocols (Hughes, 2019).

Spray painting, while essential for vehicle finishing, exposes workers to dangerous paints, coatings, and solvents during mixing and application (Abanga, 2016; Barlet, 2013). These chemicals can enter the body through inhalation, skin absorption, or even high-pressure injection, causing symptoms ranging from nausea and rashes to asthma and lung cancer (Otto & Scholl, 2011). Preparation work like sanding generates fine dust containing silica and heavy metals that adhere to skin and clothing, potentially contaminating homes (Deros *et al.*, 2010). Body fillers containing styrene and paint strippers with methylene chloride present additional cancer risks and organ damage (CDC, 1976; Fam *et al.*, 2010).

Isocyanates, used in polyurethane products, are particularly hazardous, causing respiratory issues and making painters 80 times more likely to develop asthma (Gerr *et al.*, 2014;

HSE, 2009). Other solvents like toluene and xylene affect multiple body systems, with chronic exposure leading to organ damage and developmental problems (Mandiracioglu *et al.*, 2011; Mohammadi *et al.*, 2010). Heavy metals such as chromium and cadmium, encountered during welding and grinding, accumulate in the body, causing long-term damage to lungs, kidneys, and other organs while increasing cancer risks (ATSDR, 2012; Nordberg *et al.*, 2014). Despite established exposure limits by OSHA and NIOSH, workplace concentrations often exceed safe levels, underscoring the need for enhanced protective measures in automotive manufacturing environments.

2.3.8 Ergonomic Risks in Vehicle Manufacturing

The science of ergonomics focuses on adapting workplaces, tools, and tasks to align with workers' physical and psychological capabilities, aiming to prevent injuries and strain (Ross, 1994). In vehicle manufacturing, where traditional designs often prioritize equipment over human factors, ergonomic principles have become crucial for addressing injuries caused by repetitive motions, excessive force, and awkward postures. Research identifies seven primary ergonomic risk factors that significantly impact worker health in this sector.

Repetition emerges as a critical concern, defined as performing identical motions with minimal recovery time (Jaffar *et al.*, 2011). This constant muscle use leads to fatigue and overuse injuries, often affecting stabilizing muscle groups rather than primary movers. The injury risk escalates when repetition combines with other factors like forceful exertions or poor posture, though no specific repetition threshold guarantees safety.

Vibration exposure presents another major hazard, particularly from power tools operating between 20-80 Hz (Jaffar *et al.*, 2011). Hand-arm vibration causes vascular issues like Raynaud's disease and may contribute to carpal tunnel syndrome, while whole-body vibration from vehicles or machinery affects internal organs (Mariana, 2012). The damage occurs through tissue resonance or energy absorption at low frequencies.

Forceful exertions during lifting, pushing, or gripping overwork muscles and tendons, increasing cumulative trauma risks (Genaidy *et al.*, 1993). Awkward postures that deviate from joints' neutral positions demand extra muscular effort and significantly raise injury likelihood (Kolgiri *et al.*, 2016). Common problematic positions include reaching, twisting, or working with elevated arms - all frequent in vehicle assembly tasks.

Static loading, where workers maintain fixed positions like during vehicle operation, creates discomfort and fatigue (Inyang *et al.*, 2011). Temperature extremes impair performance, with cold reducing dexterity and heat causing stress that may lead to heat stroke (Xiang *et al.*, 2014). Contact stress from tools or work surfaces compressing soft tissues completes the risk factors (Rao *et al.*, 2016).

These ergonomic hazards collectively contribute to cumulative trauma disorders (CTDs) affecting hands, wrists, shoulders, and spine (Kroemer, 1989). Beyond health impacts, CTDs create substantial economic burdens through medical costs, lost productivity, and compensation claims (Ross, 1994). Proactive ergonomic interventions are essential to protect workers and maintain operational efficiency in vehicle manufacturing environments.

2.3.9 Individual Risk Factors to Workplace Related Injuries and Diseases

Workplace environments, where employees spend significant portions of their lives, continue to pose substantial health and safety risks despite regulatory improvements. The U.S. Bureau of Labor Statistics recorded 2.8 million nonfatal occupational injuries and illnesses in 2019 alone (BLS, 2020), underscoring how workplace hazards affect both individual wellbeing and organizational productivity through increased costs and lost workdays. Key individual risk factors including age, gender, behavior, and education level significantly influence injury susceptibility as examined below.

Work-related musculoskeletal injuries (WRMSIs) demonstrate clear age correlations, with most individuals experiencing their first significant back pain episode by age 35 (Anderson & Briggs, 2008). While prevalence remains relatively stable during prime working years (25-60), degenerative tissue changes and strength reduction in later years amplify injury risks (Boocock *et al.*, 2007). BLS (2020) data reveals workers over 65 face the highest fatal injury rates, while those aged 55-64 experience more nonfatal incidents than younger cohorts. Age-related declines in physical capabilities - including reduced strength, flexibility and balance - increase susceptibility to slips, trips and falls (CDC, 2020). Chronic conditions common among older workers (such as arthritis, diabetes) may further compromise workplace safety by impairing mobility and cognitive function (NCCI, 2016). These factors warrant particular attention in physically demanding sectors like vehicle body manufacturing.

Employee actions substantially contribute to occupational safety outcomes. Hazardous behaviors like alcohol use at work, unsafe practices, inadequate task knowledge, and poor

concentration significantly elevate injury risks (Afolabi *et al.*, 2021; Ataro *et al.*, 2018). The physically taxing nature of vehicle manufacturing - involving repetitive motions, prolonged static postures and extended work hours - exacerbates these behavioral risks (Williams, 2019). Evolving job demands in the sector may further challenge workers' capacity to maintain safe practices consistently (Abdalla *et al.*, 2017).

Occupational injury patterns reveal notable gender differences. Men experience 64% of workplace fatalities (BLS, 2020), largely due to disproportionate representation in high-risk sectors like manufacturing. Conversely, women face greater repetitive strain injury risks, with studies showing 1.3-1.6 times higher compensation claim rates across industries (Cole *et al.*, 2005). Workplace violence presents additional gender-specific risks, particularly in healthcare settings (NIOSH, 2015). These disparities reflect both physiological differences and occupational segregation patterns that warrant consideration in safety planning.

Workers with limited education and training face elevated injury risks, as evidenced by higher incident rates among those without high school diplomas (BLS, 2020). Insufficient safety knowledge and skill gaps in minimally trained occupations like manufacturing labor contribute to this pattern. Limited access to employer-provided safety training further compounds these vulnerabilities (NIOSH, 2015).

Vehicle manufacturing exposes workers to diverse hazards with both immediate and latent health effects (ILO, 2015). While automated facilities mitigate some risks, labor-intensive operations - particularly in developing nations' informal sectors - present substantial dangers (Ahmed *et al.*, 2018). Acute effects range from dermatitis and respiratory irritation to occupational asthma, while chronic exposures may lead to cancer, organ damage, and reproductive harm (Safe Work SA, 2017). The sector's unique combination of chemical, physical and ergonomic hazards necessitates comprehensive protective measures tailored to both workplace conditions and individual risk factors.

2.3.10 Musculoskeletal Disorders (MSDs) in the Automotive Industry

Musculoskeletal Disorders (MSDs) are a significant occupational health concern, particularly in industries involving repetitive physical labor, such as vehicle body manufacturing and auto mechanic services. These disorders develop due to prolonged physical stress on various parts of the body, including the arms, joints, legs, and tendons, often resulting in chronic pain, repetitive strain injuries, and other debilitating conditions (Yee & Al-Rejal, 2017). Workers in

these industries frequently maintain the same posture for extended periods, sometimes over an hour without breaks—which increases the risk of musculoskeletal injuries (Dhanuraja & Krishnakumar, 2021).

According to Luttman *et al.* (2013), several workplace factors contribute to the development of MSDs, particularly in the automotive sector. One primary factor is the application of high-intensity force, which can lead to acute overloading of bodily tissues. Tasks that involve lifting, pushing, pulling, or gripping heavy objects place excessive stress on muscles, tendons, and ligaments. When these activities are performed repeatedly over months or years, they can lead to musculoskeletal deterioration. For example, long-term manual labor in auto repair shops often results in degenerative conditions, particularly in the lumbar spine. To assess the impact of such activities, researchers use cumulative dose measurements, which account for variables such as duration, frequency, and intensity of the physical load.

Even when the objects being handled are lightweight, repetitive motions can still contribute to MSDs. Occupations requiring prolonged assembly of small components, for instance, may strain specific muscle groups due to continuous use. Over time, this can lead to muscle fatigue, discomfort, and potential injury. Additionally, poor ergonomic conditions exacerbate the problem. While well-designed workstations allow workers to maintain a neutral posture, shoulders relaxed and arms close to the body—many industrial settings force employees into awkward positions. Bending, twisting, or stretching the trunk for prolonged periods increases spinal pressure and strains surrounding muscles. Similarly, working in crouched or kneeling positions further stresses the musculoskeletal system, heightening injury risks.

Another critical factor is static muscle load, which occurs when muscles remain contracted for extended periods without movement. This is common in tasks requiring sustained overhead work, such as drilling in tight spaces. Unlike dynamic movements, static contractions restrict blood flow, leading to muscle fatigue, swelling, and impaired function. Over time, this can result in chronic pain and reduced work efficiency.

Vibration exposure is another significant hazard, particularly for workers using handheld power tools like metal drills. Prolonged exposure to hand-arm vibrations can lead to nerve damage, reduced circulation (manifesting as "white finger syndrome"), and degenerative joint conditions. Whole-body vibrations, experienced by operators of heavy machinery such as forklifts or earth-moving equipment, pose additional risks. When combined with poor posture—

such as sitting in a twisted position—these vibrations accelerate spinal degeneration (Luttman *et al.*, 2013).

External environmental factors, such as extreme temperatures, can also amplify the risk of MSDs. Cold working conditions, for example, exacerbate the effects of vibration exposure, increasing the likelihood of hand and arm disorders. Similarly, inadequate workplace design, lack of rest breaks, and insufficient ergonomic training further contribute to musculoskeletal strain. Given the prevalence of MSDs in the automotive industry, implementing ergonomic interventions—such as adjustable workstations, mechanical aids, and worker education—is essential. By addressing these risk factors, employers can reduce injury rates, enhance productivity, and improve overall worker well-being.

2.3.11 Loss of Hearing

Excessive noise exposure in industrial environments, particularly in sectors such as automobile manufacturing and repair, poses a significant and escalating health hazard. Modern research underscores that prolonged exposure to high noise levels not only jeopardizes auditory health but also has broader physiological and psychological consequences for affected individuals and communities (Asad *et al.*, 2016). Among sensory impairments, hearing loss ranks as one of the most prevalent conditions worldwide (Barrett *et al.*, 2010). This condition, known as noise-induced hearing loss (NIHL), arises from either chronic exposure to loud noises over time or a single incident of extreme acoustic trauma.

The consequences of such exposure can be severe, leading to permanent auditory damage (Harrison, 2008). In fact, NIHL has emerged as the most common occupational disease in recent years, highlighting the urgent need for better workplace safety measures (Chen *et al.*, 2019). According to a World Health Organization (WHO) survey conducted in 2018, an alarming 16% of adult hearing loss cases are directly attributable to occupational noise exposure, emphasizing the widespread nature of this issue.

Hearing is an essential sense that profoundly influences an individual's quality of life, professional performance, and overall well-being. When hearing deteriorates, it creates substantial challenges in daily activities, communication, and workplace efficiency. Employees suffering from hearing impairment often experience reduced productivity and face increased safety risks, as they may struggle to hear alarms, verbal instructions, or approaching machinery. Unlike some other forms of hearing impairment, NIHL typically develops gradually and

cumulatively, worsening over years of exposure without immediate noticeable symptoms (Harrison, 2008).

There are two primary types of hearing loss: conductive and sensorineural. Conductive hearing loss occurs when sound waves are obstructed in the outer or middle ear, often due to physical blockages or infections. In contrast, noise-induced hearing loss is sensorineural, meaning it results from damage to the delicate hair cells in the inner ear or the auditory nerve (American Speech-Language-Hearing Association, 2005). When the vestibulocochlear nerve (eighth cranial nerve) is affected, the condition is classified as sensory hearing loss. If both the nerve and inner ear structures are compromised, it is termed sensorineural hearing loss (SNHL). Unfortunately, SNHL is typically permanent and irreversible, as the damaged nerve fibers and hair cells cannot regenerate. Unlike conductive hearing loss, which may sometimes be corrected surgically or medically, sensorineural damage offers no such remedy. The effects of NIHL often persist long after noise exposure ceases, underscoring the critical importance of preventive measures in occupational settings.

Even before permanent damage occurs, excessive noise can cause temporary hearing impairment, known as a temporary threshold shift (TTS). This condition manifests as muffled hearing or tinnitus (ringing in the ears) after exposure to loud noises. While hearing may initially recover after a period of rest, repeated episodes of TTS can progress into permanent NIHL over time. Noise pollution is one of the most pervasive yet overlooked hazards in modern workplaces. It affects millions of workers across various industries, with industrial noise being a leading contributor to global hearing disability. Shockingly, occupational NIHL cases more than doubled from 120 million in 1995 to 250 million in 2004, reflecting worsening conditions in many industrial sectors (Nelson *et al.*, 2005). This trend highlights the urgent need for stricter noise regulations, improved protective equipment, and workplace hearing conservation programs to safeguard workers' auditory health.

Given the irreversible nature of noise-induced hearing loss, preventive strategies must be prioritized in high-risk industries. Employers should implement engineering controls (such as noise dampening materials), administrative controls (like rotating shifts to reduce exposure time), and personal protective equipment (PPE) (such as high-quality earplugs or earmuffs). Additionally, regular hearing screenings and employee education programs can help detect early signs of hearing damage and promote safer work practices. By addressing noise hazards

proactively, industries can protect workers' hearing, enhance productivity, and reduce long-term healthcare costs associated with occupational hearing loss.

2.3.12 Asthmatic and Bronchitis Disease Symptoms/ Respiratory Diseases

The automobile industry presents numerous occupational health risks, particularly concerning respiratory diseases, due to workers' frequent exposure to hazardous airborne contaminants throughout various manufacturing and assembly processes. These dangerous substances, including fine particulate matter, toxic fumes, volatile organic compounds, and chemical vapors, can accumulate in the respiratory system over time, leading to chronic and potentially debilitating pulmonary conditions. Among the most prevalent and severe of these occupational illnesses is silicosis, a progressive and incurable lung disease caused by prolonged inhalation of crystalline silica dust. Silica is ubiquitous in automobile manufacturing, present in foundry sand used for metal casting, abrasive materials for sandblasting operations, and various composite materials. Workers regularly exposed to silica particles without adequate protection may develop this condition, which manifests through symptoms such as persistent coughing, severe shortness of breath, chest tightness, and heightened susceptibility to respiratory infections like tuberculosis (Sharma *et al.*, 2016). In advanced stages, silicosis can lead to progressive massive fibrosis, drastically reducing lung function and often proving fatal.

Another historically significant but still relevant respiratory hazard in the automotive sector is asbestosis, a chronic lung disease caused by inhaling asbestos fibers. Although the use of asbestos has declined in recent decades due to regulatory restrictions, it was once widely utilized in automobile manufacturing for its heat-resistant properties. Asbestos was commonly incorporated into brake linings, clutch facings, gaskets, and insulation materials in vehicles and production facilities. Workers involved in brake repair, demolition of old factories, or maintenance of aging industrial equipment remain at risk of exposure. Asbestosis develops gradually, causing scarring (fibrosis) of lung tissue, which impedes oxygen exchange and results in symptoms such as persistent dry cough, chest discomfort, and progressive breathlessness. Moreover, asbestos exposure is strongly linked to mesothelioma, an aggressive form of cancer affecting the lining of the lungs, as well as lung cancer—even at relatively low exposure levels (Lemen, 2004). Despite reduced usage, legacy asbestos in older facilities and vehicles means that workers, particularly in repair and demolition roles, continue to face exposure risks.

Beyond silicosis and asbestosis, automobile industry workers are vulnerable to other serious respiratory conditions, including chronic obstructive pulmonary disease (COPD) and occupational asthma. COPD is a chronic inflammatory lung disorder characterized by persistent airflow obstruction, and it encompasses two primary conditions: chronic bronchitis (marked by long-term airway inflammation and excessive mucus production) and emphysema (involving the destruction of alveoli, the lung's air sacs). Workers regularly exposed to welding fumes, paint solvents, diesel exhaust, and metal dust are at heightened risk of developing COPD, which leads to wheezing, chronic cough, frequent respiratory infections, and progressive difficulty in breathing (Brashier *et al.*, 2012).

Occupational asthma, another significant concern, arises from sensitization to workplace allergens or irritants such as isocyanates (found in automotive paints), metalworking fluids, and epoxy resins. Unlike traditional asthma, occupational asthma often worsens during work hours and may improve on weekends or vacations, though prolonged exposure can lead to permanent airway damage. Early symptoms include wheezing, chest tightness, and nocturnal coughing, but without intervention, the condition can become debilitating (Brashier *et al.*, 2012).

Given the irreversible nature of many occupational respiratory diseases, preventive strategies in the automobile industry must prioritize engineering controls (such as improved ventilation and enclosed workspaces), administrative measures (including job rotation to limit exposure duration), and strict personal protective equipment (PPE) protocols (such as NIOSH-approved respirators). Additionally, regular health surveillance, including pulmonary function tests and chest imaging, can help detect early signs of disease before irreversible damage occurs. By implementing comprehensive respiratory protection programs, employers can mitigate risks, comply with safety regulations, and safeguard workers' long-term health—ensuring a healthier, more productive workforce while reducing healthcare burdens associated with chronic occupational lung diseases (Lemen, 2004).

The automobile manufacturing industry presents significant respiratory health hazards to workers due to prolonged exposure to various airborne contaminants. These occupational risks stem from inhalation of dust particles, chemical fumes, and other harmful substances commonly encountered during production processes. Among the most concerning respiratory conditions is occupational asthma (OA), which medical researchers recognize as the most prevalent work-related respiratory disorder. This condition carries particular significance as it frequently

develops in otherwise healthy young workers, potentially leading to chronic respiratory impairment while simultaneously reducing workforce productivity. Scientific studies have identified over 300 distinct substances capable of triggering OA, with new causative agents continually being recognized as manufacturing processes incorporate novel chemical compounds. The characteristic symptoms include recurrent wheezing episodes, pronounced shortness of breath, persistent chest tightness, and chronic coughing - all resulting from increased bronchial sensitivity and ongoing inflammation of the respiratory tract's mucosal lining (Brashier *et al.*, 2012).

To effectively mitigate these respiratory risks, automotive manufacturers must implement comprehensive, multi-faceted protection strategies. A robust respiratory protection program should incorporate several critical components including appropriate personal protective equipment, engineering controls, administrative measures, and environmental monitoring systems. Workers require NIOSH-approved respirators specifically selected for the hazards present in their work areas, along with proper training in their use and maintenance. Engineering solutions such as advanced ventilation systems with local exhaust at emission sources and process enclosures can significantly reduce airborne contaminant levels. Administrative controls including job rotation schedules, designated clean break areas, and thorough hazard communication programs further enhance protection. Regular air quality monitoring for silica, isocyanates, and other hazardous substances provides essential data to evaluate control effectiveness and identify areas needing improvement (Brashier *et al.*, 2012).

The serious health consequences of occupational respiratory exposures demand sustained, proactive prevention efforts throughout the automotive industry. Workers routinely encounter multiple respiratory hazards including crystalline silica during foundry operations, asbestos fibers in brake component maintenance, and asthma-inducing isocyanates in paint applications. These exposures can lead to debilitating conditions such as silicosis, asbestosis, chronic obstructive pulmonary disease, and occupational asthma - all potentially causing permanent lung damage and diminished quality of life. Effective prevention requires more than minimal regulatory compliance; it necessitates an organizational culture that prioritizes respiratory health through regular medical surveillance, comprehensive worker education, investment in cleaner production technologies, and continuous improvement of exposure control measures. By implementing these comprehensive protections, manufacturers can achieve substantial reductions

in occupational respiratory diseases while maintaining operational efficiency, ultimately benefiting both worker health and business outcomes through lower healthcare costs, reduced compensation claims, and improved workforce retention (Sharma *et al.*, 2016).

2.3.13 Skin Diseases

Automotive workers face significant dermatological hazards in their daily work environments, with numerous studies documenting the prevalence of occupational skin diseases among this population (Dhanuraja & Krishnakumar, 2021; Ford, 2012). Employees in vehicle body shops and manufacturing facilities routinely encounter multiple cutaneous irritants including petroleum-based products (oils and greases), allergenic chemicals, industrial solvents, cleaning detergents, paint components, and airborne particulates from sanding operations (HSE, 2008). These substances compromise the skin's natural protective barrier through both mechanical abrasion and chemical corrosion, creating entry points for pathogenic microorganisms while simultaneously increasing susceptibility to various dermatological conditions (Mohammad *et al.*, 2019).

Contact dermatitis emerges as the most frequently diagnosed work-related skin disorder among automotive professionals (Srinivas *et al.*, 1987). This inflammatory skin condition manifests in two primary forms: irritant contact dermatitis resulting from direct chemical damage to the skin, and allergic contact dermatitis stemming from delayed hypersensitivity reactions. The automotive work environment contains numerous causative agents including cutting fluids, metalworking lubricants, paint hardeners, epoxy resins, and cleaning solvents (HSE, 2011). Clinical presentation typically involves erythematous patches, intense pruritus, and vesiculation, with the hands and forearms being most commonly affected due to frequent direct contact with hazardous substances (Dhar *et al.*, 2016).

Beyond contact dermatitis, automotive workers demonstrate increased incidence rates of several other dermatoses. Prolonged exposure to petroleum products leads to oil folliculitis, characterized by inflammatory papules and pustules (Burdon *et al.*, 2010). Occupational eczema shows significantly higher prevalence among paint department workers, with prevalence rates exceeding 30% in some automotive painting operations (Dhar *et al.*, 2016). The work environment also presents multiple risks for acute skin injuries including thermal burns from welding operations, chemical burns from battery acids, and abrasions from metal filings (HSE, 2011). Most concerning is the elevated risk of skin cancer from chronic exposure to polycyclic

aromatic hydrocarbons in used engine oils combined with ultraviolet radiation exposure during welding operations (Burdon *et al.*, 2010).

Current occupational health research emphasizes comprehensive prevention programs incorporating engineering controls, personal protective equipment, worker education, and medical surveillance (Mohammad *et al.*, 2019). The substantial body of epidemiological evidence underscores the occupational origin of these dermatological conditions and establishes clear employer responsibilities for implementing effective prevention programs (Burdon *et al.*, 2010; Dhar *et al.*, 2016; Srinivas *et al.*, 1987). As the automotive industry continues to develop new materials and processes, ongoing dermatological surveillance and adaptation of protective measures remains essential for maintaining workforce skin health (Dhanuraja & Krishnakumar, 2021).

2.3.14 Occupational Eye Hazards in the Automotive Industry

Automotive industry workers face numerous occupational hazards that threaten their eye health across various job functions (CCOHS, 2018; NIOSH, 2008). In welding operations common to vehicle manufacturing and repair shops, employees risk developing conjunctivitis - an inflammation of the eye's protective membrane - due to exposure to intense light and airborne particulates (Martinelli, 2018). Government health agencies report that nearly one-third of all manufacturing-related eye injuries occur during assembly, sanding and grinding tasks fundamental to auto body work (U.S. Bureau of Labor Statistics, 2022).

The ultraviolet radiation emitted during welding poses particularly severe risks, capable of causing both immediate conditions like photokeratitis (commonly called "arc eye") and long-term damage including cataract formation that may lead to permanent vision impairment (Martinelli, 2018). Beyond welding hazards, automotive painters encounter dangers from isocyanate compounds present in spray paints, which can irritate ocular tissues and potentially damage the cornea (Mwatu, 2011).

The modern automotive workplace also presents less obvious but equally concerning eye health challenges (Dhanuraja & Krishnakumar, 2021). Many technicians develop dry eye syndrome from prolonged exposure to workshop air conditioning and dust (AOA, 2008; Lemp, 1995), while office-based staff increasingly report computer vision syndrome from extended screen time (AOA, 2008). These conditions manifest through symptoms ranging from mild

irritation and redness to severe pain and blurred vision, with potential complications including secondary infections that could threaten eyesight (Campbell *et al.*, 1983).

The prevalence of these occupational eye disorders underscores the need for comprehensive protective measures in automotive workplaces (Attarchi *et al.*, 2009). Essential safeguards include proper eye protection equipment tailored to specific tasks, workplace ergonomic assessments, environmental controls to maintain air quality and humidity, and regular vision screenings to detect early signs of damage. As automotive technologies evolve, maintaining vigilance about ocular health risks remains crucial for protecting workers across all sectors of the industry.

2.3.15 Cancer

Automotive industry workers face significant cancer risks due to prolonged exposure to carcinogenic substances in their daily work environments. Multiple studies have identified vehicle manufacturing and repair shops as high-risk settings for occupational carcinogenesis (Ataro *et al.*, 2019). The International Agency for Research on Cancer (IARC) has classified several chemicals commonly encountered in this sector as known human carcinogens, including asbestos, benzene, and polycyclic aromatic hydrocarbons (IARC, 2019). These hazardous exposures occur through multiple pathways during routine tasks such as engine repair, welding, and parts cleaning (Udonwa *et al.*, 2009).

Workers are particularly vulnerable to inhalation exposures from brake dust containing asbestos fibers, which significantly increases risks for lung cancer and mesothelioma (Kanarek & Anderson, 2018). The American Cancer Council has documented strong associations between benzene exposure in automotive settings and development of leukemia, particularly acute myeloid leukemia. Welding operations present additional hazards, with fumes containing carcinogenic metals like chromium and nickel that elevate risks for bladder and kidney cancers (Jill *et al.*, 2017). Secondary exposure routes include dermal absorption and accidental ingestion when workers eat or smoke without proper hand hygiene (Christopher *et al.*, 2007).

The latency period for many occupational cancers often spans decades, making early intervention challenging. Recent epidemiological studies suggest rising incidence rates of work-related malignancies in the automotive sector, potentially linked to newer chemical formulations with insufficient safety data (Lavicoli *et al.*, 2019). This troubling trend underscores the urgent need for enhanced protective measures including improved ventilation systems, mandatory

personal protective equipment protocols, and comprehensive worker health monitoring programs to mitigate these preventable occupational health threats.

2.4 Occupational Exposure to Hand-Arm Vibration and Its Health Consequences in the Automotive Industry

Workers engaged in vehicle manufacturing and repair operations face significant health risks from prolonged exposure to hand-transmitted vibration through power tools, with vibration white finger (VWF) representing one of the most prevalent and debilitating occupational diseases in this sector. This condition, clinically recognized as hand-arm vibration syndrome (HAVS), develops through chronic use of vibrating equipment such as orbital sanders, pneumatic chisels, angle grinders, and polishers that are ubiquitous in auto body shops and assembly lines (Gemne *et al.*, 1987). The pathophysiological progression of HAVS involves a complex interplay of vascular, neurological, and musculoskeletal damage mechanisms that collectively manifest through a constellation of distressing symptoms. These include persistent paresthesia (tingling sensations), progressive hypoesthesia (numbness), diminished grip strength compromising work capacity, and the hallmark Raynaud's phenomenon characterized by triphasic color changes - initial pallor (white finger) upon cold exposure, followed by cyanosis (bluish discoloration), and subsequent painful erythema (redness) during rewarming phases (Gemne & Taylor, 1983).

The biomechanical transmission of vibration energy from power tools initiates a cascade of tissue damage primarily concentrated in the hands and upper extremities, but with potential systemic ramifications. High-frequency vibrations between 50-150 Hz are particularly damaging as they resonate with the natural frequency of finger tissues, causing microtrauma to vascular endothelium, peripheral nerve fibers, and musculoskeletal structures (Gemne *et al.*, 1992). Contemporary research has elucidated the multifactorial pathogenesis involving: (1) direct mechanical damage to capillary beds and digital arteries; (2) repetitive trauma to Pacinian corpuscles and other sensory receptors; and (3) sustained overstimulation of sympathetic nervous system pathways (Sakakibara *et al.*, 1993). The systemic consequences extend beyond the upper limbs, with documented autonomic nervous system dysregulation potentially contributing to cardiovascular abnormalities including sinus bradycardia, left ventricular hypertrophy, and altered hemodynamic responses (Pyyko *et al.*, 1994).

The clinical presentation of HAVS often includes troubling neuropsychiatric comorbidities such as chronic tension headaches, sleep architecture disturbances, auditory

tinnitus, and in some cases, sexual dysfunction - findings that suggest possible supraspinal involvement through afferent neurological pathways (Sakakibara *et al.*, 1988). Advanced cases frequently demonstrate a triad of chronic manifestations: (1) persistent cardiac rhythm disturbances and peripheral vascular dysfunction; (2) accelerated auditory damage with pronounced noise-induced hearing loss; and (3) cold-induced vasospastic responses in non-exposed extremities, indicating generalized autonomic dysregulation (Toibana *et al.*, 1994). The underlying pathomechanisms involve sustained sympathetic overactivity leading to excessive peripheral vasoconstriction, potential endothelial dysfunction through oxidative stress pathways, and structural vascular remodeling with smooth muscle hyperplasia that may progress to digital artery stenosis in severe, untreated cases.

These well-documented health risks necessitate implementation of comprehensive workplace control measures in automotive occupations. Engineering solutions should incorporate vibration-dampening technologies in tool design, including anti-vibration materials and ergonomic modifications. Administrative controls must establish mandatory work-rest cycles and job rotation schedules to limit continuous vibration exposure. Personal protective equipment programs should provide properly fitted anti-vibration gloves with demonstrated attenuation properties. Medical surveillance protocols should include regular vascular and neurological assessments to enable early detection of subclinical damage. Without such rigorous interventions, affected workers risk developing irreversible, disabling conditions that not only impair occupational performance but also significantly diminish quality of life. The automotive industry must prioritize these evidence-based prevention strategies to mitigate the substantial burden of occupational vibration-related diseases among its workforce.

2.4.1 Psychosocial Health Issues

Automotive industry workers face a complex array of psychosocial health challenges that significantly impact their overall wellbeing. The nature of assembly line work creates an environment where mental, emotional, and social health concerns frequently develop and often go unaddressed (Williams, 2019). Modern automotive manufacturing plants typically organize production into sequential specialized shops - body construction, painting, and final assembly - each presenting unique stressors that contribute to worker distress (WHO, 2017). The physical work environment itself, characterized by constant machinery noise, vibration exposure, and

hazardous equipment operation, serves as a persistent source of physiological stress that can precipitate psychological strain over time.

Compounding these environmental factors, many assembly workers report feeling undervalued by management, with perceived indifference toward creating supportive workplace conditions (Kvarnstrom, 1997). The rapid implementation of advanced manufacturing technologies has further exacerbated worker stress by increasing job complexity while simultaneously reducing workers' ability to oversee complete production processes. This combination of heightened demands and reduced control fosters significant anxiety about job performance and fear of the unknown among automotive employees (Kvarnstrom, 1997). Research consistently identifies assembly line workers as particularly vulnerable to occupational stress, with studies demonstrating substantially higher stress levels among automotive workers compared to other industrial sectors (Oleske *et al.*, 2004).

The structural organization of automotive assembly work creates near-ideal conditions for chronic stress development. Workers must perform highly prescribed tasks with minimal autonomy, maintain relentless production pace, and often work in relative isolation with limited social interaction (Lottridge, 2004). These conditions align precisely with known psychosocial risk factors for workplace mental health issues. Adding to this burden, the automotive industry's economic volatility creates pervasive job insecurity that functions as a chronic stressor, with mental health impacts intensifying as exposure duration increases (Heaney *et al.*, 1994). The psychological toll manifests in elevated rates of depression, anxiety disorders, and stress-related conditions among automotive workers (Bennett *et al.*, 2004).

Contemporary research increasingly examines how specific psychosocial job characteristics influence mental health outcomes using models like the Job Demand-Control-Support (JDCS) framework. This model identifies three critical dimensions - psychological job demands, decision-making autonomy, and workplace social support - that interact to determine stress vulnerability (Sanne *et al.*, 2005). However, other significant stressors including physical job demands, hazardous exposures, and employment instability remain understudied in automotive settings (Bin Abdin *et al.*, 2008). Workers reporting low decision-making authority combined with job insecurity and inadequate social support demonstrate particularly high risks for developing severe depression (Wang *et al.*, 2001). These findings underscore the urgent need

for comprehensive workplace interventions addressing both the physical and psychosocial dimensions of automotive work to protect and promote worker mental health.

2.5 Legal structure and directive for occupational safety and health in Kenya

2.5.1 Policy, legal, and institutional frameworks for occupational safety and health

The International Labour Organization (ILO) has consistently emphasized the fundamental right of all workers to safe, healthy, and decent working conditions since the landmark 1944 Declaration of Philadelphia on Social Justice for Fair Globalization. This commitment is operationalized through several key conventions establishing comprehensive frameworks for occupational safety and health (OSH) management. The foundational Convention No. 155 (1981) articulates core principles and methodologies for workplace safety improvements, while the 2002 Protocol enhances these provisions by mandating systematic data collection to monitor progress. Convention No. 187 (2006) further strengthens these mechanisms by promoting preventative safety cultures through cyclical national policy processes (ILO, 2006). Together, these instruments form an integrated approach to developing and sustaining effective OSH systems.

A critical requirement of these conventions is the establishment of tripartite consultation mechanisms, where signatory states must collaborate with representative employer and worker organizations to develop, implement, and regularly evaluate national OSH policies. Article 7 of Convention No. 155 (1981a) specifically mandates periodic reviews to identify emerging workplace hazards, assess intervention effectiveness, and establish action priorities. This dynamic policy cycle ensures national OSH frameworks remain responsive to technological advancements and evolving work environments. By requiring formal national policies, the conventions position governments as primary stakeholders in treating workplace safety as a matter of significant public health importance (ILO, 1981a).

While these conventions create binding obligations for ratifying nations and serve as benchmarks for global best practices, implementation gaps persist - particularly in developing countries. Many nations have yet to establish comprehensive national OSH policies that would provide structured frameworks for both preventative measures and corrective actions. This lack of policy infrastructure significantly hinders the development of robust workplace safety systems in regions that often face the greatest occupational health challenges. The conventions' cyclical

review requirements offer a mechanism for continuous improvement, but their full potential remains unrealized without proper national implementation and enforcement mechanisms.

2.5.2 History on the Kenya's Act on Occupational Safety and Health

Kenya's Occupational Safety and Health (OSH) Act was first established in 2007. The law aimed to create a system for ensuring the well-being, safety, and health of workers across industries such as agriculture, manufacturing, construction, and mining. Its introduction followed a rise in workplace injuries and deaths, linked to insufficient safety protocols, low awareness, and poor law enforcement. This paper examines the Act's history, including its development, main regulations, and effects on workplace safety. Kenya's 2010 Constitution guarantees every citizen fair labor practices, safe working conditions, and a healthy environment under the Bill of Rights.

The origins of Kenya's OSH Act trace back to colonial times when laws were passed to address workplace safety. However, these primarily served colonial employers rather than workers (Mugambi & Macharia, 2016). Post-independence, the government shifted focus to worker protection through new legislation. The need for OSH regulations became evident in the 1950s, prompting laws to safeguard non-colonial industrial workers (KIPPRA, 2021). The Factories Act Cap 514 (1951) laid the foundation, addressing factory conditions, safety equipment, machine maintenance, emergency protocols, and protective gear (Nyakang'o, 2005). This was influenced by the Workers' Compensation Act Cap 236 (1948) (Ndegwa *et al.*, 2014).

In 1974, Kenya's labor minister sought ILO support to strengthen industrial inspections and establish specialized units, marking the first structured OHS efforts (Nyakang'o, 2005). The Factories Act (1937) was revised in 1990 as the Factories and Other Places of Work Act, broadening its reach (KIPPRA, 2021). The Workmen's Compensation Act (1972) introduced injury and disease compensation but had limited enforcement (Koskei & Langat, 2020). Weak compliance persisted due to poor oversight.

Rising workplace accidents led to the Factories and Other Places of Work Act (1983), regulating safety in factories and workshops. It mandated safe working conditions and inspections but faced criticism for excluding many sectors and lax enforcement (Koskei & Langat, 2020). Kenya's first national OSH profile was drafted in 2004, with updates in 2013 (ILO, 2013).

The Occupational Safety and Health Act (2007), or OSHA 2007, replaced the 1983 law, introducing a broader framework for worker safety across all sectors (Koskei & Langat, 2020). It established the National Council for OSH to enforce regulations and coordinate safety efforts. The Act also protects third parties from workplace hazards (KIPPRA, 2021). The Work Injury Benefits Act (2007) ensured compensation for work-related injuries, with mechanisms to monitor compliance.

The Directorate of Occupational Health and Safety Services (DOSHS) enforces OSHA (2007) by inspecting workplaces, measuring pollutants, investigating accidents, and testing equipment (KIPPRA, 2021). DOSHS also reviews building plans, approves worker medical tests, and educates stakeholders on OSH (National-OSH Policy, 2012).

2.5.2 Occupational Health and Safety Regulations in Motor Vehicle Workshops

Occupational safety and health (OSH) is a critical component of any organization, focused on safeguarding workers from workplace risks. The Kenyan government, under the Ministry of Labour and Social Protection, has implemented laws and regulations to uphold workplace safety. Among these is the Occupational Safety and Health Act (OSHA) of 2007, which sets out mandatory safety standards for employers.

The main goal of OSHA is to protect workers' well-being by ensuring a hazard-free work environment that minimizes the risk of injuries or illnesses. This is accomplished by identifying and mitigating workplace dangers, providing safety training, and establishing clear workplace policies and procedures (Republic of Kenya, 2007). Additionally, OSHA seeks to enhance employee welfare and establishes an Advisory Council on Occupational Safety and Health.

This council advises the government on OSH matters, conducts research, and supports the growth of OSH initiatives. It also evaluates and proposes updates to OSH regulations and guidelines (Republic of Kenya, 2007).

The Occupational Safety and Health Act (OSHA) serves as a comprehensive legal framework designed to safeguard and enhance the welfare of employees within their work environments. In the Kenyan context, the provisions and applicability of OSHA are clearly outlined in the Occupational Safety and Health Act of 2007. As stipulated in this legislation, the primary objective of OSHA is to ensure that workers across all professions achieve and maintain optimal levels of physical, mental, and social well-being (OSHA, 2007).

The jurisdiction of OSHA in Kenya extends to all types of workplaces, encompassing government agencies, private sector enterprises, and non-governmental organizations. Furthermore, the Act provides protection to all categories of workers, whether they are engaged on a casual, part-time, or full-time basis, without any discrimination based on gender or nationality (OSHA, 2007). This inclusive coverage spans diverse industries such as agriculture, manufacturing, construction, and mining, as well as all employment arrangements, including permanent, temporary, and contractual positions.

A fundamental aspect of OSHA in Kenya is its mandate for employers to ensure that their workplaces are safe and conducive to employee health. This obligation involves the elimination of potential hazards that could lead to injuries or health complications. Employers are specifically required to supply appropriate personal protective equipment (PPE) to their workforce and to provide adequate training on its correct usage (OSHA, 2007).

Additionally, OSHA enforces the requirement for employers to perform systematic risk assessments on a regular basis. Based on these assessments, organizations must develop and implement tailored safety and health programs. These initiatives are crucial for minimizing workplace accidents, preventing occupational diseases, and fostering a culture of employee wellness (OSHA, 2007).

Another critical provision of the Act is the protection of employees from any form of retaliation or discrimination when they report unsafe working conditions or exercise their right to refuse tasks that pose imminent danger (Republic of Kenya, 2007). This safeguard ensures that workers can voice concerns without fear of reprisal, thereby promoting transparency and accountability in workplace safety practices.

By establishing these regulations, OSHA in Kenya plays a pivotal role in creating safer work environments, reducing occupational risks, and enhancing overall productivity through the well-being of the workforce. The Act not only sets minimum safety standards but also encourages continuous improvement in occupational health practices across all sectors of the economy.

Kenya's Occupational Safety and Health Act (OSHA) of 2007 establishes a comprehensive framework for workplace safety, creating the Occupational Safety and Health Authority (OSHA) as the primary enforcement body (Republic of Kenya, 2007). This regulatory agency wields significant powers to ensure compliance, including conducting workplace

inspections, investigating accidents, and imposing penalties on non-compliant employers (OSHA, 2007). The Act mandates that all employers develop detailed safety policies outlining organizational commitments to worker protection while clearly defining management and employee responsibilities (Republic of Kenya, 2007). Regular workplace inspections must be conducted to identify potential hazards, with findings properly documented and shared with all staff members to foster collective safety awareness (ILO, 2013).

A critical component of the legislation requires employers to provide comprehensive safety training programs covering proper equipment usage, safe work practices, and emergency preparedness, along with supplying appropriate personal protective gear for high-risk tasks (OSHA, 2007). The law further stipulates the formation of joint safety committees comprising both management and worker representatives, tasked with hazard identification, policy development, training coordination, and accident prevention strategies (Republic of Kenya, 2007). Enforcement falls under the Directorate of Occupational Safety and Health Services (DOSHS), which operates under the Ministry of Labour and Social Protection (ILO, 2013) and conducts regular inspections while possessing authority to issue improvement notices for corrective actions or prohibition notices for immediate cessation of hazardous operations (GoK, 2007).

The legislative framework establishes severe consequences for violations, including substantial fines reaching 1 million Kenyan shillings and potential imprisonment of up to three years (GoK, 2007, Section 107). These measures reflect Kenya's commitment to creating safer work environments through a combination of proactive prevention strategies, worker education, and stringent enforcement mechanisms designed to reduce occupational hazards across all sectors of the economy (KIPPRA, 2021). The system is further strengthened by the Occupational Safety and Health Advisory Board established under Section 53 of the Act, which provides expert guidance to the government on evolving workplace safety matters (Republic of Kenya, 2007), ensuring the regulatory framework remains responsive to emerging challenges in occupational health and safety (Nyakang'o, 2005).

2.5.3 Provisions Within the OSHA

General Occupational Health and Safety regulations in Kenya are governed by the Occupational Safety and Health Act, 2007. Occupational safety and health Act of 2007 provides rules and regulations that also apply to motor vehicle manufacturing. This Act sets out the duties

and responsibilities of employers and employees to ensure a safe and healthy working environment. Employers are required to provide and maintain a safe working environment, including providing appropriate personal protective equipment and training for employees. The act is guided by the ILO Employment Act on employers and employees and it entail the following regulations that are directly related to the automobile industry:

As per this provision, every work place is required to be kept clean. Accumulations of dirt and refuse are to be removed daily by a suitable method from the floors and benches. Every floor of the work room shall be cleaned at least once every week by washing and the wall must be washed with hot water every period of twelve months (GoK, 2007). Painted walls must be repainted every five years. Work places must not be overcrowded so as to cause injury to health of persons employed; hence all workshops shall not be less than three meters in height measured from the floor to the rest point of the ceiling. All these apply to motor vehicle workshops.

Among the important features of Occupational Safety and Health Act (2007) that on the health provision include; i) Employers' Duty of Care: The Act requires employers to take all reasonable steps to ensure the health and safety of their employees, including providing a safe working environment, adequate training and equipment, and access to first aid. ii) Workers' Right to a Safe Workplace: Workers have the right to a safe and healthy working environment and are entitled to raise safety concerns and report incidents to their employer. iii) Health and Safety Representatives: The Act requires the appointment of health and safety representatives by employers, who will represent workers and promote health and safety in the workplace. iv) Reporting of Incidents: Employers are required to report incidents and accidents that occur in the workplace to the relevant authorities, and to keep accurate records of such incidents. v) Hazardous Substances: The Act requires employers to take measures to prevent exposure to hazardous substances in the workplace, and to provide appropriate training to workers on the handling and storage of such substances. vi) Inspection and Enforcement: The Act empowers the Department of Occupational Safety and Health Services to inspect workplaces and enforce compliance with OSH laws and regulations. vii) Penalties: The Act imposes penalties, including fines and imprisonment, for employers who fail to comply with OSH provisions.

The Occupational Safety and Health Act (OSHA) of 2007 establishes a robust framework to protect workers across various industries in Kenya. Among its most critical provisions is the employer's duty of care, which legally binds employers to take all reasonable steps to ensure

employee safety. This includes maintaining a secure work environment, providing necessary safety training, supplying appropriate protective equipment, and ensuring access to first aid facilities. By mandating these measures, the Act places the responsibility on employers to proactively mitigate workplace hazards.

Equally important is the recognition of workers' right to a safe workplace. Employees are entitled to an environment free from unnecessary risks and have the legal right to raise safety concerns or report incidents without fear of retaliation. This provision fosters a culture of transparency and accountability, empowering workers to participate in maintaining workplace safety. To further strengthen safety oversight, the Act requires employers to appoint health and safety representatives. These designated individuals act as liaisons between workers and management, advocating for safer working conditions and ensuring compliance with OSHA regulations. Their role is crucial in identifying potential hazards and facilitating corrective measures before accidents occur.

Another key requirement is the reporting of workplace incidents. Employers must document and formally report accidents, injuries, and near-misses to the relevant authorities. Maintaining accurate records not only aids in regulatory compliance but also helps in analyzing trends to prevent future incidents. Given the risks associated with hazardous materials, the Act enforces strict guidelines on the handling, storage, and disposal of dangerous substances. Employers must provide proper training to workers who handle such materials, ensuring they understand safety protocols to minimize exposure and prevent accidents.

To enforce these regulations, the Department of Occupational Safety and Health Services is empowered to conduct workplace inspections. These audits verify compliance with safety laws, and inspectors have the authority to mandate corrective actions if violations are found. Finally, the Act imposes strict penalties for non-compliance, including substantial fines and even imprisonment for employers who neglect their legal obligations. These punitive measures underscore the seriousness of workplace safety and serve as a deterrent against negligence. Collectively, these provisions create a structured approach to occupational safety, ensuring that Kenyan workplaces adhere to high standards that protect both employees and employers.

Another critical provisions in the OSHA is machine safety is Section 27(1), which requires employers to ensure that every machine used in the workplace is safe and does not pose a risk to workers' health and safety. This section states that "every employer shall ensure, so far

as is reasonably practicable, that every machine, plant, and equipment used in his workplace is safe and without risks to health when properly used." In addition to the general requirement for machine safety, the OSHA also provides specific guidance on the use of specific types of machinery. For example, Section 38(1) requires that all machinery, including electrical machinery, be installed, maintained, and used in accordance with the manufacturer's instructions. The OSHA also requires employers to provide training and information to workers on the proper use of machinery. Section 27(3) states that "every employer shall provide information, instruction, training, and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees." Furthermore, Section 36(1) requires employers to conduct periodic inspections of machinery to identify any potential hazards and to take corrective action. The section states that "every employer shall ensure that all machinery, plant, and equipment used in his workplace are regularly inspected, tested, and maintained to ensure that they are in safe working order."

In general, the Occupational Safety and Health Act of 2007 contain several provisions aimed at ensuring machine safety in the workplace in Kenya. These provisions require employers to ensure that all machinery is safe and without risks to health, provide training and information to workers, conduct periodic inspections, and use machinery in accordance with the manufacturer's instructions. Compliance with these provisions can help to prevent workplace accidents and injuries, thereby promoting a safe and healthy work environment for employees (GoK, 2023).

One of the other essential provisions of OSHA is the Safety General Provision, which outlines the general responsibilities of employers and employees in ensuring a safe and healthy working environment. The Safety General Provision under OSHA requires employers to provide a workplace that is free from recognized hazards that are likely to cause death or serious physical harm to employees. According to Section 7 of OSHA, employers are required to provide employees with a working environment that is free from hazardous conditions. Employers must also comply with occupational safety and health standards set by the Ministry of Labour and Social Protection.

Furthermore, OSHA requires employers to ensure that employees have access to information and training necessary to protect themselves from workplace hazards. According to Section 12 of OSHA, employers are required to provide training to employees on the use of

personal protective equipment, handling hazardous chemicals, and other safety measures relevant to the workplace. Employers must also ensure that employees have access to safety equipment and protective gear. Employees also have a responsibility to ensure their own safety and that of others in the workplace. According to Section 17 of OSHA, employees are required to comply with occupational safety and health standards set by the Ministry of Labour and Social Protection. Additionally, employees must report hazardous working conditions to their employers or the Ministry of Labour.

A crucial aspect of Kenya's Occupational Safety and Health Act (OSHA) of 2007 is its emphasis on machine safety, particularly outlined in Section 27(1). This provision mandates that employers must ensure all machinery, equipment, and plant systems in the workplace are safe and pose no health risks when operated correctly. The law explicitly states that employers are required to take all reasonably practicable measures to guarantee that every piece of machinery is free from hazards that could endanger workers.

Beyond this general requirement, OSHA provides detailed regulations for specific types of machinery. Section 38(1), for instance, stipulates that all mechanical and electrical equipment must be installed, operated, and maintained strictly in accordance with the manufacturer's specifications. Additionally, employers are obligated to provide comprehensive training to employees under Section 27(3), ensuring workers receive the necessary instruction, supervision, and information to operate machinery safely.

To further mitigate risks, Section 36(1) requires employers to conduct routine inspections and maintenance of all workplace machinery. This provision emphasizes the importance of regular testing to identify potential malfunctions or hazards, followed by prompt corrective actions to maintain safe operational conditions. Collectively, these OSHA provisions establish a systematic approach to machine safety, requiring employers to ensure hazard-free equipment, provide proper training, conduct periodic inspections, and adhere to manufacturer guidelines. Compliance with these regulations significantly reduces workplace accidents, fostering a safer and healthier environment for employees (GoK, 2023).

Another fundamental component of OSHA is its Safety General Provision, which outlines the shared responsibilities of employers and employees in maintaining workplace safety. Under Section 7, employers are legally required to provide a work environment devoid of recognized hazards that could result in serious injury or death. This includes complying with all

occupational safety standards established by the Ministry of Labour and Social Protection. To reinforce this, Section 12 mandates that employers must equip workers with adequate safety training, covering essential topics such as the proper use of personal protective equipment (PPE), safe handling of hazardous chemicals, and other job-specific safety protocols. Employers must also ensure that all necessary protective gear is readily accessible to employees.

However, workplace safety is not solely the employer's responsibility. Section 17 clarifies that employees must also adhere to established safety regulations, follow proper procedures, and promptly report any unsafe conditions to their employer or the relevant authorities. This shared accountability ensures a collaborative effort in maintaining a hazard-free workplace, aligning with OSHA's overarching goal of minimizing occupational risks and promoting worker well-being.

The Occupational Safety and Health Act (OSHA) in Kenya includes comprehensive welfare provisions that mandate employers to provide essential amenities for workers' health and comfort. Section 35 of the Act explicitly requires employers to maintain a safe workplace while ensuring adequate welfare facilities such as clean drinking water, proper sanitation, and designated rest areas. These measures align with international labor standards set by the ILO (2020), which emphasize that access to basic amenities is fundamental to workers' physical and mental well-being. By providing such facilities, employers not only comply with legal obligations but also create conditions that help prevent work-related illnesses and injuries.

Beyond basic amenities, the welfare provisions also address hazard prevention in the workplace. Employers must supply appropriate personal protective equipment (PPE) for high-risk tasks and ensure its proper maintenance, as stipulated in Section 35(2). Additionally, OSHA requires employers to conduct regular safety training programs, educating workers on proper PPE usage and other occupational safety measures. The ILO (2020) highlights that such training fosters a culture of safety, empowering employees to recognize risks and take preventive actions. Collectively, these provisions underscore the importance of a holistic approach to workplace welfare, one that combines adequate facilities, protective measures, and continuous education to enhance worker safety and productivity.

OSHA firmly establishes the right of every employee to a safe and healthy work environment. Section 5 of the Act mandates employers to take all reasonably practicable measures to safeguard their workers' physical and mental well-being. This includes proactive

steps to minimize workplace accidents, such as conducting thorough risk assessments in collaboration with employees or their representatives, as outlined in Section 7. Workers' involvement in hazard identification is critical, as their firsthand experience often yields valuable insights into potential risks and effective mitigation strategies.

The Act further specifies employer obligations regarding workplace conditions. Sections 9 and 10 require employers to maintain a hazard-free environment while providing suitable welfare facilities, such as clean restrooms and break areas. Equally important is the emphasis on worker education: Section 12 compels employers to deliver comprehensive safety training, ensuring employees understand job-specific risks and protective measures.

OSHA also includes safeguards for vulnerable groups, such as pregnant women and young workers. Section 28 mandates special accommodations for expectant mothers, while Section 31 prohibits minors from engaging in hazardous tasks. These provisions reflect OSHA's commitment to inclusive protection, ensuring that all workers, regardless of their circumstances, operate in a safe and supportive environment (GoK, 2023). By enforcing these standards, the Act not only reduces workplace injuries but also promotes a culture of accountability and care across industries.

2.5.4 The Directorate of Occupational Health and Safety Services

The Directorate of Occupational Health and Safety Services (DOHSS) operates as a key department within Kenya's Ministry of Labour and Social Protection, tasked with safeguarding workplace safety and health across the nation. Its primary objective is to minimize occupational hazards, thereby reducing the risk of work-related injuries and illnesses. Formerly known as the Division of Occupational Safety and Health (DOSHS), the directorate was restructured in 2007 to strengthen its capacity in enforcing safety regulations and promoting worker welfare. The establishment of both DOSHS and its successor, DOHSS, reflects the government's commitment to creating safer working environments in response to growing concerns over occupational accidents and diseases.

The origins of formal occupational safety oversight in Kenya trace back to 1959 during the colonial period, when the Industrial Hygiene Branch was formed under the Ministry of Health. Initially focused on combating silicosis, a pervasive respiratory disease among miners—this marked Kenya's first structured effort to address workplace health hazards. Following

independence in 1963, the unit was reorganized as the Division of Occupational Health and Safety and transferred to the Ministry of Labour, signaling an expanded mandate.

During this transitional period, the division's responsibilities grew to encompass accident prevention, workplace investigations, injury compensation, and the promotion of protective equipment. Its operational framework was anchored by the Factories Act of 1951, which laid down critical safety standards for industrial operations and established the Office of the Chief Inspector of Factories. This inspectorate played a pivotal role in monitoring compliance, with DOSH serving as the enforcement arm to ensure that factories adhered to prescribed health and safety measures. The evolution from a disease-specific focus to comprehensive workplace safety regulation demonstrates Kenya's progressive approach to protecting its workforce through institutional and legal reforms.

The Division of Occupational Safety and Health (DOSHS) underwent significant transformation in 2007 with the enactment of the Occupational Safety and Health Act, which established the Directorate of Occupational Health and Safety Services (DOHSS). This new body was created to oversee and enforce occupational health and safety standards across all economic sectors in Kenya. Operating under the Ministry of Labour and Social Protection, DOHSS is led by a Director who oversees its operations and reports directly to the Principal Secretary. The directorate is structured into three specialized divisions—Occupational Health and Safety, Occupational Hygiene, and Occupational Medicine—each headed by a Chief Officer.

The Occupational Health and Safety Division focuses on ensuring safe working conditions through workplace inspections, accident investigations, safety certification, and awareness campaigns. The Occupational Hygiene Division identifies and assesses workplace hazards, including chemical, biological, and physical risks, while also advising on hazard control and personal protective equipment (PPE). The Occupational Medicine Division provides medical surveillance and treatment for workers exposed to occupational hazards, ensuring their health is monitored and protected.

One of DOHSS's key functions is the registration and renewal of workplaces, including those in the automobile industry. Employers must submit completed application forms (DOSHS 21A, DOSHS 21B, and DOSHS 23) to their respective county offices after conducting a self-assessment of their facilities. DOHSS officers review the submissions for accuracy and

completeness. If approved, the employer is required to pay the registration fee and Occupational Safety and Health (OSH) levy. Incomplete or inconsistent forms are returned for correction.

Once payment is confirmed, the documents are forwarded to the DOHSS headquarters in Nairobi for final processing. The directorate then issues and signs the Workplace and Plant Registration and Renewal Certificates, which are dispatched back to the county offices for delivery to the applicants. This structured process ensures compliance with safety regulations while maintaining an efficient system for workplace certification.

A critical function of the Directorate of Occupational Safety and Health Services (DOSHS) is conducting occupational inspections to proactively prevent workplace accidents, injuries, and illnesses. These unannounced inspections, carried out by DOSHS officers from county offices, serve to identify potential hazards and assess compliance with safety regulations. During these visits, inspectors evaluate various aspects including work processes, environmental conditions, and adherence to legal safety standards. Depending on their findings, officers may issue improvement or prohibition notices, recommend additional safety training, or simply document observations for follow-up. For more comprehensive evaluations, DOSHS utilizes certified Occupational Safety and Health (OSH) auditors who conduct thorough workplace audits in accordance with established auditing standards and codes of conduct.

DOSHS also plays a vital role in ensuring the operational safety of industrial plants, including those in the automobile sector, through its plant inspection and testing program. The directorate maintains a national registry of certified inspectors and approved facilities. These qualified professionals are assigned by DOSHS to conduct on-site evaluations of plant equipment and infrastructure. Following their assessment, inspectors complete standardized forms detailing their findings, which are then submitted to DOSHS technical officers for review. Based on this evaluation, DOSHS may issue improvement directives or restriction notices to address any identified safety concerns, ensuring all industrial plants meet required safety benchmarks.

Another essential responsibility of DOSHS involves investigating workplace accidents and facilitating compensation through the Work Injury Benefits Act (WIBA). Employers are legally obligated to report all occupational accidents - within 24 hours for fatal incidents and 7 days for non-fatal cases - using the prescribed DOSHS1 form. Upon notification, DOSHS officers conduct thorough investigations at accident sites, documenting the circumstances, root

causes, and consequences of each incident. These reports serve as the foundation for WIBA compensation claims. Even for employers not enrolled in WIBA, alternative insurance protections must provide equivalent coverage. The claims process concludes with the issuance of a WIBA7 payment certificate once compensation is settled, after which the case is officially closed. This system ensures proper accountability and support for workers affected by occupational injuries.

The Directorate of Occupational Health and Safety Services (DOHSS) encounters significant obstacles that hinder its capacity to fulfill its regulatory mandate effectively. A primary constraint is the chronic shortage of both financial and human resources. Research by Wafula *et al.* (2020) reveals that inadequate funding severely limits the directorate's ability to conduct routine workplace inspections, resulting in widespread non-compliance with safety standards across Kenyan industries. The scarcity of qualified inspectors further exacerbates this problem, making comprehensive nationwide coverage virtually impossible. To mitigate these resource constraints, DOHSS could consider strategic collaborations with non-governmental organizations and private sector entities, leveraging shared resources and expertise to enhance its operational capacity (WHO, 2017).

Compounding these operational challenges is the pervasive lack of occupational safety awareness among both employers and workers. Many workplaces remain vulnerable to preventable hazards due to insufficient understanding of safety protocols. Implementing targeted public education campaigns could significantly improve risk recognition and mitigation practices (Bahrami *et al.*, 2021). Perhaps more damaging is the issue of institutional corruption, as highlighted in Transparency International's 2021 report. The findings indicate that some DOHSS inspectors solicit bribes to overlook safety violations, creating a culture of impunity that undermines regulatory effectiveness. Addressing this requires implementing stringent anti-corruption measures with severe consequences for misconduct.

Despite these multifaceted challenges, DOHSS can enhance its effectiveness through strategic interventions. Strengthening partnerships, intensifying awareness programs, and establishing robust monitoring systems would significantly improve workplace safety standards. By adopting these measures, the directorate can progressively overcome its current limitations and better protect Kenya's workforce, ensuring safer and healthier working environments

nationwide. These reforms would not only boost compliance but also foster a culture of safety that benefits both employers and employees across all sectors.

2.5.5 Financing for Good OSH Practices in Kenya

Kenya employs a multi-faceted approach to financing occupational safety and health (OSH) initiatives, drawing resources from government allocations, employer contributions, international donor support, and public-private collaborations. As the primary regulatory body, the Kenyan government bears the fundamental responsibility for ensuring workplace safety standards through budgetary provisions to relevant institutions. The Occupational Safety and Health Act (2007) legally mandates government funding for the National Council for Occupational Safety and Health (NACOSH) and the Directorate of Occupational Safety and Health Services (DOSHS). These allocations facilitate critical functions including policy formulation, regulatory enforcement through workplace inspections, and comprehensive training programs for both employers and employees (GoK, 2007).

Kenyan legislation places significant responsibility on employers to finance workplace safety measures. The OSHA (2007) explicitly requires businesses to dedicate resources for OSH implementation, covering essential aspects such as safety policy development, procurement of personal protective equipment (PPE), and worker training programs. Beyond domestic funding, Kenya benefits from substantial international assistance, with organizations like the International Labour Organization (ILO) playing a pivotal role. Notably, the ILO's 2018 initiative supported the creation of Kenya's national OSH policy framework, while other entities including the World Health Organization and United Nations Development Programme provide complementary funding and technical expertise.

Public-private partnerships (PPPs) have emerged as an innovative financing mechanism, exemplified by the 2018 launch of the National Occupational Safety and Health Policy Framework (NOSH). This collaborative effort between the Kenyan government and the Federation of Kenya Employers demonstrates how joint initiatives can enhance workplace safety standards. Such partnerships leverage combined resources and expertise from both public institutions and private sector stakeholders.

Collectively, these diverse funding streams - encompassing government budgets, employer investments, international aid, and cooperative ventures - form a robust financial foundation for OSH programs in Kenya. This multi-source financing model enables the

continuous development and implementation of effective workplace safety measures, ultimately contributing to safer working environments nationwide. The synergistic combination of these funding channels ensures sustainable support for Kenya's occupational health and safety ecosystem.

2.6 Challenges in Implementation of Good OSH Practices

While Kenya's Occupational Safety and Health Act (2007) provides comprehensive regulations for worker protection, full compliance remains elusive, particularly when compared to safety standards in developed nations (Hamalainen *et al.*, 2017). This implementation gap persists despite evidence showing that proper adherence to OSH protocols could prevent most workplace injuries and illnesses (Hui-Nee, 2014). The continuing rise in occupational incidents suggests systemic challenges undermining regulatory effectiveness. Research identifies several critical factors contributing to this compliance failure across industries, particularly in high-risk sectors like automotive manufacturing and repair.

Knowledge and Training Deficiencies

Effective OSH implementation fundamentally depends on workforce education. Proper training provides employees with crucial awareness of potential hazards and safe operational procedures (Williams, 2019). In the automotive sector, specialized safety training is particularly vital given the industry's unique risks (Afolabi *et al.*, 2021). However, studies reveal widespread deficiencies - many workshops lack structured OSH training programs and safety manuals, leaving workers unprepared to recognize or mitigate workplace dangers (Abanga, 2016; Oche *et al.*, 2020). This knowledge gap creates environments where preventable accidents regularly occur.

Compliance is further hindered by psychological and informational barriers. Workers' risk perception - shaped by their work environment and experiences - often leads to underestimation of hazards, especially in routine operations (Fuller & Vassie, 2004). Many workshop employees, accustomed to familiar tasks, fail to recognize the need for safety protocols. This problem is compounded by ineffective risk communication strategies that fail to adequately reach automotive workshop managers and staff.

The awareness gap extends to employers as well. Many small-scale operators, particularly in informal vehicle repair shops, remain uninformed about their legal OSH obligations (Quinlan *et al.*, 2001). Without understanding regulatory requirements or best

practices, these businesses often prioritize profits over safety investments. This contrasts with more formal manufacturing settings where professional staff typically have better OSH knowledge (Abanga, 2016). The disparity highlights how information accessibility and business priorities significantly influence safety implementation across different automotive industry segments.

A significant barrier to occupational safety implementation stems from workers' limited understanding and dismissive attitudes toward safety protocols. Research by Azuike *et al.* (2016) reveals a troubling paradox in automotive workshops: while many mechanics possess awareness of workplace hazards, they consciously disregard safety measures even when protective equipment is accessible (Abanga, 2016; Afolabi *et al.*, 2021). This complacency often arises because the health consequences of hazardous exposures frequently manifest gradually rather than immediately (Ojo *et al.*, 2017). Bryan's (1990) findings further demonstrate how workers' unfamiliarity with occupational risks leads to inadequate precautions, while others perceive safety protocols as unnecessarily burdensome (Mullen, 2004).

Employee mindsets critically influence safety outcomes, as Damalas *et al.* (2018) established. Workers with constructive safety attitudes demonstrate better compliance, whereas negative perceptions, often stemming from insufficient training or poor management communication (Lingard *et al.*, 2001) - undermine regulatory adherence. This attitudinal divide highlights the need for comprehensive behavioral interventions alongside standard safety training.

Effective safety management requires systematic record-keeping and regular audits, yet many automotive repair shops neglect these crucial practices. Williams (2019) emphasizes that consistent hazard monitoring enables timely corrective actions, while Abanga's (2016) research found most vehicle workshops lack even basic accident registers. This documentation gap prevents workplaces from analyzing past incidents to prevent recurrences.

The absence of mandatory annual inspections compounds these risks, allowing unidentified hazards to persist (Abukhashabah *et al.*, 2020). Proper hazard recognition forms the foundation for implementing appropriate controls - without rigorous auditing and data collection, both workers and management remain unaware of critical safety vulnerabilities. These systemic failures in monitoring and documentation perpetuate preventable workplace dangers throughout Kenya's automotive service sector.

Personal Protective Equipment serves as a fundamental requirement for maintaining workplace safety, encompassing essential items like protective gloves, respiratory masks, safety goggles, and face shields designed to shield workers from occupational hazards. The Occupational Safety and Health Administration (OSHA) mandates that employers must supply appropriate PPE to employees at no cost, tailored to address specific job-related risks (OSHA, 2018). However, numerous organizations face substantial difficulties in meeting these requirements.

A primary obstacle is supply chain instability, particularly evident during the COVID-19 pandemic. The Centers for Disease Control and Prevention (CDC) documented severe PPE shortages due to unprecedented global demand, leaving many workplaces unable to secure necessary protective gear (CDC, 2020). These supply disruptions significantly compromised worker safety across industries.

Financial constraints present another major barrier, especially for small businesses. The National Safety Council (2018) found that nearly half of small enterprises in the U.S. consider PPE costs prohibitive to implementing proper safety protocols. When organizations cannot afford adequate protective equipment, employees face heightened risks of workplace injuries and illnesses. Additionally, the rapidly evolving nature of safety regulations complicates consistent PPE provision. The Government Accountability Office (2020) reported that frequent changes to PPE guidelines during the pandemic created widespread confusion among employers. Without clear, stable standards, many organizations struggled to maintain compliance, leaving workers vulnerable to improperly mitigated hazards. These multifaceted challenges underscore the need for more resilient systems to ensure reliable access to critical protective equipment across all workplaces.

The nature of employment arrangements significantly impacts occupational safety and health (OSH) implementation due to varying work conditions, job responsibilities, and associated risk levels. Modern labor markets feature diverse employment categories including temporary, part-time, contract, shift, and freelance work (Bauer, 2017; OSHA, 2018), each presenting unique safety challenges.

Temporary employment, characterized by short-term engagements, often compromises safety standards. Bauer (2017) notes that temporary workers typically receive minimal safety

training and may lack familiarity with company safety protocols. Frequently assigned to high-risk tasks without proper protective equipment, these workers face elevated injury risks. Similarly, part-time employment - defined by OSHA (2018) as work involving fewer than standard hours - creates safety vulnerabilities through limited training opportunities and reduced supervision, leaving less experienced workers particularly susceptible to accidents.

Contract work introduces different complications, as Bauer (2017) observes. The transient nature of project-based employment means workers often encounter changing environments without comprehensive safety orientation. Contract personnel frequently miss out on the thorough training and oversight provided to permanent staff. Shift work compounds these issues through its inherent physiological impacts. OSHA (2018) highlights how non-traditional work schedules increase fatigue and sleep deprivation, impairing workers' cognitive and physical capacities and consequently elevating accident risks.

Freelance arrangements present perhaps the most significant safety gaps. Bauer (2017) explains that independent contractors typically operate without organizational safety oversight, receiving neither training nor protective equipment from hiring entities. This complete self-reliance on safety measures often leads to inadequate hazard protection. These employment structures collectively demonstrate how alternative work arrangements can undermine workplace safety through insufficient training, limited supervision, and inadequate protective measures. Employers must address these vulnerabilities by extending comprehensive safety programs to all workers regardless of employment classification, ensuring uniform protection across all labor categories to maintain truly safe work environments.

Gender plays a significant role in occupational safety and health, influencing both exposure to workplace hazards and safety-related behaviors. Occupational segregation by gender means men and women frequently encounter different workplace risks. Male-dominated fields like construction and mining often involve physically strenuous labor that predisposes workers to musculoskeletal injuries (Bambra *et al.*, 2010). Conversely, female-concentrated service sectors such as healthcare present distinct hazards including exposure to infectious diseases and workplace violence (Messing *et al.*, 2013).

Gender norms further shape safety outcomes through their impact on worker attitudes and behaviors. Traditional masculine ideals may encourage risk-taking behaviors among male workers, while women often demonstrate greater risk aversion, prioritizing safety over

productivity (Goldenhar *et al.*, 2001). These gendered behavioral patterns can significantly influence the effectiveness of workplace safety initiatives.

A critical challenge emerges in safety reporting patterns, with research indicating women are less likely than men to report occupational hazards and injuries (Bambra *et al.*, 2010). This reporting gap creates incomplete safety data, making it difficult to identify and address gender-specific safety concerns. The resulting information deficit hampers the development of targeted interventions to protect female workers, highlighting the need for gender-sensitive approaches to occupational safety monitoring and policy implementation.

2.7 Solutions to Challenges in Implementing Good OSH Practices

Organizations frequently encounter obstacles when implementing occupational health and safety (OSH) programs, including limited resources, organizational resistance, and competing operational demands. However, research by Ofori *et al.* (2020) identifies several evidence-based solutions that can effectively address these challenges, particularly in high-risk sectors like the automotive industry.

Strong organizational commitment forms the foundation for successful OSH programs. Management must demonstrate visible leadership by establishing clear safety objectives, allocating necessary resources, and fostering a workplace culture that prioritizes safety. Equally crucial is active employee participation through comprehensive training programs, open communication channels, and involvement in hazard identification processes. The Occupational Safety and Health Administration (OSHA, 2018) recommends establishing joint health and safety committees or designating worker representatives to enhance engagement and cultivate a shared responsibility for workplace safety.

A robust OSH framework requires regular hazard assessments and control implementation. Organizations should adopt structured risk management processes that include thorough hazard identification, risk evaluation, and the implementation of appropriate mitigation strategies. Many enterprises benefit from implementing internationally recognized management systems such as ISO 45001 or OHSAS 18001, which provide comprehensive frameworks for managing workplace safety risks while ensuring regulatory compliance (International Organization for Standardization, 2018).

Sustained OSH success depends on ongoing performance monitoring and data-driven improvements. Organizations should establish systems for collecting and analyzing safety

metrics, identifying areas for enhancement, and implementing corrective measures. Maintaining strict adherence to evolving legal requirements ensures that safety standards remain current and effective. By integrating these solutions, organizations can develop resilient OSH programs that protect workers while supporting operational objectives, even in challenging industrial environments.

The implementation of effective occupational safety and health (OSH) practices requires a multifaceted approach that addresses contemporary challenges through technological innovation, accessible training methods, and gender-inclusive policies. Modern organizations are increasingly turning to advanced technological solutions to strengthen their safety programs. Wearable sensors now enable real-time monitoring of workers' exposure to hazardous conditions, while virtual reality simulations provide immersive training experiences that replicate dangerous scenarios without actual risk. Sophisticated data analytics software helps identify patterns and trends in workplace incidents, allowing for proactive hazard prevention (OSHA, 2022). These digital tools complement traditional safety measures by offering more precise monitoring and more engaging training methodologies.

For workforces with diverse literacy levels, organizations must adopt tailored communication strategies to ensure all employees understand critical safety protocols. Effective approaches include redesigning safety materials to incorporate visual aids such as diagrams and pictograms, using simplified language, and conducting training sessions in workers' native languages. Practical, hands-on demonstrations and peer-to-peer mentorship programs have proven particularly valuable for reinforcing safety practices among employees who may struggle with conventional training formats. These methods help bridge comprehension gaps and ensure all workers, regardless of literacy level, can participate fully in maintaining workplace safety.

Gender considerations remain a crucial aspect of comprehensive OSH programs. To create truly inclusive safety policies, organizations should implement several key strategies: First, physically demanding tasks should be redesigned with ergonomic solutions that accommodate workers of all physical capabilities. Second, specialized training programs should address and prevent gender-based harassment, particularly in service industries where such risks are prevalent (Messing *et al.*, 2013). Third, awareness initiatives can help transform outdated gender stereotypes about safety behaviors, promoting universal accountability for maintaining safe work environments (Goldenhar *et al.*, 2001). Finally, establishing confidential, non-punitive

reporting systems with targeted outreach encourages all employees, particularly female workers who may be reluctant to come forward, to report hazards and near-misses without fear of reprisal (Bambra *et al.*, 2010).

By integrating these technological innovations with literacy-sensitive training methods and gender-conscious policies, organizations can develop more robust and equitable OSH programs. This comprehensive approach not only addresses current implementation challenges but also fosters safer, more inclusive work environments that protect all employees effectively. The combination of cutting-edge technology, accessible training, and thoughtful policy design ensures safety measures meet diverse worker needs while maintaining operational efficiency and full regulatory compliance.

2.8 Theoretical Framework

2.8.1 Health Belief Model (HBM)

The Health Belief Model (HBM) represents a psychological framework designed to explain and anticipate health-related behaviors by examining individuals' attitudes and convictions regarding their wellbeing. Originally formulated in the 1950s by U.S. Public Health Service researchers, this model has become fundamental to numerous health education and promotion initiatives. The HBM operates on the principle that health behaviors stem from personal perceptions about illnesses and available preventive measures, with these perceptions being shaped by various internal psychological factors (Solidaki *et al.*, 2010).

The model identifies four core components that influence health decisions. Perceived seriousness reflects an individual's assessment of a disease's potential severity, often informed by medical knowledge. Perceived susceptibility, considered one of the most influential factors, drives people toward preventive actions when they feel personally vulnerable to a health threat. Perceived benefits involve weighing the advantages of adopting protective behaviors, while perceived barriers - the most decisive factor - address the practical and psychological obstacles to behavior change. These elements collectively explain why individuals embrace or resist health-promoting actions.

Modern adaptations of the HBM have incorporated additional dimensions, including cues to action (external triggers prompting behavior change), motivating factors, and self-efficacy (belief in one's capability to execute recommended actions). This expanded version offers a more

comprehensive understanding of the complex psychological processes underlying health-related decision making, making the model increasingly relevant for contemporary health interventions.

The HBM's enduring value lies in its ability to systematically analyze the cognitive factors that shape health behaviors, providing valuable insights for designing effective public health strategies and personalized health education programs. By understanding how individuals perceive health threats and preventive measures, practitioners can develop more targeted interventions that address specific psychological barriers to healthy behaviors.

2.8.2 Multiple Accident Causation Theory

The Multiple Accident Causation Theory, often visualized through the Swiss Cheese Model developed by James Reason (1990), provides a comprehensive framework for understanding workplace accidents as the culmination of multiple contributing factors rather than isolated incidents. This influential model distinguishes between active failures - immediate human errors or unsafe acts - and latent conditions, which represent underlying weaknesses in organizational systems, procedures, or safety protocols. Building upon traditional human factors theories, Reason's approach incorporates critical additional elements including ergonomic deficiencies, willful violations of safety protocols, and systemic organizational failures that create conditions ripe for accidents. Supporting this multi-causal perspective, Khanzode *et al.* (2012) demonstrated through their Domino Theory research that human factors account for a striking 88% of workplace incidents, with environmental hazards (10%) and unavoidable natural events (2%) constituting the remainder.

Their research further developed a sequential five-factor accident model, conceptualized as a line of falling dominoes where each factor triggers the next: (1) ancestral and social environmental influences, (2) individual worker shortcomings, (3) unsafe actions combined with physical hazards, (4) the accident event itself, and (5) resultant injury or damage. Gyekye (2010) significantly extended this model by demonstrating how targeted intervention at any point in the sequence - particularly at the critical third factor where unsafe actions and physical hazards intersect - can effectively interrupt the accident cascade, much like removing a key domino prevents the chain reaction. This theoretical approach fundamentally transforms accident prevention strategies by emphasizing the need to address both immediate human factors and the deeper organizational and systemic conditions that enable accidents to occur.

The multiple causation theory offers a sophisticated framework for understanding accident etiology by expanding upon the simpler domino theory. This model recognizes that workplace incidents typically emerge from complex interactions among multiple contributing factors rather than single causes. Gambatese *et al.* (2008) systematically classify these factors into two interconnected domains: human behavioral elements and environmental conditions. On the behavioral side, worker-specific variables such as improper safety attitudes, insufficient knowledge or skills, and physical or mental limitations create vulnerabilities in the safety system. Simultaneously, environmental factors including inadequate machine guarding, equipment degradation, and unsafe work procedures establish hazardous conditions. The manufacturing sector presents a particularly relevant context for examining this theory, as its operations inherently involve dynamic interactions between human workers and industrial equipment across complex production processes. These interactions create numerous potential failure points where behavioral and environmental factors can intersect to produce accidents. The current study will specifically investigate how this theoretical framework applies within manufacturing environments, analyzing the relative contributions and interactions of these various factors in accident causation. Such an examination promises to yield practical insights for developing more effective, system-oriented safety interventions that address both human and technical aspects of workplace safety in industrial settings.

2.9 Research Gaps

While existing literature provides valuable insights into occupational health and safety (OSH) challenges within the broader automotive manufacturing sector, significant knowledge gaps remain regarding Kenya's specialized vehicle body fabrication industry. Current studies predominantly examine general motor vehicle production without focusing on the unique processes, hazards, and safety considerations specific to body manufacturing operations prevalent in the Kenyan context. This research addresses this critical gap by investigating the distinct OSH challenges emerging from Kenya's vehicle body fabrication processes, which may differ substantially from those in complete vehicle assembly plants.

The study also responds to the notable absence of comprehensive research examining the implementation of OSH principles within Kenya's vehicle manufacturing sector. By analyzing how leading Kenyan vehicle body manufacturers integrate OSH policies into their operations, the research provides much-needed empirical data on: The current state of OSH policy adoption

and implementation, stakeholder preparedness and competency levels regarding safety protocols and operational challenges specific to Kenyan manufacturing contexts

These findings offer evidence-based insights that can inform national OSH policy development, particularly for Kenya's growing manufacturing sector. The research is especially timely given the lack of recent, localized studies in this specialized field, despite its economic importance and inherent occupational risks. By focusing on Kenya's unique vehicle body manufacturing ecosystem, the study generates context-specific knowledge that can guide targeted safety interventions while contributing to global understanding of OSH implementation in emerging automotive manufacturing hubs.

The investigation bridges both academic and practical gaps by not only identifying previously undocumented hazards but also assessing the effectiveness of current safety measures in preventing workplace injuries within this specialized industrial segment. This dual focus on discovery and application ensures the research outputs will be valuable for both scholarly discourse and practical safety improvements in Kenya's vehicle manufacturing industry.

Table 2.3 Research Gap

Author and Year	Research	Research gap	Addressing Research gap
1 Bureau of Labour Statistics of United States of America Department of Labour (2011)	Motor Vehicle Parts and Manufacturing	The study report is general to motor vehicle manufacturing and thus does not give specific statistics on vehicle body manufacturing	This study focused on vehicle body manufacturing firms
2 Warner <i>et al.</i> ,(1998)	Acute traumatic injuries in automotive manufacturing	The study does not identify specific operations that lead to injuries	This study identified hazards in vehicle body manufacturing firms
3		The study predominantly focused on injuries	This study included the existing challenges to the implementation of OSHA
4 DOSHS (2016)	Directorate of Occupational Safety and Health Services Report	The study looked at the manufacturing sector as a whole	This study focused on vehicles body manufacturing firms

2.10 Conceptual Framework

This study presented a conceptual framework (Figure 2.1) that systematically examines the determinants of occupational safety and health (OSH) outcomes in Kenya's vehicle body manufacturing industry. The framework identifies workplace hazards (including physical, chemical, and ergonomic risks), administrative measures (such as PPE provision, training programs, and supervision protocols), workers' safety knowledge and practices, and compliance with OSH protocols as key independent variables that directly influence workplace safety.

These factors are mediated by critical intervening variables including government regulatory enforcement through inspections and audits, social partner initiatives like worker training and advocacy programs, and the effectiveness of the legal framework governing workplace safety. The dependent variable - the overall OSH status of the workplace - manifests as either adequate safety conditions (characterized by strong safety culture, proper documentation, robust policies, and good housekeeping) or inadequate conditions (marked by safety failures and poor administrative controls). The framework proposed that optimal OSH outcomes emerge from the positive interaction of these variables, where effective hazard control measures, comprehensive administrative systems, worker compliance, and strong regulatory oversight collectively create safer working environments.

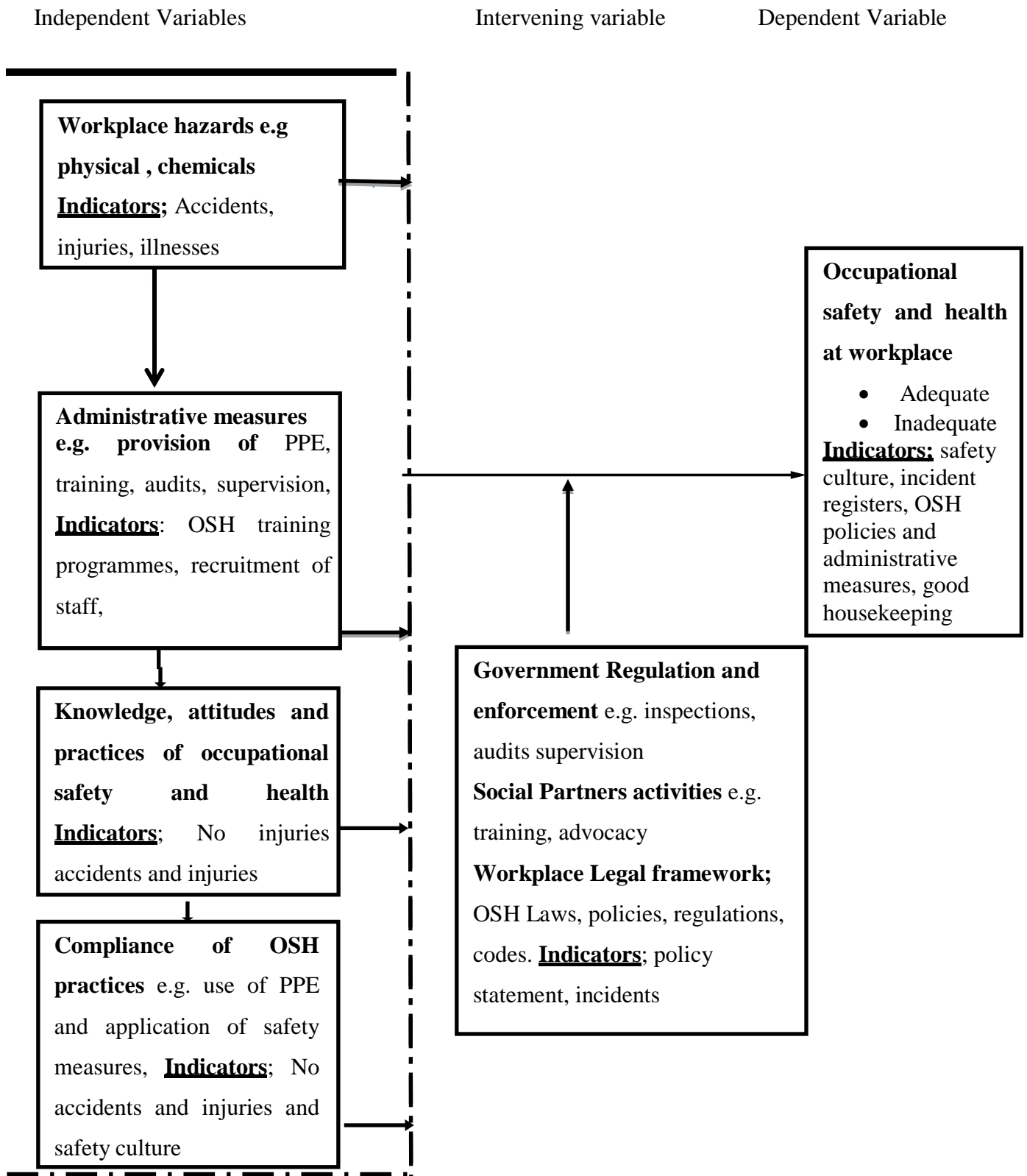


Figure 2.1 Conceptual framework showing the factors influencing workers' health in

vehicle body manufacturing industry

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

Nairobi, the capital city of Kenya in East Africa, is strategically located in the country's central highlands at an elevation of 1,680 meters. Situated approximately 480 kilometers northwest of Mombasa, Kenya's primary Indian Ocean port, Nairobi serves as the nation's industrial core and the economic center of East Africa (Encyclopaedia Britannica, 2015). The city's industrial area, located in its southeastern sector, hosts numerous vehicle body manufacturing firms. Nairobi's status as Kenya's most populous city ensures a steady supply of skilled labor for these industries. The concentration of steel and iron sheet suppliers in the city provides manufacturers with easy access to essential raw materials. Additionally, Nairobi's central location offers logistical advantages, with major vehicle distributors and dealerships situated nearby, allowing new commercial vehicles to be transported efficiently to body manufacturing facilities.

Nairobi experiences a subtropical highland climate due to its elevation of 1,795 meters above sea level. The region's weather patterns reflect modified equatorial conditions influenced by altitude, with temperatures occasionally dropping to 9°C during the cool June/July season. Average annual temperatures hover around 19°C, while rainfall varies from 800mm in eastern areas to over 1,000mm in western zones (Makokha & Shisanya, 2010). Humidity levels fluctuate significantly throughout the day, exceeding 80% in mornings but falling below 40% in afternoons. Daily sunshine duration ranges between 4 to 9 hours, with the warmest and sunniest period occurring from December to March, when daytime temperatures average 24°C. Nairobi's equatorial proximity results in minimal seasonal variation, with weather patterns primarily alternating between wet and dry seasons rather than traditional four-season cycles.

As East Africa's most dynamic economy, Nairobi boasts sophisticated financial infrastructure housing both domestic institutions like Kenya Commercial Bank and international banks including Barclays and Citibank. The city drives Kenya's industrial sector, which contributes approximately 20% to national GDP, with key products including processed foods, vehicles, construction materials, and textiles. A vibrant informal sector provides employment for artisans, metalworkers, and automotive technicians.

Agriculture remains Kenya's economic backbone, employing 80% of the population and generating 29% of GDP (Mogaka, 2006). The fertile lands surrounding Nairobi produce staple crops like maize and beans alongside cash crops such as coffee. Horticulture has emerged as a growth sector, with flower exports becoming a major foreign exchange earner. Tourism, now surpassing coffee as Kenya's top foreign currency source, benefits from Nairobi's extensive hospitality infrastructure ranging from budget to luxury accommodations, complemented by numerous tour operators capitalizing on Kenya's renowned wildlife parks and coastal attractions.

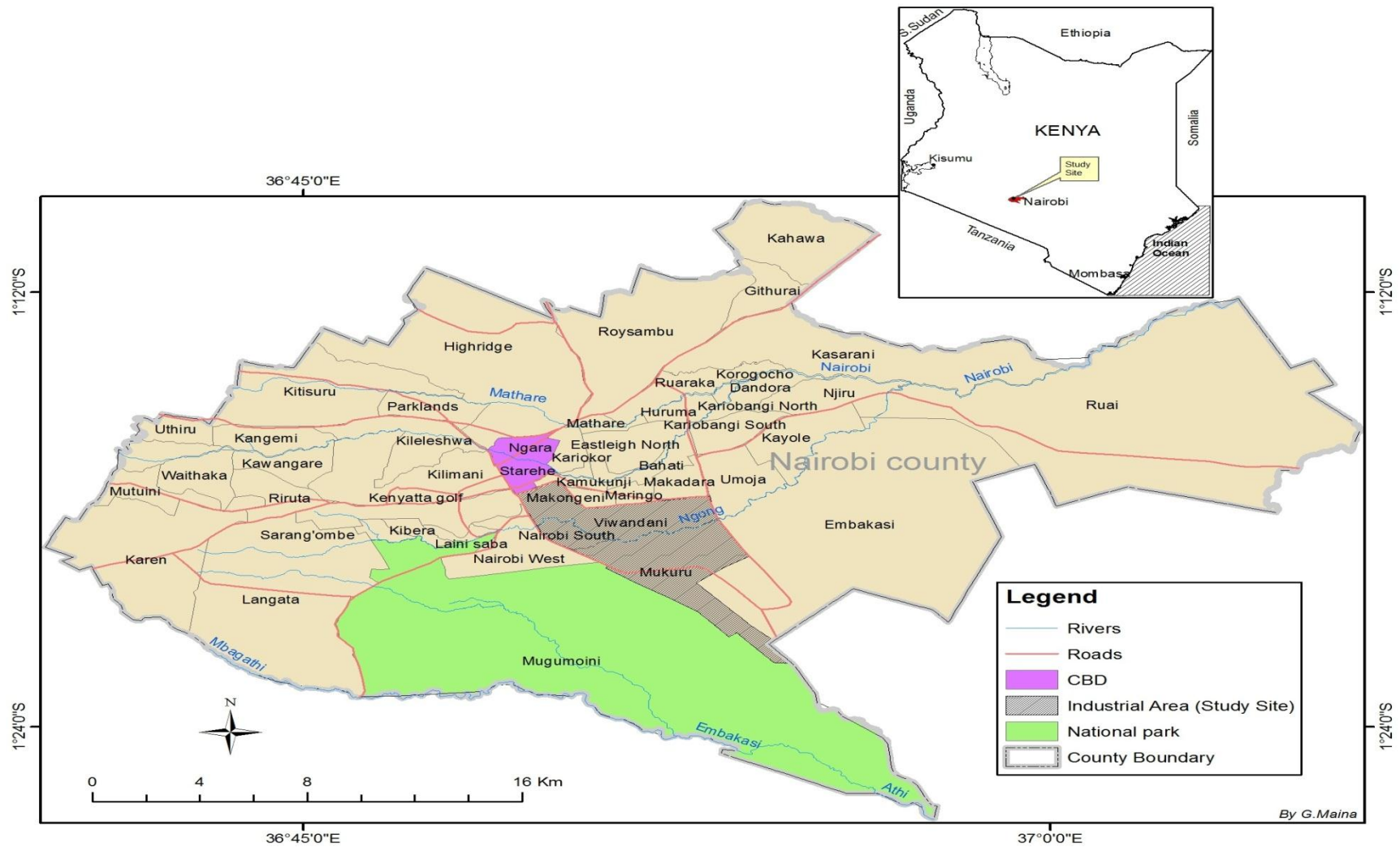


Figure 3.1 Map of Nairobi Indicating the Study Site.

Source: Survey of Kenya (2015)

3.2 Research Design

This study employed a cross-sectional research design to examine occupational health and safety (OSH) practices across four major vehicle body manufacturing companies in Nairobi. This approach, also referred to as cross-sectional analysis, enabled the simultaneous collection of data from both workers and management regarding OSH needs and implementation. The design offered distinct advantages in terms of cost-effectiveness and efficiency compared to longitudinal methods like case or cohort studies, while capturing self-reported information about respondents' experiences, perceptions, and behaviors (Kombo & Tromp, 2007).

As a widely utilized scientific method, the cross-sectional approach provided a representative snapshot of the target population by examining demographic variables including gender, age, education level, and job roles in relation to OSH implementation outcomes. This methodology not only facilitated immediate analysis of current OSH practices but also established a foundation for subsequent research initiatives. The design proved particularly valuable for investigating potential correlations between manufacturing processes and worker health/safety indicators, offering preliminary insights that could guide more focused experimental studies.

For instance, the collected data indicated how various OSH interventions might influence injury frequency, providing evidence to shape future preventive strategies. By administering standardized questionnaires simultaneously across all study participants, the research captured a comprehensive picture of prevailing OSH conditions within a defined timeframe. This temporal consistency ensured data comparability while identifying potential areas for intervention that could be explored through more specialized research designs in subsequent studies. The cross-sectional approach thus served both immediate analytical purposes and longer-term research planning functions in examining workplace safety dynamics.

3.3 Study Population

The term population refers to the complete set of individuals, events, or objects sharing specific observable characteristics relevant to the study's focus (Orotho, 2004). For this investigation, the target population comprised employees from four leading vehicle body manufacturing companies operating in Nairobi's industrial sector. With each firm typically employing around 200 workers, the aggregate study population approximated 800 individuals. However, the research specifically concentrated on production personnel directly engaged in

manufacturing processes, deliberately excluding administrative staff and office workers whose roles were less pertinent to the core examination of occupational health and safety practices in vehicle production environments. This focused approach ensured that the study's findings would accurately reflect the safety conditions and challenges faced by workers actively involved in the physical fabrication and assembly of vehicle bodies.

3.4 Sample Size

There are four major vehicle body manufacturing companies in Nairobi which were all selected for the study and the target population being employees in these companies. Each company has an average employee population of two hundred. In this industry, most of the firms have four major sections, mainly framing, panelling, painting and finishing. For the four firms sampled, there was a further sampling of staff from every section in order to have a representative population. Thus the entire study population in terms of workers was approximately eight hundred. Calculation based on the known sampling formula provided the actual sample on which the study was carried as shown below.

To establish a statistically representative sample of workers in Nairobi's bus body manufacturing firms, this study applied Kothari's (2004) sampling formula designed for finite populations. The formula calculates an appropriate sample size (n) based on the known total population (N) of approximately 800 production workers across the four target companies. This methodological approach ensures the selected sample maintains proportional representation of the workforce while achieving research efficiency.

Kothari's formula accounts for critical parameters including confidence levels and acceptable margins of error, enabling researchers to derive meaningful conclusions about occupational safety practices without surveying the entire population. The application of this established sampling technique enhances the study's reliability by providing a mathematical basis for determining the minimum number of respondents needed to generalize findings to the broader population of vehicle body manufacturing workers in Nairobi's industrial sector.

$$\frac{n = z^2 NP (1-P)}{\sigma^2 (N - 1) + z^2 P (1 - P)}$$

Where:

n = required sample size

N = the given population size of 800 employees

P = population proportion, assumed to be 0.50

σ^2 = the degree of accuracy whose value is 0.05

z^2 = this is standard normal deviation (1.96) at 95% level of confidence, hence 1.96^2 is 3.841

Substituting these values in the equation, estimated sample size (n) is:

$$n = \frac{3.841 \times 800 \times 0.50 (1 - 0.5)}{(0.05)^2 (800 - 1) + 3.841 \times 0.5 \times (1 - 0.5)}$$
$$n = 259.72$$

n ≈ 260

The total sample size of 260 was further divided among the four firms to get a representative sample size of 65 respondents from each firm.

3.5 Sampling Design

This study employed a cross-sectional mixed methods research design to survey workers from Kenya's vehicle body manufacturing sector. The integration of qualitative and quantitative approaches through mixed methodology ensured comprehensive data collection while meeting key research criteria of efficiency, representativeness, reliability, and methodological flexibility.

The sampling process followed a structured two-stage approach. Initially, four vehicle manufacturing companies were randomly selected from the target population. Subsequently, 65 employees were systematically sampled from each organization. To ensure balanced representation across production processes, the study further implemented random sampling within four core manufacturing divisions: framing, paneling, painting, and finishing - selecting approximately 16 workers per operational section.

The sampling frame specifically targeted production personnel directly engaged in manufacturing activities. Administrative and clerical staff were intentionally excluded from participation as their occupational exposure and safety considerations differ substantially from frontline production workers. Only consenting employees actively involved in the physical vehicle body fabrication process were included in the final sample, ensuring data relevance to the study's focus on production-line occupational health and safety conditions. This stratified random approach enhanced the validity of findings while maintaining proportional representation across different manufacturing processes and organizational settings.

3.6 Research Instruments

The study utilized a carefully designed questionnaire consisting primarily of closed-ended questions to ensure both ease of analysis and relevance of responses to the research objectives. As outlined in the Appendices, three specialized instruments were developed to gather comprehensive data from different perspectives. The first questionnaire (Appendix I) targeted managers and supervisors, specifically designed to evaluate the implementation level of occupational safety regulations and identify organizational challenges in maintaining workplace safety standards. Production workers received the second questionnaire (Appendix II), which focused on documenting their personal experiences with work-related health issues, injuries, and safety concerns encountered during daily operations.

The third instrument (Appendix III) served as an observational checklist for researchers to systematically assess and record actual workplace hazards across different production areas of the manufacturing facilities. This multi-method approach - combining managerial insights, worker experiences, and direct observational data - allowed for thorough triangulation of information, providing a robust, multi-dimensional understanding of occupational health and safety conditions in vehicle body manufacturing. The standardized format of closed-ended questions across all instruments facilitated consistent data collection while enabling comparative analysis between reported safety measures, health outcomes, and observed risk factors in the production environment.

3.7 Data Collection

Prior to commencing formal data collection, the researcher conducted comprehensive preliminary assessments of Nairobi's motor vehicle body manufacturing facilities to develop effective research strategies. This preparatory phase included detailed consultations with selected participants to coordinate appropriate meeting times and locations, ensuring full attendance at scheduled sessions. The methodology incorporated systematic workplace walkthrough surveys utilizing structured hazard identification protocols to document existing occupational risks and evaluate implemented safety controls.

During these assessments, researchers visited each sampled production area within the bus body manufacturing process. At every designated work station, both supervisory personnel (managers/supervisors) and production workers received their respective, role-specific questionnaires for completion. This dual-level approach enabled the collection of complementary

perspectives from management and frontline employees regarding operational safety conditions and practices. The preliminary activities served multiple purposes: establishing researcher presence in the industrial setting, verifying study feasibility, refining data collection instruments, and building rapport with participants - all of which contributed to the subsequent quality and reliability of the gathered occupational health and safety data.

3.8 Reliability and Validity

The study rigorously assessed both validity (the extent to which instruments accurately measure intended constructs) and reliability (the consistency of measurement) to ensure data quality. To establish these psychometric properties, researchers conducted a pilot test administering 30 questionnaires across two comparable vehicle body manufacturing facilities in Nairobi - Masters Fabricators Ltd (Likoni Road) and Choda Fabricators Ltd (Enterprise Road/Gilgil Road) - distinct from the main study sample.

The validation process employed the Content Validity Index (CVI), which quantifies how appropriately each questionnaire item measures its target attribute. Calculated as the ratio of relevant items (RI) to total presented items (PI) multiplied by 100 ($RI/PI \times 100$), the instruments achieved a CVI of 0.66, exceeding Odiya's (2009) established threshold of 0.6 for acceptable validity. This validation approach systematically evaluated each research objective by analyzing the proportion of relevant measurement items, confirming the tools' capacity to generate meaningful data about occupational safety practices in vehicle manufacturing environments. The satisfactory CVI outcome demonstrated that the instruments effectively captured the intended safety constructs while maintaining consistent measurement across different industrial settings.

3.9 Ethical Considerations

This study strictly observed all ethical protocols and regulatory requirements prior to data collection. Official research clearance was obtained from multiple oversight bodies, including Egerton University's postgraduate research committees, the institutional Bioethics Review Board, the Nairobi County administration, and Kenya's National Commission for Science, Technology and Innovation (NACOSTI). The research team implemented comprehensive ethical safeguards throughout the study. All potential participants received detailed explanations of the research objectives and procedures before voluntarily consenting to participate. The questionnaire instruments were carefully designed to meet international ethical standards for

social science research. Researchers maintained professional decorum in all interactions, treating respondents with dignity and respect while safeguarding their rights.

Participants were fully informed about their entitlements, including the right to withdraw from the study at any stage without consequence. The research process emphasized data accuracy through rigorous verification procedures while ensuring participant confidentiality. These measures guaranteed both the scientific integrity of the findings and the protection of participants' welfare during and after the study period. The multiple approval levels and consent procedures demonstrated the study's commitment to maintaining the highest ethical standards in research involving human subjects.

3.10 Data Analysis

Following data collection, the research team conducted thorough data cleaning to remove ambiguous or incomplete responses before systematically coding the remaining data for digital processing. The processed data was subsequently analyzed using IBM's Statistical Package for the Social Sciences (SPSS) software, version 26. Analytical procedures focused on generating descriptive statistics, including frequency distributions and percentage calculations, which were then visually presented through tables and graphs for enhanced interpretation.

The study examined several key variables in its analysis: workplace hazards, safety knowledge, attitudes, and practices served as independent variables, while dependent variables included occupational injuries, work-related illnesses, absenteeism rates, and insurance compensation claims. Government regulations and policies functioned as intervening variables in the analytical model. All statistical tests were conducted at a 95% confidence level ($\alpha = 0.05$) to ensure robust findings. Table 3.1 provides a comprehensive summary of the data analysis framework and key outcomes.

Table 3.1. Summary of Data Analysis

Objective	Variable Collected	Data Analysis Tool
To identify and characterize the hazards in vehicle body manufacturing workplace.	Types of workplace hazards; welding glare, grinding, cutting, paint, noise, poor housekeeping, machinery	Descriptive statistics and percentages

<p>To determine the effects of the hazards on the workers safety and health in vehicle body manufacturing work place.</p>	<p>Level of knowledge, type of hazards, experience, training, use of PPE, work Environment and safety reports.</p>	<p>Descriptive statistics: percentages, frequencies and chi square</p>
<p>To investigate knowledge and attitude on practices of occupational safety and health in vehicle body manufacturing.</p>	<p>Level of education, technical training, work experience, work practices, use of PPE, hazard identification and house keeping</p>	<p>Descriptive statistics in tables, percentages and graphical.</p>
<p>To determine factors that influence compliance to occupational and safety regulations in vehicle body manufacturing industry.</p>	<p>Management enforcement, workplace inspections, safety audits, OSH practices, attitudes, use of PPE, training and awareness.</p>	<p>Descriptive statistics percentages, tables, Chi square and Binomial logistic.</p>
<p>To identify the challenges of implementing occupational safety and health practices in vehicle body manufacturing.</p>	<p>Production targets, work pressure, OSH practices, use of PPE, accident reporting, safety awareness, hazard identification, safety training and equipment upgrading.</p>	<p>Descriptive statistics and percentages.</p>

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the study findings and their discussions in relevance to other studies conducted. The statistical summary of descriptive statistics of the variables used in the study and objective one which was to identify and describe the hazards in the vehicle body manufacturing workplace are presented in the first part followed by results for objective two which was to determine the effects of hazards on the workers' safety and health. Results of objective three; to examine the challenges of implementing occupational safety and health regulations are also presented in this chapter. Thereafter, results of the fourth objective which was to establish the cost of injuries to the organization that is related to occupational hazards. The estimate for all the parameters was obtained through statistical analysis under the facilitation of SPSS data management tool.

4.2 Socioeconomic Characteristics

The study findings reveal significant gender disparities within Kenya's vehicle manufacturing industry, with male employees constituting the vast majority of the workforce. This pronounced imbalance stems from several industry-specific factors that traditionally favor male participation. The sector's fundamental characteristics—including physically demanding tasks, extended working hours, and intensive machinery operation—align closely with conventional male-dominated occupations. These findings are consistent with prior research by Ataro *et al.* (2018), Mulugeta *et al.* (2021), and Oluoch (2015), who similarly attributed such gender disparities to the industry's technical and labor-intensive nature.

The workforce's educational profile further illuminates this trend, with most workers having attained secondary-level education, a qualification level that corresponds with Kenya's vocational training system where male enrollment predominates in technical fields. The requirement for hands-on mechanical skills, combined with the need to operate heavy industrial equipment, creates employment barriers that perpetuate the sector's gender imbalance. These occupational patterns reflect broader societal norms regarding gender roles in technical professions and physically demanding work environments within the Kenyan context.

Table 4.1: Socio-demographic characteristics of respondents (Categorical variables)

Variable	Frequency	Percentage (%)
Gender		
Male	241	92.7
Female	19	7.3
Marital status		
Single	51	19.6
Married	209	80.4
Education level		
Primary	32	12.3
Secondary	127	48.8
Certificate	15	5.8
Diploma	62	23.8
Graduate	24	9.2

As presented in Table 4.2, analysis of respondent data revealed key workforce characteristics in the vehicle manufacturing sector. The average worker age of 35 years reflects the physically demanding nature of the industry, which typically requires the stamina and energy levels associated with younger workers. These results concurred with those of Aluko *et al.* (2016) and Oluoch (2015) who found out similar results. However, the results were contrary with those of Manyele *et al.* (2008) who found the mean age of the workforce to be 44 years of age. Employment duration averaged 11 years, indicating that significant experience is necessary to develop the specialized craftsmanship vital for quality production in this field. Regarding work schedules, employees reported standard shifts of 8 hours per day across a 6-day work week, demonstrating the sector's intensive labor requirements. Similar results were established by Mulugeta *et al.* (2021) by indicating that, most of the vehicle manufacturing companies had a work timeline program of 6 days and employees worked for 8 hours per day translating to 48 hours per week. The longer work hours enable vehicle body manufacturing process to be accomplished on time and often it allows the customers to visit and check on work progress. These findings collectively illustrate the physical demands and skill development timelines

inherent in vehicle manufacturing occupations, where both youthful vigor and accumulated experience contribute to workforce productivity. The data suggests an employment environment that balances the need for physical capability with the value of long-term technical expertise.

Table 4.2: Socio-demographic characteristics of respondents (Continuous variables)

Variable	Mean	Standard deviation
Age	35.0	0.39
Duration of employment	10.5	0.62
Working hours / day	8.0	0.04
Working days / week	6.0	0.00

4.3 Identification and Characterization of Safety and Health Hazards in the Workplace

The main types of hazards prevalent in the vehicle body manufacturing workplaces were investigated. The main activities included metal cutting, grinding, welding, painting, lifting, framing, upholstery and assembling of vehicle components.

4.3.1 Description of the Hazards in the Vehicle Body Manufacturing Workplace

Study findings indicated that majority of the respondents (86%) noted that their work stations had put safety and health hazards measures to combat any safety and health issues arising from such (Figure 4.1). However, 14% of the respondents noted that their work places had no such measures in place despite their working in such risky conditions. This means that without hazard control measures in place the workers are exposed to safety and health risks that could have a long term effect on their occupation.

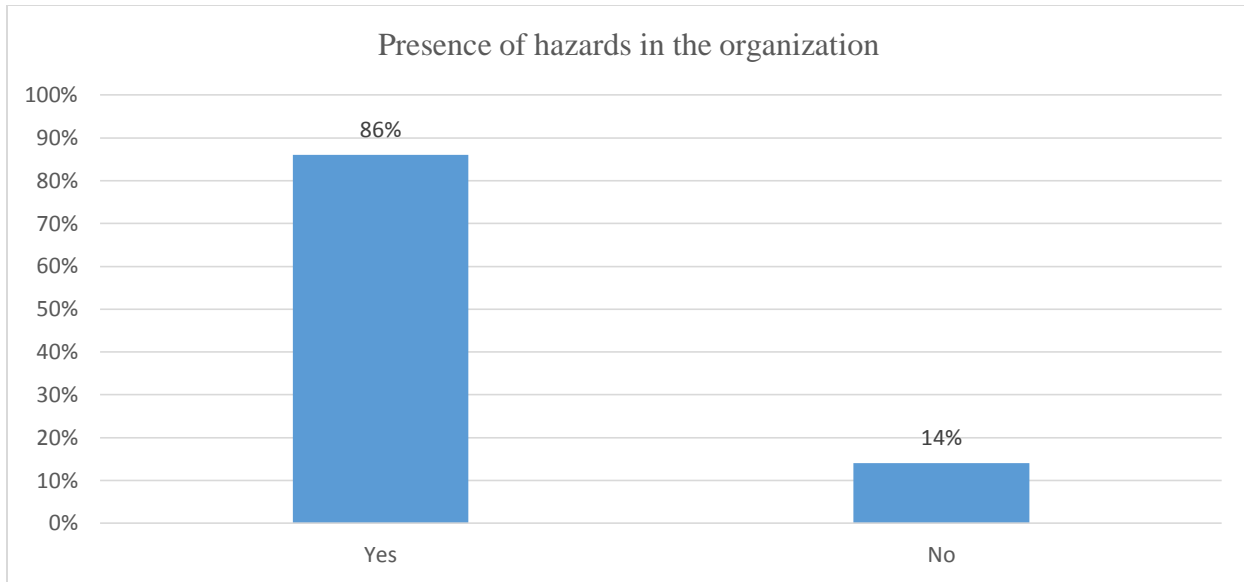


Figure 4.1: Presence of safety and health hazards at work place

Presence of health hazards in the companies was also confirmed by majority of the respondents. Physical hazards were found to be the most common in the bus manufacturing companies (53.9%) on (Table 4.3). These hazards included presence of slippery floors, fires, sparks. The slippery floor is due to water that is used for washing the vehicle bodies during paint preparation that could make the floor wet and lead to worker slips and fall that may cause injury. The hazard of fire is attributed to arc and gas welding that is done in the workshop areas where other activities are carried out as well and could lead to spontaneous ignition when the flame or arcs get in contact with paper, fuel, oil, paints and thinners. The hazard of sparks could be attributed to metal cutting machine that is used to cut steel bars and generate flying sparks that could cause body burns and eye injury. The other cause of spark is the grinding machine that is used to finish uneven metal surfaces after welding that generate excessive sparks that can cause body injury and ignition when in touch with flammable materials. Mechanical hazards are associated with power driven machines that are used in metal cutting and fabrication. The machines rotating belts and pulleys that operates at high revolutions which can easily cause injury to the workers.

Table 4.3: Types of safety and health hazards at work place

Types of safety and health hazards	Frequency	Percentage (%)
Physical hazards	123	53.9
Chemical hazards	39	17.1
Electrical hazards	2	0.9
Biological hazards	4	1.8
Psychosocial hazards	1	0.4
All the above	59	25.9

Closely related to physical hazards is the exposure to chemical hazards (17.1%) that is attributed to gases generated from mists, vapours, dusts and fumes. Exposures to welding fumes that are complex mixture of hazardous chemical substances were noted in vehicle body manufacturing workplaces. In the assembling of vehicle upholstery and component assembling sections, it was noted that workers are exposed to adhesive glue fumes, oil and greases. Panel beaters who prepare the vehicle body for painting are exposed to chemicals from body fillers and spot putty. It was noted that vehicle body spray painters are exposed to paint fumes, mists, vapours and thinners that are easily inhaled.

Chemical hazards (17.1%) that are inhaled from fumes, dust and vehicle paints made employees highly prone to respiratory systems disorders and diseases that may also be long-term. While preparing newly constructed vehicle bodies for painting, the body filler is applied and when dry is smoothen using a file and this process generate dust that can be inhaled by the panel beater and the other workers in the nearby vicinity and more so if they have not put on mouth and nose mask of good quality. The next step in this process is to paint spray the vehicle body with undercoat paint, after this has dried water sanding of the whole body is carried out and this involves applying water and then meticulously rubbing with sand papers to obtain a good finish.

This process can easily lead to a skin condition on the worker's hands if he has not employed suitable gloves. The pouring water causes the floor around to be wet that can cause slips and falls leading to injury. The next process in preparing for painting is to check for uneven surfaces and close these by using body filler, which is a chemical material that can affect the skin if suitable protective gloves are not used. Following this step, another under coat paint is

sprayed, then the main paint and finally clear coat paint is applied that makes the new vehicle body look shiny. In the process of spraying paint, compressed air is connected to a spray gun which sprays paint in mist form to enable good finish. Paint mist under pressure will affect the eyes and the chemicals can be inhaled through the nose and mouth thus affecting the lungs and gradually and may cause lung cancer if a complete suitable face mask is not used by the worker. This paint spray mists can affect the other workers nearby if the painting area is not completely built into a booth with air extractors that operate with fans.

Electrical hazards (0.9% incidence) primarily stem from the frequent use of powered tools equipped with motors, including drills, screwdrivers, and buffing machines. These risks escalate when equipment becomes worn or when workers lack proper training in electrical safety protocols. Additional electrical dangers emerge during vehicle assembly processes involving electrical components like wiring harnesses, wiper motors, lighting systems, and horns. Exposure to open sockets and exposed wiring further compounds these electrical risks in the workplace.

Biological hazards (1.8% incidence) originate from various sources, including microbial contaminants like bacteria and fungi. These organisms proliferate on surfaces such as stored metal sheets, parked vehicles, and building structures, particularly in environments with organic matter accumulation. Workers face exposure through multiple pathways: inhalation of contaminated air, ingestion of tainted food, and direct contact with infected materials. Inadequate sanitation facilities, poor hand hygiene practices, and improper waste management significantly contribute to biological risks. The absence of designated, categorized waste bins in observed workplaces exacerbated these hazards, with poor housekeeping practices emerging as a key factor in biological hazard prevalence.

Psychosocial hazards are factors in the design or management of work that increase the risk of work related stress and lead to physical harm. They include poor supervisor support or high job demand. They have been identified as main contributing challenges to occupational safety and health today and linked to work related stress, violence and bullying. Results from the study show psychosocial hazards to be (0.4%) which can be attributed to long working hours (9 hours a day for six days a week) and fatigue. The time pressure and meeting vehicle delivery deadlines also adds to this. Social interactions at work, worker ability to control situations and non-availability of amenities such as eating rooms, rest corners and suitable toilets are all sources

of stress for workers as they influence their wellbeing. However most of these hazards are not known in the vehicle body manufacturing sector due to limited knowledge and hence not addressed. They mainly manifest into social and mental problems in society.

Psychosocial hazards on the other hand made employees de-motivated in the work place thereby reducing their ability and urge to perform their tasks as specified which negatively affects the company's performance. Some of the identified psychosocial hazards were work pressure, de-motivation, being looked down upon by colleagues and management and which often resulted to fatigue, stress and low morale in performing work duties. Findings further showed that looking down upon other employees by both the top management and colleagues affected the well-being and performance of employees' hence psychosocial hazard (0.4%).

Other hazards are summarized in the work place check list and include fire that is inherent due to welding both of gas and arc, grinding and cutting that emits sparks and lack of clear signage for emergency exits. 25.9% of the respondents however, noted that their workplaces were affected by different safety and health hazards. They further argued that one hazard led to the other in that they are closely interrelated hence it was only just to say that all hazards (physical, chemical, psychosocial, electrical and biological hazards) in one way or the other affected employees in different ways and periods.

The vehicle body manufacturing sector is prone of physical, chemical, biological, electrical and psychosocial hazards. The most hazardous sections being the metal sheet cutting, vehicle body framing and spray painting areas. The less hazardous sections are vehicle final finishing and quality control. There are several incidents, ill health, injuries and accidents in the vehicle body manufacturing industry which are not reported, recorded and managed. This therefore, calls for strategic control measures to be put in place in order to mitigate such health hazards. Some of the identified control strategies in place included; engineering controls, elimination and substitution controls, administration controls and use of PPEs in the workplace. Trainings are also paramount in curbing occupational related hazards such as offering trainings on machinery usage and managing work stress. The findings of this study collaborate with that of Ataro *et al.* (2018), Che Huei *et al.* (2020) and Metzler and Bellingrat (2017) who also found a positive correlation between hazards in the work place with occupational related hazards.

Due to the safety and health hazards faced by employees in bus body manufacturing companies, the companies' management has come up with several control measures to curb and minimize the occurrence of effects that could be caused by the hazards. From the study findings as indicated in Table 4.4 below, majority of bus body manufacturing company employees pointed out that the use of personal protective gears was commonly used in their workplaces. This enables them to protect themselves against body harms resulting from physical and chemical hazards in most cases. Some of the PPE commonly used by bus manufacturing companies include; helmets for head protection, ear plugs to cushion against too much noise, hand gloves, eye goggles, overalls and masks.

Administrative controls and combination of all the above mentioned control measures were found to also aid in protection of the employees in the work places. Administrative controls such as safety rules and regulations in workplaces, employee trainings and provision of user manuals were found to be effective in mitigating health hazards in the work place. Additionally, it was also found out that combination of the different control measures proved effective in controlling safety and health hazards in the work place. Arguably, the kinds of hazards in the workplace might vary from one employee to the other at different phases of the vehicle body manufacturing stages; hence combining all the control measures in place proves to be more effective in managing the different occurrences. Engineering controls and elimination and substitution were also found to be among the control measures put in place by bus manufacturing companies at 7.6% and 1.8% respectively.

Table 4.4: Control measures for safety and health hazards at work place

Types of control measures for safety and health hazards	Frequency	Percentage (%)
Personal protective gears	140	62.2
Administrative controls	32	14.2
Elimination and substitution	4	1.8
Engineering controls	17	7.6
All the above	32	14.2

4.3.2 Training in Safety and Health Hazards

A high number of the respondents (55.0%) noted that their companies conducted of trainings and awareness forum in safety and health hazards in their respective workplaces. Conversely, 45.0% argued that no such trainings were offered in their workplaces despite the work's nature. This means that the employees not trained could be working without following laid out safety procedures thus exposing themselves to risks that could have long term effects on their health.

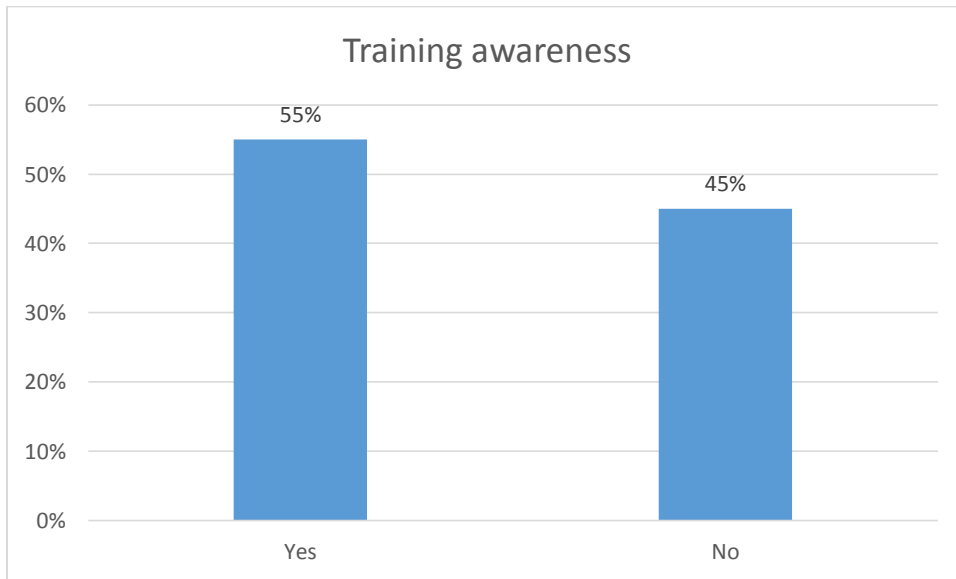


Figure 4.2: Training/ awareness of workplace safety and health

In most cases, the task of carrying out trainings to vehicle body manufacturing staff was outsourced from external trainers who had adequate knowledge in the specific training areas. 81.1% of respondents noted that most of the trainings carried out were by external trainers. External trainers majorly outsourced by these companies included Safety solutions, Fire companies and JICA Company. Staff being trained by outsourced firms has the advantage of benefitting from their expertise and they could have no fear of intimidation as the trainers are independent. A likely justification for this is that training of employees is not a core activity of the vehicle manufacturing companies therefore by recruiting external trainers, the management focuses on the core activities of the company. Independent external trainers would allow the employees to express themselves freely without fear of intimidation. The external trainers are likely to have expertise and experience on industrial safety matters that may not be available

within the company. The disadvantage could be that such trainers might not be abreast with health and safety situations that are peculiar to this industry and any underlying challenges as well. By allowing external specialists to train allows the managers to dedicate their entire time to supervisory roles that ensures efficient and timely production and dispatch of vehicles to the market. Buniya *et al.* (2021) however found contrary results indicating that such companies did not provide employee trainings in the workplaces. However, only 18.9% of the respondents noted that most of the health and safety trainings were carried out by internal trainers who include their human resources department staff and immediate supervisors. There is advantage in using internal trainers since they are aware of safety and health matters as well as challenges peculiar to their work. The disadvantage is that the staff may not be free to express their concerns and opinions during the training due to fear of victimization by the supervisors.

Table 4.5: Organization that conducted the workplace safety and health training

Organizations	Frequency	Percentage (%)
Internal trainers	26	18.9
External trainers	112	81.1

Results in figure 4.3 below indicate the training areas covered by companies during their training sessions. Employees in vehicle manufacturing companies in Nairobi County mainly received training related to work safety awareness (29.4%) followed closely by fire prevention and safety procedures (28.7%). Respondents also confirmed that they received trainings on First Aid (5.1%) and wearing of safety equipment (PPEs) (4.4%). However, employees noted that as much as the vehicle manufacturing companies necessitated high rate of machinery usage in the workplace in almost all the processes, machinery usage trainings (2.9%) were the least trained by both external and internal trainers. Some of the machines used in this industry include metal cutting, metal bar bending, grinding, lathe and milling machines among others. These pose greater hazard to occupational safety and health given lower rate of safety training on them.

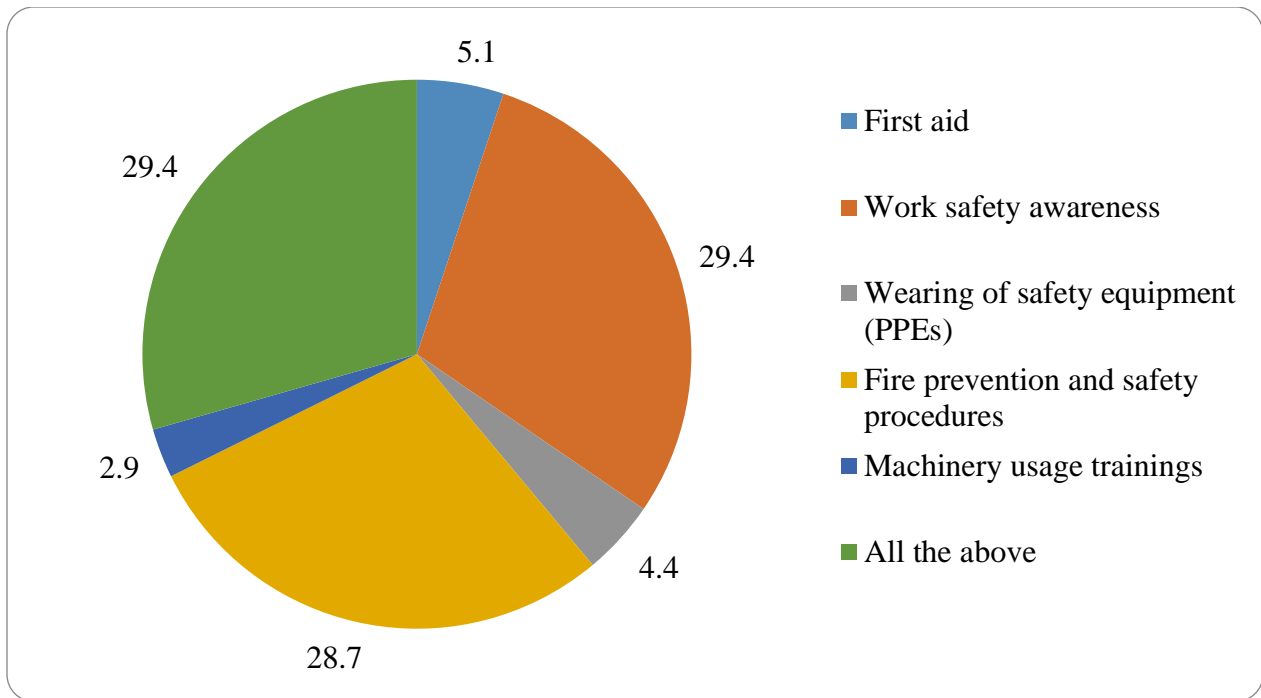


Figure 4.3: Training areas on workplace safety and health

4.4 Effects of the Hazards on the Workers' Safety and Health

4.4.1 Involvement in Injury/Accident or Illness at Work Place

Respondents were asked whether they were ever involved in any injury or accident in the workplace. Most of the respondents (62.7%) had not been involved in any work-related injury or accident. Majority of the respondents had not been involved in any work-related injuries or accidents and work-related illnesses among workers. A probable explanation for this is that most of the vehicle body manufacturing companies have put preventive measures in place for mitigation against dangers arising from OSH hazards. Such measures could include use of PPEs, work inspection and supervision and trainings that help enlighten workers on their OSH. Another possible reason for less reported occupational illnesses could be attributed to the relatively shorter period that the workers have had exposure as the actual effects may take many years down the line.

Table 4.6: Involvement in injury/accident or illness at work place

Hazard	Frequency	Percentage (%)
Employee involvement in Injury or accident		
Yes	97	37.3
No	163	62.7
Area of body affected		
Head	4	4.1
Hand	67	69.1
Eye	19	19.6
Body burns	3	3.1
Chest pains	4	4.1
Employee suffering from work related Disease/Illness		
Yes	80	30.8
No	180	69.2
Availability of off duty		
Yes	94	36.2
No	166	63.8
Number of off days		
0	169	65.0
1	45	17.3
2	28	10.8
3	8	3.1
6	1	0.4
7	5	1.9
14	1	0.4
30	3	1.2
Place respondents seek health services		
No where	11	4.2
Recommended health facility within the work place	48	18.5

Government facility outside work place	79	30.4
Private clinic	122	46.9

However, some workers confirmed having been affected by hazards within the workplace (37.3%) had been involved in injuries or accidents. They further cited to having had part of their bodies affected by the injuries which included hand, eyes, head, chest pains and body burns. Majority had suffered from hand injuries (69.1%), followed by eye related conditions at 19.6%. The high rate of hand injuries can be attributed to metal sheet and metal bar handling by many of the production staff; these materials often have rough surfaces and sharp edges that could easily lead to hand injury. The eye injuries can be attributed to flying sparks that emanate from grinding and cutting machines. Exposure to mig and arc welding glare often leads to paining eyes. Head injuries, chest pains and body burns were less commonly experienced injuries within the workplaces at 4.1%, 4.1% and 3.1% respectively. The low rate of head injuries is perhaps due less work activity that involves lifting and working at height. The low percentage of chest pains is due to very few staff that handles painting which normally have chemical fumes that are easily inhaled. The low rate of body burns can be attributed to little hot work apart from welding heat that quickly cools. 69.2% of the respondents had not suffered from any work related disease or illness compared to 30.8% of the respondents who had at one point in their work experience suffered from work-related illnesses and diseases.

Important to note was the fact that most of the vehicle manufacturing companies in Nairobi County did not offer two days off duty to their employees yet it is an important requirement in the Employment Act of Kenya. Only, 36.2% of the companies had off duty programs in place for their employees. The maximum number of days that employees are offered off days in case of work related injuries or diseases was 30 days (1 month) with the minimum being 1 day with yet some companies offering no off days at all (65.0%). This can be related to the nature of employment in this industry most of which are contractual; some are based on piece work while a few are on permanent employment. Respondents were also asked where they got treated in cases where they suffered work-related injuries/ accidents and diseases. Most of them got treatment at private clinics (46.9%) and Government facilities outside the work places (30.4%). The reason could be that majority of these industries are located in Nairobi industrial

area where there are few hospitals. Recommended health facilities within the work places (18.5%) were not commonly used by employees in case they suffered from such injuries and diseases. Yet, other employees sought to not seek medical attention at all (4.2%) when they get injuries. The small number of employees who did not seek medical attention could be due to minor nature of their injuries.

4.4.2 Workplace Hazards Affecting Workers’ Safety and Health

The study sought to evaluate perceptions the worker’s on how workplace hazards affect their safety and health. 46.95% indicated that they were being affected by physical hazards and these include welding glare, noisy machinery, cutting and grinding sparks. Chemical hazards have effects on the workers’ safety and health at 14.62% and this can be attributed to body fillers, sprayed paint fumes and thinners that are commonly used in preparation for vehicle body painting. The electrical hazards are shown from the results to be 0.77% and this is because most of the processes deal with vehicle body construction that has more mechanical features and only a few powered tools use electricity hence the low hazard level. The results present biological hazards at 1.54% and this can be attributed low chances of infectious bacteria or moulds accumulating on components since the vehicle parts used are new and paint chemicals used may inhibit their survival. The psychosocial hazards are represented by 0.38% and this could due to the silent nature of this since stress and fatigue may manifest after a long period of time. 20.77% agreed that all the other hazards make a contribution and this may include machinery hazard and the inherent fire hazard due to presence welding that emanates heat and easily available flammable paint materials.

Table 4.7: Workers’ Perception on Workplace Hazards

Hazards	No		Yes	
	Frequency	Percentage	Frequency	Percentage
Not applicable	27	10.38	5	1.92
Physical hazards	3	1.15	120	46.95
Chemical hazards	1	0.38	38	14.62
Electrical hazards	0	0.00	2	0.77

Biological hazards	0	0.00	4	1.54
Psychosocial hazards	0	0.00	1	0.38
All the above	5	1.92	54	20.77

4.5 Knowledge and Attitude of Workers on Safety and Health Practices

4.5.1 Perception on Occupational Health Risks and Safety Hazards

The majority of respondents (79.6%), as illustrated in Table 4.8, expressed strong agreement regarding the necessity of reporting occupational health risks and safety hazards to the administration. They emphasized the importance of being informed about such incidents in their workplaces to ensure proper awareness and preventive measures. However, a smaller proportion (20.4%) believed that informing management was unnecessary, primarily due to bureaucratic delays and inefficiencies in addressing reported cases. This reluctance may stem from management's concerns over the financial implications of compensating injured workers, which could discourage prompt reporting. Additionally, employees might avoid reporting minor injuries to prevent potential reprimands or victimization by supervisors, further contributing to underreporting.

Among those who supported notifying the administration (29.6%), many argued that transparency regarding workplace hazards would encourage employers to enhance safety and health management systems. They contended that if management remains unaware of these risks, there would be little motivation to implement effective administrative controls, such as comprehensive safety programs or medical coverage for affected workers. Furthermore, respondents highlighted that reporting hazards would likely lead to increased supervision from senior staff and more frequent safety training sessions. Such initiatives would educate employees on the proper use of machinery and reinforce a culture of workplace safety, ultimately reducing the likelihood of accidents and injuries. By fostering open communication between workers and management, organizations can create a safer and more responsive work environment for all employees.

Table 4.8: Perception on occupational health risks and safety hazards

Need	Frequency	Percentage (%)
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Yes	207	79.6
No	53	20.4
Reason		
Enforcement of PPE usage	22	11.2
Improved personnel management	99	50.5
Supervision and training	58	29.6
All the above	17	8.7

4.5.2 Mitigation Measures of Hazards

The findings presented in Table 4.9 reveal that a significant portion of respondents (48.5%) strongly agreed that the proper and consistent use of Personal Protective Equipment (PPE) serves as a crucial mitigation measure against workplace hazards in vehicle body manufacturing companies. This highlights the recognition among employees that PPE plays a vital role in minimizing exposure to occupational risks.

Beyond PPE, respondents identified several other key strategies for hazard prevention. Among these, training and awareness programs were strongly supported by 45.4% of participants, underscoring the importance of employee education in promoting workplace safety. Additionally, regular workplace inspections were acknowledged by 39.2% of respondents as an effective preventive measure, ensuring that potential hazards are identified and addressed proactively. Another notable finding was that 35.8% of workers strongly agreed on the necessity of readily available first aid facilities, emphasizing the need for immediate medical response in case of emergencies. Similarly, 35.0% affirmed that hazard identification processes are essential in mitigating risks before they escalate.

Further insights from the survey indicate that 36.5% of respondents agreed that maintaining a clean and organized work environment, along with proper incident and accident reporting, contributes significantly to hazard reduction. Additionally, 36.2% recognized the importance of adequate supervision in enforcing safety protocols, while 34.6% acknowledged the role of fire extinguishers in emergency preparedness. Collectively, these responses demonstrate that a substantial proportion of workers possess a strong awareness of occupational safety and health practices. The data suggests that while PPE remains the most widely

recognized mitigation measure, employees also value structured safety initiatives such as training, inspections, and emergency preparedness. These findings reinforce the need for companies to implement comprehensive safety programs that integrate multiple preventive strategies to ensure a secure and healthy work environment.

Table 4.9: Mitigation of hazards

Statements	SD%	D%	N%	A%	SA%	Mean	SD
Training and awareness	1.5	6.7	4.6	41.5	45.4	4.22	0.93
Adequate/ appropriate use of PPE	0	11.5	9.6	30.4	48.5	4.16	1.01
Fire extinguishers	0	0.8	30.4	34.6	34.2	4.02	0.82
Hazard identification	0	4.2	26.9	33.8	35.0	4.00	0.89
Availability of First Aid	1.2	2.3	28.1	32.7	35.8	4.00	0.92
Keeping work place neat and tidy	0	4.6	27.3	36.5	31.5	3.95	0.88
Incident and accident reporting and registering	0	8.5	22.7	36.5	32.3	3.93	0.94
Adequate supervision	0	15.4	26.9	36.2	21.5	3.64	0.99
Work place inspection	1.2	21.9	17.3	20.4	39.2	3.75	1.22

***1= Strongly disagree, 2= Disagree, 3= No opinion, 4= Agree, 5= Strongly agree**

4.5.3 Use of PPE in Prevention of Risks

As illustrated in Table 4.10, the survey findings highlight employees' perceptions regarding the role of Personal Protective Equipment (PPE) in minimizing workplace health and safety risks. A significant portion of respondents acknowledged the protective benefits of various PPE components, though the level of agreement varied across different safety measures. The data reveals that 50.0% of workers strongly agreed that safety boots effectively reduce foot injuries, while 39.6% strongly affirmed that gloves play a crucial role in preventing hand-related hazards. Additionally, 45.0% of respondents agreed that masks help safeguard respiratory health, and 38.5% recognized that aprons and overalls provide essential protection for the body. Beyond these, other notable perceptions included: 45.2% agreement that earplugs prevent hearing damage, 43.8% acknowledgment that goggles shield the eyes from harm, 38.5% recognition that risk assessments encourage better PPE compliance, 37.3% agreement that post-shift bathing

reduces health risks, and 35.4% support for handwashing as a measure to minimize chemical exposure.

Despite these positive responses, the findings suggest that less than half of the workforce fully appreciates the protective advantages of PPE, which may influence their willingness to use it consistently. This limited awareness raises concerns, as employees who underestimate the importance of PPE are less likely to adhere to safety protocols—even when equipment is readily provided. The survey underscores a critical gap in occupational safety awareness, where a substantial portion of workers exhibit low knowledge of PPE benefits, potentially hindering compliance. To enhance workplace safety, organizations should prioritize targeted training programs that emphasize the direct correlation between PPE usage and injury prevention. By fostering a deeper understanding of these protective measures, companies can improve compliance rates and cultivate a stronger culture of safety among employees.

Table 4.10: Perception of respondents towards use of PPE in prevention of risks

Statements	SD%	D%	N%	A%	SA%	Mean	SD
Wearing gloves can reduce damage to your hands	8.8	6.9	5.8	38.8	39.6	3.93	1.24
Wearing masks can reduce damage to respiratory organs	0	0.8	16.9	45.0	37.3	4.19	0.74
Wearing safety boot can reduce damage to your feet	0.8	0.8	10.0	38.5	50.0	4.36	0.76
Wearing apron can reduce damage to your body	3.1	13.1	18.8	38.5	26.5	3.72	1.09
Wearing goggles can reduce damage to your eyes	0	3.1	14.2	43.8	38.8	4.18	0.79
Wash hand can reduce risks from chemicals	1.2	14.2	25.0	35.4	24.2	3.67	1.03
Bathing after work can reduce damage to health risks	1.2	16.2	30.0	37.3	15.4	3.50	0.98
Wearing ear plugs can reduce damage to your ears	0	3.5	15.0	45.2	35.4	4.13	0.79

Carrying out risk assessment	0	11.5	18.1	38.5	31.9	3.91	0.98
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*1= Strongly disagree, 2= Disagree, 3= No opinion, 4= Agree, 5= Strongly agree

4.5.4 Perception on Improving Safety and Health

The survey results presented in Table 4.11 reveal critical insights into employee perceptions regarding effective strategies for improving occupational safety and health within vehicle manufacturing companies. A majority of respondents (53.8%) emphasized that vocational and technical training should be prioritized as a key solution for mitigating workplace hazards. Such specialized training programs provide structured, industry-specific education that enhances workers' technical competencies while simultaneously strengthening their awareness of safety protocols. The strong support for this approach suggests that many employees recognize its value, likely due to prior participation in similar training initiatives.

Additionally, 48.1% of respondents identified workplace safety and health training as essential for raising safety standards in the industry. These findings highlight the importance of targeted training programs that address the unique risks associated with vehicle manufacturing, as opposed to generic safety instruction. Tailored training ensures that workers gain practical, relevant knowledge, leading to better hazard recognition and prevention. Another significant portion of participants (43.8%) advocated for increased provision of Personal Protective Equipment (PPE), underscoring its role in minimizing injuries and promoting a safer work environment. Ensuring the availability of appropriate PPE not only safeguards employees but also contributes to operational efficiency by reducing downtime caused by workplace accidents.

Respondents also highlighted other medium-priority measures, including: Upgrading equipment and technology (38.1%) – Modernizing machinery can reduce reliance on manual labor, thereby decreasing worker fatigue and associated risks. Advanced technology also enhances production speed and precision, benefiting both safety and productivity. Strengthening collaboration between manufacturers, government agencies, and stakeholders (38.1%) – Partnerships with regulatory bodies such as the Department of Occupational Safety and Health Services (DOSHS) could improve compliance with safety regulations through stricter enforcement and oversight. These findings collectively indicate that workers perceive a multi-faceted approach as necessary for meaningful safety improvements. While vocational training

and PPE availability are seen as immediate priorities, long-term advancements—such as technological upgrades and regulatory collaboration—are also considered vital for sustainable progress. By implementing these strategies, vehicle manufacturing firms can foster a culture of safety, reduce workplace injuries, and enhance overall productivity.

Table 4.11: Perception on improving safety and health

Statements	NA%	LP%	MP%	HP%	E%	Mean	SD
Workplace safety and health training	0	2.3	3.5	46.2	48.1	4.40	0.67
Provision of more PPE	1.2	1.2	17.3	43.8	36.5	4.13	0.82
Collaboration with government agencies and other stakeholders	0.4	6.2	38.1	28.1	27.3	3.76	0.94
Upgrading equipment / technology	0.8	5.8	33.1	31.2	29.2	3.82	0.95
Vocational / technical training	0.8	7.7	16.2	53.8	21.5	3.88	0.86

***1= Not a priority, 2 = Low priority, 3= Medium priority, 4= High priority, 5= Essential**

4.6 Compliance to Occupational and Safety Regulations in the Vehicle Body Manufacturing Industry

4.6.1 Adherence to Occupational Safety and Health Regulations

The research findings presented in Table 4.12 provide valuable insights into workers' adherence to occupational safety and health (OSH) measures within vehicle manufacturing facilities. The data reveals a mixed picture of compliance levels, with some encouraging trends alongside areas requiring significant improvement. A substantial portion of respondents (36.9%) demonstrated regular compliance with hazard control measures, indicating that a reasonable segment of the workforce maintains consistent adherence to established safety protocols. This finding suggests that safety awareness has been effectively instilled in a significant percentage of employees, contributing to a safer working environment.

However, the study identified gaps in safety reporting practices, with 34.2% of workers admitting they rarely report incidents or unsafe acts to their supervisors. This underreporting tendency creates multiple organizational challenges, including the compilation of inaccurate safety statistics that may lead to flawed decision-making regarding safety improvements. The

reluctance to report appears to stem from workers' apprehension about potential reprimands from management, highlighting a need for cultivating a more open and non-punitive safety culture.

On a positive note, the research found that 33.5% of employees frequently seek OSH information, demonstrating proactive engagement with workplace safety knowledge. This practice of information-seeking behavior is crucial as it enhances workers' understanding of potential risks and appropriate preventive measures, ultimately contributing to better hazard avoidance and risk mitigation. The study identified a moderate level of intermittent compliance, with 33.8% of workers sometimes following safety practices. While this indicates some degree of safety awareness, it also represents a significant vulnerability, as inconsistent adherence to safety measures can leave workers exposed to preventable hazards. This pattern of behavior underscores the need for more effective safety reinforcement strategies.

Regarding personal protective equipment (PPE) usage, the data shows that 33.1% of respondents consistently use and maintain their PPE. While this group demonstrates commendable safety practices, the remaining workforce's inconsistent or non-existent PPE usage represents a serious concern, as it leaves many employees vulnerable to occupational injuries and illnesses. This finding particularly warrants attention, as proper PPE usage is among the most fundamental and effective safety measures in industrial settings. These findings collectively suggest that while a foundation of safety awareness exists within the workforce, there are substantial opportunities for improvement in safety compliance and reporting culture. The data emphasizes the need for targeted interventions to address the identified gaps, particularly in encouraging consistent safety practices, fostering open reporting channels, and ensuring universal PPE compliance. Addressing these issues could significantly enhance overall workplace safety and health outcomes in the vehicle manufacturing sector.

Table 4.12: Adherence to occupational safety and health regulations

Acceptance of OSH measures	Never	Rarely	Often	Sometimes	Always	Mean	SD
PPE for my job is always available	0	13.5	25.0	28.5	33.1	3.81	1.04
Always comply with safety	0.8	13.1	30.4	33.8	21.9	3.63	0.99

practices at work							
Always comply with hazard control measures at work	0	15.4	36.9	18.8	28.8	3.61	1.06
I always ask for OSH information	11.2	21.5	33.5	21.5	12.3	3.02	1.17
Always comply with reporting incidents and unsafe acts to my supervisor	1.9	34.2	22.3	15.0	25.5	3.30	1.24

***1= Never, 2= Rarely, 3= Often, 4= Sometimes, 5= Always**

These findings align with yet also contrast against previous research on occupational safety compliance patterns. The current results show partial agreement with a Nigerian study conducted in Oyo State, which observed that recently hired employees demonstrated better knowledge, attitudes, and compliance with safety preventive measures compared to their more experienced counterparts. However, an interesting contradiction emerges when examining the same Nigerian study's additional finding that 93.7% of workers with over six years of industry experience maintained strong compliance with occupational health and safety practices (Onajole, 2004). This apparent discrepancy in compliance patterns between newer and veteran employees may be explained by several contextual factors specific to the vehicle manufacturing sector.

The higher compliance rates among long-tenured workers in vehicle body manufacturing could potentially stem from the industry's more stringent regulatory framework compared to other industrial sectors. Vehicle manufacturing firms often operate under close scrutiny from both government regulators and their corporate partners, leading to more robust internal safety systems. Additionally, the close operational relationships between vehicle body manufacturers and major automotive franchise holders likely creates an environment where safety standards are continuously reinforced through contractual obligations, regular audits, and shared best practices. These industry-specific conditions may account for why veteran employees in this sector demonstrate stronger safety compliance than what might be expected based solely on general industry trends.

The contrast between these findings suggests that while new employee orientation programs may effectively instill initial safety awareness, sustained compliance over time

depends heavily on workplace culture, regulatory environment, and management systems. In vehicle manufacturing, the combination of strong institutional safety frameworks and partnership requirements appears to create conditions where safety compliance actually improves with tenure, rather than deteriorating as might occur in less regulated industries. This highlights the importance of considering sector-specific factors when analyzing occupational safety compliance patterns across different industries and employment durations.

4.6.2 Workers' Compliance to Occupational Safety and Health Measures

The study sought to find out the workers' compliance to occupational safety and health measures in vehicle manufacturing companies and the results are shown on Table 4.14 below.

Table 4.13: Workers' compliance to occupational safety and health measures

Statements	Never	Rarely	Often	Sometimes	Always	Mean	SD
Comply with safety measures at work	0	9.6	29.2	23.5	37.7	3.89	1.02
Wear personal protective clothing / equipment	0	2.3	18.8	46.2	32.7	4.09	0.78
Report incidents to my superiors	0	19.6	33.8	23.5	23.1	3.50	1.05
Read all instructions before doing dangerous work	2.7	31.5	20.8	20.8	24.2	3.33	1.29
Avoid unsafe acts at work	1.2	8.1	32.3	27.7	30.8	3.32	1.23
Wash hands after work	0.4	11.05	26.5	29.6	31.9	3.79	1.01
Take special precautions while working with sharp objects/ machines	0.4	4.6	20.8	40.4	33.8	3.81	1.02
Use materials hazards sheet/ manuals	3.1	22.3	35.0	18.1	21.5	4.03	0.88
Adhere to safety instructions/ rules	0	5.0	34.2	36.5	24.2	3.33	1.13
Follow proper work procedures	1.5	5.0	28.5	25.8	39.2	3.80	0.87

***1= Never, 2= Rarely, 3= Often, 4= Sometimes, 5= Always**

The data presented in Table 4.13 reveals important insights into workers' adherence to occupational safety and health (OSH) measures. A significant proportion of respondents (37.7%) reported always complying with OSH requirements, while 29.2% indicated they often follow safety protocols. However, the finding that 23.5% only sometimes comply raises concerns, as this inconsistent adherence potentially exposes these workers to preventable hazards. This variation in compliance levels may stem from workers' risk perception, where they tend to be more vigilant with activities they perceive as high-risk while being less consistent with tasks they consider lower risk.

Regarding personal protective equipment (PPE) usage, the results show that while 32.7% of workers consistently use protective gear, a larger segment (46.2%) only sometimes utilizes PPE. This inconsistent PPE usage pattern represents a significant safety gap, as sporadic protection leaves workers vulnerable to occupational hazards. The data suggests that while awareness of PPE importance exists, full compliance remains challenging to maintain consistently across all work activities.

Several specific OSH practices showed strong compliance rates: Following proper work procedures was always practiced by 39.2% of respondents, demonstrating good procedural adherence that enhances workplace safety. Handwashing after work, maintained by 31.9% of workers, serves as a critical barrier against biological hazards and prevents potential disease transmission to workers' homes. Reviewing instructions before hazardous tasks, practiced by 24.2%, ensures workers understand material safety data sheets (MSDS) and helps prevent accidents.

Areas showing room for improvement include: Taking special precautions with sharp objects and machinery (sometimes done by 40.4%). Consistent adherence to safety instructions (always followed by only 24.2%). Regular use of hazard sheets/manuals (often practiced by 35.0%). Positive safety behaviors were also noted: Incident reporting to supervisors (often done by 33.8%) enables management to implement preventive measures. Avoiding unsafe acts (often practiced by 32.3%) contributes to accident prevention.

These findings align with Adebola's (2014) UAE study showing low PPE usage despite hazard awareness. However, they contrast with Parimalam *et al.*'s (2007) textile industry research, where workers demonstrated strong PPE knowledge but poor compliance. This

comparison suggests that knowledge alone doesn't guarantee compliance, and that industry-specific factors significantly influence safety behaviors. The current study highlights the need for targeted interventions to bridge the gap between safety knowledge and consistent practice, particularly in maintaining PPE usage and hazard precautions across all work activities.

4.6.3 Factors influencing compliance to Occupational and Safety Regulations in the Vehicle Body Manufacturing Industry

To systematically examine the underlying causes of non-compliance with occupational health and safety standards, a comprehensive Chi-square statistical analysis was performed, as detailed in Table 4.14. This rigorous analytical approach was employed to identify potential correlations between various demographic and professional factors and workers' adherence to safety regulations. The study specifically focused on five key variables that were hypothesized to potentially influence compliance behavior: Age Demographics: The analysis sought to determine whether workers' age ranges correlated with different levels of safety protocol adherence, as different age groups may perceive risks differently or have varying levels of experience with safety procedures.

Gender Distribution: This variable was included to assess whether biological or sociocultural gender differences might affect compliance rates with occupational safety measures. Educational Attainment: The researchers examined how workers' formal education levels might impact their understanding and implementation of safety regulations, with the hypothesis that higher education might correlate with better compliance. Professional Tenure: Measured in years of work experience, this factor was analyzed to determine if length of service in the industry influenced safety behavior patterns, potentially indicating either increased safety awareness or possible complacency over time. Safety Training History: The study evaluated whether participation in formal occupational safety and health training programs significantly affected workers' compliance rates with safety protocols.

The Chi-square methodology was particularly appropriate for this analysis as it allowed for the examination of categorical variables and their potential relationships with compliance outcomes. This statistical approach enabled the researchers to determine whether observed differences in compliance rates across these variables were statistically significant or likely due to random chance. By analyzing these specific factors, the study aimed to identify which

demographic and professional characteristics might serve as predictors of safety regulation compliance, thereby providing valuable insights for targeted workplace safety interventions and training programs.

Table 4.14: Chi-square analysis of variables affecting compliance to occupational and safety regulations

Variable	Chi square	p-value
Gender	6.287	0.043**
Marital status	3.937	0.047**
Presence of hazards	30.457	0.000***
Type of hazards	51.649	0.000***
Control measures	43.333	0.000***
Trainings in OSH	8.022	0.046**
Trainer organizations	6.395	0.094*

Note: *=10% significance level; **=5% significance level and ***=1% significance level

The statistical analysis yielded several significant findings regarding compliance with occupational safety and health (OSH) regulations. All examined variables demonstrated statistical significance at $p < 0.05$, indicating a 95% confidence level in the results. The data revealed particularly noteworthy gender disparities in compliance rates, with male respondents showing substantially better adherence to safety protocols (93.33%, $n=112$) compared to their female counterparts ($p < 0.05$, $\chi^2 = 6.287$). This gender gap may be attributed to the underrepresentation of women in the industry, resulting in fewer female workers gaining extensive experience with OSH practices. The limited participation of women in this sector potentially creates a cyclical effect where reduced exposure leads to lower familiarity with safety protocols, further exacerbating the compliance disparity.

A robust statistical relationship emerged between three key variables - age, gender, and OSH training - and the implementation of occupational safety practices ($p = 0.00$, $\chi^2 = 30.457$). This strong correlation underscores the multifaceted nature of safety compliance, demonstrating how demographic factors intersect with training opportunities to influence workplace safety behaviors. The findings emphasize that when organizations fail to implement adequate hazard control measures, they inadvertently contribute to non-compliance with OSH regulations. Proper

mitigation strategies are therefore essential not only for risk reduction but also for fostering a culture of regulatory adherence. The analysis further revealed a statistically significant relationship between hazard control measures and the practical application of OSH protocols ($p = 0.00$, $\chi^2 = 43.333$). This compelling evidence confirms that effective control measures directly enhance proper safety practices in the workplace. Organizations that prioritize and implement comprehensive hazard controls create environments where safety compliance becomes an integral part of daily operations rather than an afterthought.

Perhaps most significantly, the study demonstrated that OSH training has a profound impact on regulatory compliance ($p < 0.05$, $\chi^2 = 8.022$). This finding strongly supports the value of targeted safety education programs, showing that when workers receive proper training, they are significantly more likely to adhere to safety regulations. The resulting improvement in compliance naturally leads to a reduction in workplace incidents and injuries. These results collectively highlight the importance of a multi-pronged approach to workplace safety - one that combines demographic awareness, hazard control implementation, and comprehensive training programs to achieve optimal compliance with occupational health and safety standards.

The implications of these findings are particularly relevant for safety managers and organizational leaders. By understanding the statistical relationships between these variables and compliance rates, companies can develop more effective, data-driven interventions to improve workplace safety outcomes. The evidence clearly shows that investment in proper training and hazard controls yields measurable improvements in safety protocol adherence, ultimately creating safer work environments for all employees.

Extensive research has examined the relationship between demographic factors, safety training, and workplace accident rates. Ercan and Kiziltan's (2014) seminal study revealed significant gender and age disparities in occupational accidents, finding that male workers experience workplace injuries more frequently than their female counterparts, with these incidents typically being more severe in nature. Their research further identified that young male workers under 25 years old represent the most vulnerable demographic, experiencing a disproportionately high rate of accidents compared to other age groups in the workforce.

The transformative power of safety training emerges as a consistent theme across multiple studies. Ravindran's (2021) research demonstrates that comprehensive workplace safety training programs not only equip employees with essential skills to perform their duties safely but also foster an organizational culture that simultaneously prioritizes both safety and productivity. This dual focus creates a positive feedback loop where safety awareness enhances work performance. Huang *et al.* (2014) further substantiate these findings, providing empirical evidence that trained workers develop enhanced capabilities to identify potential hazards and implement corrective measures proactively, thereby preventing both accidents and their associated productivity losses.

Grabowski's (2019) work emphasizes the behavioral aspects of safety training, showing how structured training programs instill desirable safety-conscious behaviors among employees. These include adherence to safe working practices and reduced incidence of critical errors that could lead to severe accidents. Complementing these findings, Malavi *et al.* (2021) highlight the psychological benefits of safety training, particularly in high-risk environments like manufacturing facilities. Their research indicates that properly trained employees experience reduced anxiety about workplace hazards, enabling them to focus more effectively on their tasks without debilitating safety concerns. Collectively, these studies establish that the combination of thorough safety training and appropriate protective measures yields significant improvements in both employee safety and overall productivity.

The current study's findings align with and expand upon this existing body of research, identifying four critical factors that significantly influence compliance with occupational safety and health (OSH) practices in the vehicle body manufacturing sector: Age: The research reveals a strong positive correlation between worker age and safety compliance, with older employees demonstrating markedly better adherence to OSH regulations. This likely stems from accumulated experience and greater awareness of workplace hazards developed over time.

Gender: The study confirms significant gender-based differences in safety practices, reinforcing previous findings about demographic disparities in occupational safety outcomes. Education Level: Higher educational attainment emerges as a key predictor of better safety compliance, as more educated workers appear better equipped to understand and mitigate occupational hazards. Work Experience: The duration of industry experience shows a clear

relationship with safety practices, though this factor interacts complexly with age and training history.

The study particularly highlights how additional specialized OSH training substantially improves regulatory compliance. When workers receive targeted safety education specific to their roles, they demonstrate significantly better adherence to safety protocols. This finding has crucial implications for the vehicle body manufacturing industry, which remains particularly prone to accidents affecting younger, less experienced workers with limited safety training. These insights underscore the urgent need for industry-wide reforms, including: implementation of comprehensive regulatory frameworks, development of targeted training programs, dissemination of accessible safety information and creation of robust onboarding processes for new and young workers.

Table 4.15: Binomial logistic results for factors that influence compliance to occupational and safety regulations in the vehicle body manufacturing.

Attention OHRSH	Coef.	Std. Err.	Z	P > z
Age	-0.0139	0.0357	0.39	0.697
Sex	2.0318***	0.7388	2.75	0.006
Marital status	0.1555	0.5698	0.79	0.785
Educ Level	0.6593***	0.2178	3.03	0.002
Experience	-0.0627***	0.0169	3.70	0.000
Work Hours	0.4315	0.4953	0.87	0.384
Hazard Present	3.6318***	0.7136	5.09	0.000
Training	1.2361**	0.5548	2.23	0.026
Involved Accident	2.7510***	1.0161	2.71	0.007
Off-duty	0.0562	0.8190	0.07	0.945
Off-days	0.0113	0.0925	0.12	0.903
PREVM	1.8037**	0.7802	2.31	0.021
USPPE	0.2231	0.7114	0.31	0.754
SOL	-0.0221	0.6009	0.04	0.971
_cons	2.2521	4.5235	0.50	0.619
Number of obs = 260	LR chi ² (14) = 114.710		Prob > chi ² = 0.0000	
Log likelihood = -74.124868	Pseudo R ² = 0.4362			

The statistical analysis presented in Table 4.15 reveals significant correlations between various demographic factors and attention to occupational safety and health (OSH) practices in vehicle body manufacturing environments. Each variable demonstrates distinct patterns of influence on workers' safety compliance behaviors, supported by relevant empirical studies. The data indicates a strong positive correlation between gender and safety attention ($r = 2.0318$, $p =$

0.006), with male workers showing significantly greater adherence to OSH practices. This finding reflects the physical demands characteristic of vehicle body manufacturing, which typically involves: heavy lifting of metal components and equipment, prolonged physical exertion during 8-hour shifts, six-day work weeks requiring sustained stamina and handling of commercial vehicles under construction

These occupational requirements align with traditional male physical capabilities, explaining the industry's gender imbalance. The study's results corroborate Chen's (2016) research documenting female workers' predominant employment in domestic or street-based occupations rather than industrial workshops. Similarly, Leeth *et al.* (2006) established that women statistically occupy fewer physically hazardous positions and generally work fewer total hours in industrial settings, further validating our findings.

Educational level emerged as another positively significant factor ($r = 0.693$, $p = 0.002$), demonstrating that workers with advanced education exhibit greater OSH compliance. This relationship suggests that: Formal education enhances hazard recognition capabilities, Schooling develops critical thinking about workplace risks, and Educational attainment correlates with better understanding of safety protocols. These observations support Thumbi *et al.'s* (2019) conclusions about education's transformative role in human development. Their research emphasizes how structured learning enables individuals to: acquire essential safety discernment skills, develop enhanced risk assessment abilities, and make informed decisions regarding hazard avoidance.

Contrary to expectations, work experience showed a negative correlation with safety compliance ($r = -0.00627$, $p = 0.000$), indicating that: veteran workers often disregard established safety protocols, long-tenured employees frequently rely on informal experience over formal procedures and experienced staff commonly develop hazardous work shortcuts. This phenomenon aligns with Gharibi *et al.'s* (2016) findings about behavioral resistance among seasoned workers. Their research identified several concerning patterns: overconfidence in personal work methods despite safety risks, resistance to updated safety procedures and protocols, underestimation of potential hazards due to complacency and difficulty in modifying entrenched work behaviors.

These insights reveal a critical challenge in occupational safety management, while experience should theoretically enhance safety awareness, in practice it often leads to dangerous complacency. This paradox underscores the need for targeted interventions to maintain safety vigilance among long-term employees in the vehicle manufacturing sector.

The study reveals a strong positive correlation ($r = 3.6318$, $p = 0.000$) between the presence of identifiable workplace hazards and employees' attention to occupational safety concerns. This significant relationship demonstrates that visible and recognized dangers in the work environment substantially heighten workers' safety consciousness. When employees become aware of potential threats to their wellbeing - whether through direct observation or safety training - they naturally develop greater vigilance about their work practices and surroundings.

In the context of vehicle body manufacturing, this heightened awareness manifests in several important ways: increased utilization of appropriate personal protective equipment (ppe) during high-risk operations including: welding procedures, metal cutting and grinding activities, paint spraying applications, greater caution when working in potentially hazardous areas or with dangerous equipment and improved adherence to established safety protocols and procedures

The research further indicates that employers respond proactively to known hazards by implementing comprehensive safety measures. This managerial response stems from two primary motivations: financial considerations regarding potential accident-related costs, and protection of corporate reputation and brand image. The study's findings align with Pignata *et al.'s* (2016) research on workplace stress interventions, which established that employees without proper stress management training exhibited significantly lower job satisfaction levels. This parallel suggests that hazard awareness, when coupled with appropriate training interventions, creates a more engaged and safety-conscious workforce. The current research expands on these findings by demonstrating how hazard recognition combined with stress reduction strategies can lead to improved safety outcomes in industrial settings.

The analysis demonstrates a statistically significant positive correlation ($r = 1.2361$, $p = 0.026$) between safety training initiatives and employees' attention to occupational safety and health (OSH) hazards. comprehensive training programs serve multiple critical functions in promoting workplace safety: knowledge dissemination: educates workers about relevant OSH

laws and regulations; provides information about workplace-specific hazards; clarifies employee rights and employer responsibilities; hazard identification enhancement: improves recognition of both obvious and subtle workplace dangers; teaches systematic approaches to risk assessment; enables early detection of potential safety issues; employee engagement: creates platforms for workers to voice safety concerns; allows for discussion of implementation challenges; fosters collaborative problem-solving for safety issues; behavioral modification: encourages consistent use of safety equipment; promotes adherence to established protocols; develops a culture of safety mindfulness.

These findings corroborate Verbeek *et al.*'s (2013) research demonstrating that OSH training substantially improves workers' ability to recognize and respond to potential risks. The current study further validates earlier research by Dhanuraja *et al.* (2021), Afoboli *et al.* (2021), Azuike *et al.* (2016), and Thumbi *et al.* (2019), all of whom established clear connections between safety training initiatives and improved OSH practices across various industrial sectors.

The study findings demonstrate a clear relationship between workplace accidents and improved safety awareness among employees. Statistical analysis revealed a significant positive correlation ($r = 2.7510$, $p = 0.007$), indicating that experiencing or witnessing accidents leads to greater attention to occupational hazards. Employees who have been involved in workplace incidents tend to develop heightened vigilance when performing their duties, taking extra precautions to avoid future injuries.

Similarly, coworkers who observe accidents often modify their own work behaviors, becoming more cautious when undertaking similar tasks. These results align with previous research by Abidin and colleagues (2013), which established that increased compliance with occupational safety measures corresponds with reduced accident rates. The findings suggest that accident experiences, while unfortunate, can serve as powerful motivators for behavioral change and enhanced safety consciousness in industrial workplaces.

Regarding preventive measures, the analysis showed another significant positive correlation ($r = 1.8037$, $p = 0.021$) between implemented safety controls and employee attention to hazards. The provision of adequate personal protective equipment and other preventive strategies appears to effectively raise safety awareness among workers. Most surveyed companies maintained proper PPE supplies, which helped employees remain alert to potential

dangers during their work activities. This supports Alaloul and associates' (2020) conclusion that visible preventive measures promote greater workplace attentiveness. However, the study also acknowledges Nderitu and coworkers' (2019) contrasting perspective that extensive safety provisions might occasionally lead to complacent behaviors, as some employees may develop overreliance on protective measures. These findings highlight the complex dynamics of workplace safety management, where preventive strategies must be carefully balanced with ongoing training and supervision to maintain optimal safety vigilance without fostering dependency or reduced personal responsibility.

4.7 Challenges of Implementing Occupational Safety and Health Practices

Respondents were required to identify the various challenges and factors that were faced when implementing occupational safety and health regulations in the vehicle manufacturing companies. Study findings showed that the most common factors that affect occupational safety and health practices in vehicle manufacturing companies included; lack of and limited protective gears in the workplace, inadequate information, trainings, PPEs and laid down work procedures, employee ignorance and negative attitudes, poor management and too much work pressure on employees during implementation of occupational safety and health regulations.

Lack of and limited protective gears in the workplace as shown in Table 4.15 (37.3%) were found to be the most common challenge faced by companies when implementing occupational safety and health. This could be attributed to the high cost of suitable PPE and the different types required by various employees as well as the necessary regular replacement due to wear and tear. The required PPE vary from one section to another as was noted; a staff who works of preparing vehicle body panels require to use safety shoes which are steel toed to provide proper protection to the feet from falling objects, it has good treads on the sole that is resistant to slips, protects the feet from piercing by sharp objects and provides protection when the worker feet hits a hard blunt object.

The worker also requires a suitable overall, hard gloves to protect the hand from sharp metal parts, hard head helmet to protect from being injured when hit by high or falling objects. This staffs also requires goggles to protect the eyes from grinding and cutting sparks. On the other hand, the paint worker need to use in addition complete face masks to give protection from inhaling the chemical fumes; all these can be very expensive to be purchased by the employer

hence the challenge of providing adequate PPE. Additionally, an employer may be inclined not to provide adequate PPE to employees whose contracts are of temporary nature. The employer will consider it expensive to provide expensive PPE to workers who are temporarily employed.

Table 4.16: Challenges affecting occupational safety and health practices at work place

Challenges	Frequency	Percentage (%)
Poor management and work pressure	36	14.1
Lack of and limited protective gears in the workplace	95	37.3
Inadequate information, trainings, PPEs and laid down procedures	83	32.5
Ignorance and negative attitudes by employees	38	14.9
All the above	3	1.2

Poor management and work pressure is 14.1% and this can be attributed to pressure to meet vehicle completion deadlines that may contribute to the workers taking short cuts thus avoiding following the safe work procedures. The managers and supervisors may tend to overlook the occupational safety and health regulations due customers pressure to have their vehicles delivered. Ignorance and negative attitude also has effect on safety and health practices at 14.9% and this may be due to inadequate training of the workers thus contributing to their ignorance on underlying hazards. The attitude of the workers may be attributed to their being used to unsafe way of working without immediate negative effects, for example a welder may work without using eye protection (welding shield or goggles) for a short interval without immediate side effect on the eyes and eventually get used to unsafe way of working.

Effective usage of PPEs enables workers to avoid occurrences of OSH hazards in the workplace. While the usage of PPEs is important in cushioning workers against any hazardous incidents, it was found out that their utilization was considered optional in most of the vehicle manufacturing companies and there was no laid down regulations for their protection. Even so, it was further discovered that most of these companies only tend to comply with OSH regulations only when Government agencies are on the look-out for non-compliant companies Abanga (2016) and Buniya *et al.* (2021). Following the laxity in usage of the PPEs in the workplaces, this meant that there were no adequate PPEs in the workplace and only those who were willing to use

could be fortunate to get them. As such, implementation of OSH regulations in vehicle manufacturing companies becomes a burden to the management as they cannot be able to implement such regulations without quality and adequate PPEs in place. Similar results were established by Alaloul *et al.* (2020) who argued that one of the greatest hindrance to OSH regulations in the workplaces were poor quality of PPEs, lack of mandatory regulations on usage of PPEs and inadequate PPEs in the workplaces.

Important to note is the fact that any minor changes in the workplace need attention of workers otherwise implementation of such regulations will be faced with rigidity from them. Hence, provision of training opportunities to employees is important during the transitioning and implementation of the OSH regulations in the workplace. It was discovered that the training which the companies had undertaken was on fire prevention and first aid that is a small part of OSH. However as observed the day today activities involved use of machines for grinding, metal cutting, bending, arc welding and lathe machines. These require specific safety training in their operation to avoid injuries and any exposure that could lead to occupational diseases. However, if the vehicle manufacturing companies fail to invest in employee trainings and provide information as well as work procedure information to them, then implementation of the OSH regulations will not only be costly but may tend not to be taken up easily by employees. Similar findings were established by Buniya *et al.* (2021) and Yazdani *et al.* (2015) who asserted that poor safety awareness that resulted from lack of trainings, information provision (limited knowledge of risks and safety concerns) and lack of safety awareness and inspection led to failures in controlling risks and preventing OSH related hazards. Again, these items are interlinked to each other.

Inadequate information, trainings, PPEs and laid down work procedures was yet another factor identified to be facing vehicle companies' management when implementing safety and health control measures. Inadequate information, trainings and laid down work procedures proved to be an important factor when implementing OSH regulations within the companies. Ideally, inadequate information on how to use specific machinery with safety consideration during vehicle body manufacturing processes hinders effective use of the machines. Limited work procedures and manuals containing information on how safety protocols should be adhered to is yet a challenge to OSH regulations Masi *et al.* (2014). If no information is made available to

workers, then the OSH regulations cannot be applied too. Trainings form an important part of workers' perception towards OSH, bring a positive change and acceptance to OSH regulations within the workplace.

While employees' attitude can either present a barrier or be a driver to effective implementation of OSH regulations, it was evident from this study that it was among the barriers identified. This comes in as a barrier in that employees' have already developed certain behaviours over time in the workplace that they are reluctant to change. This was noticed when some workers would carry out certain duties without using proper PPE such as safety shoes, hard hand gloves while handling metals, use of goggles while grinding or cutting metal and use of welding shields. Such behaviours, according to them are assumed to be correct and help them counter any hazardous incidents despite being trained and provided with safety regulations by experts in the industry. The top management and supervisors further confirmed that it is difficult to change employees' attitudes and behaviour which is in agreement with Afolabi *et al.* (2021), Gharibi *et al.* (2016) and Masi *et al.* (2014), results as it always translated to ignorance in the workplace which leads to more OSH hazards in the workplace. This sign of lack of commitment due to negative attitudes makes employees' more prone to work-related injuries, accidents and illnesses. Lastly, poor management and too much work pressure on employees were found to also hinder good practices of OSH regulations in the workplace.

However, poor management and too much work pressure on employees (14.1%) made it difficult for the companies to implement OSH in the sector. Work pressure drives down employees' morale in the workplace. While poor management results in occurrences of OSH hazards in the work place, as was observed the pressure to complete job comes mainly from the customers who require their new vehicles to be delivered and put to use as soon as possible and in turn the supervisors pressurize the staff, in this situation safety procedure are not adhered to. Majority of the customers obtain bank loans to purchase the buses and trucks hence they are under pressure for the vehicle bodies to be constructed as fast as possible in order to put them in business and pay the lenders. Most of the respondents asserted that as much as they would like to adhere and help their employers' in the fight against OSH hazards in their work place, poor management which included negligence on provision of adequate controls to them by the companies, unanswered complaints and prejudice from top management made them less likely to

accept implementation of the OSH regulations in their work places. This, they argued that, as much as the OSH regulations would be implemented, they were certain that nothing will be done to enforce the regulations to ensure smooth transition. These results are in consonance with those of Buniya *et al.* (2021) and Yiu *et al.* (2019). On the other hand, work pressure due to high customer demands and harsh work environments made it difficult to implement OSH in the companies. Due to high customer demands, most of the time is dedicated to ensuring that production flows hence limited commitment is given to OSH regulations. In most cases, commitment to OSH regulations is often thought as a sole responsibility of the workers hence management has minimal control over it. Nevertheless, collaboration between the management all through to the downstream employees is crucial in implementing OSH regulations as it has continuous proven to be a success factor. However, a small number of the respondents (1.2%) still felt that a combination of all the above challenges had an influence in implementation of OSH in their companies.

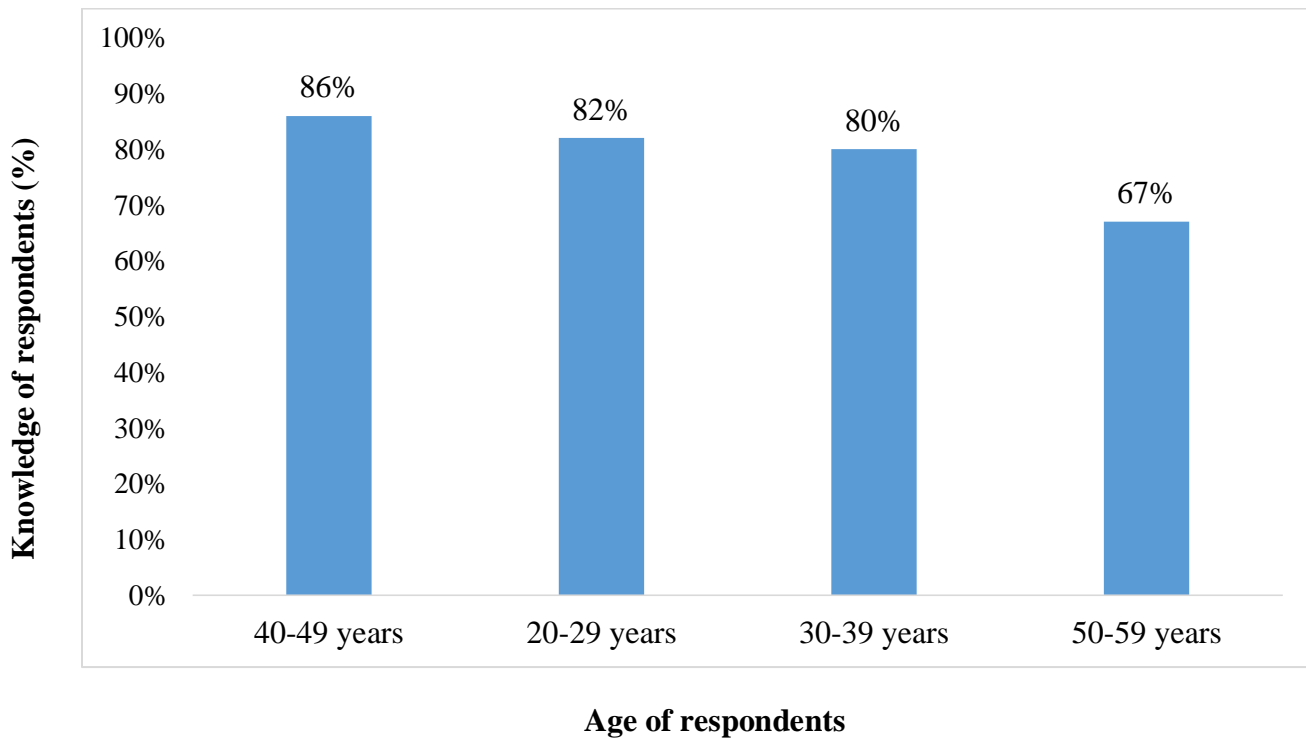


Figure 4.4: Knowledge on occupational health risks and safety hazards and age of the respondents

The survey results presented in Figure 4.4 reveal important age-related differences in workers' perceptions of occupational health and safety priorities. Workers aged 40-49 demonstrated the highest level of awareness (86%) regarding the need to address workplace health risks and safety hazards, followed closely by those aged 20-29 (82%). This pattern suggests that safety consciousness follows a U-shaped curve across workers' careers. The middle-aged group's heightened awareness likely stems from their extensive work experience, which has exposed them to various hazards while also making them more familiar with safety protocols. Their accumulated knowledge helps minimize exposure to occupational risks and potential health consequences. Younger workers' strong safety awareness may reflect recent training and a natural caution stemming from their limited experience.

These findings partially align with Amir et al.'s (2017) study of Pakistani oil rig workers, which found 62.6% of participants had good occupational safety knowledge, though that study did not analyze results by age group. The current results suggest that safety training programs should be tailored to workers' career stages - providing foundational knowledge for younger employees, refresher courses for mid-career workers, and adapted practices for older staff. This age-sensitive approach could help maintain strong safety awareness throughout workers' careers while addressing the specific needs and vulnerabilities of each age cohort. The findings underscore how demographic factors like age can significantly influence safety perceptions and should be considered when developing workplace health and safety interventions.

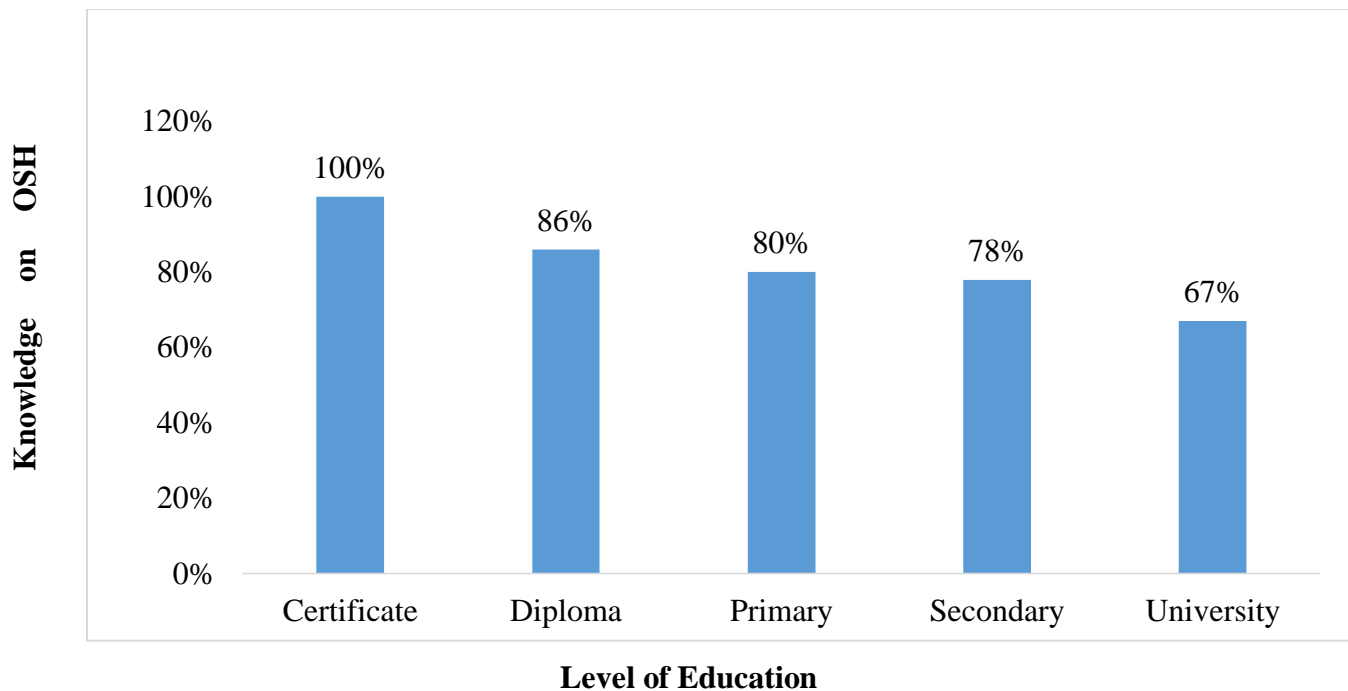


Figure 4.5: Knowledge on occupational health risks and safety hazards and education level

The data presented in Figure 4.5 highlights the relationship between workers' educational attainment and their awareness of occupational safety and health (OSH) risks and hazards. The results indicate that respondents holding a Diploma certification demonstrated the highest level of OSH knowledge (86%), followed by those with Primary (80%) and Secondary (78%) education, respectively. Notably, all surveyed workers possessed at least one type of certification, contributing to the universal (100%) recognition of safety concerns. The superior performance of Diploma holders may be attributed to their practical, skills-based training, which likely emphasizes hazard identification and risk mitigation in workplace settings. This hands-on approach to education appears to foster greater attentiveness to OSH practices compared to more theoretical or general academic training.

However, these findings contradict a previous study by Rongo (2004), which examined ergonomic hazard awareness in small-scale industries in Dar es Salaam. Despite vocational training, business owners in that study displayed very low awareness of key ergonomic risks, suggesting that formal education alone does not always translate into improved safety knowledge. This discrepancy may stem from differences in training quality, industry-specific hazards, or workplace enforcement of safety standards. While the current study suggests that

higher education correlates with better OSH awareness, Rongo’s research implies that structural and cultural factors, such as inadequate safety policies or lack of regulatory oversight—may undermine theoretical knowledge in practice. These contrasting findings highlight the need for context-specific safety training programs that combine formal education with real-world applications to ensure consistent compliance and hazard awareness across different industries.

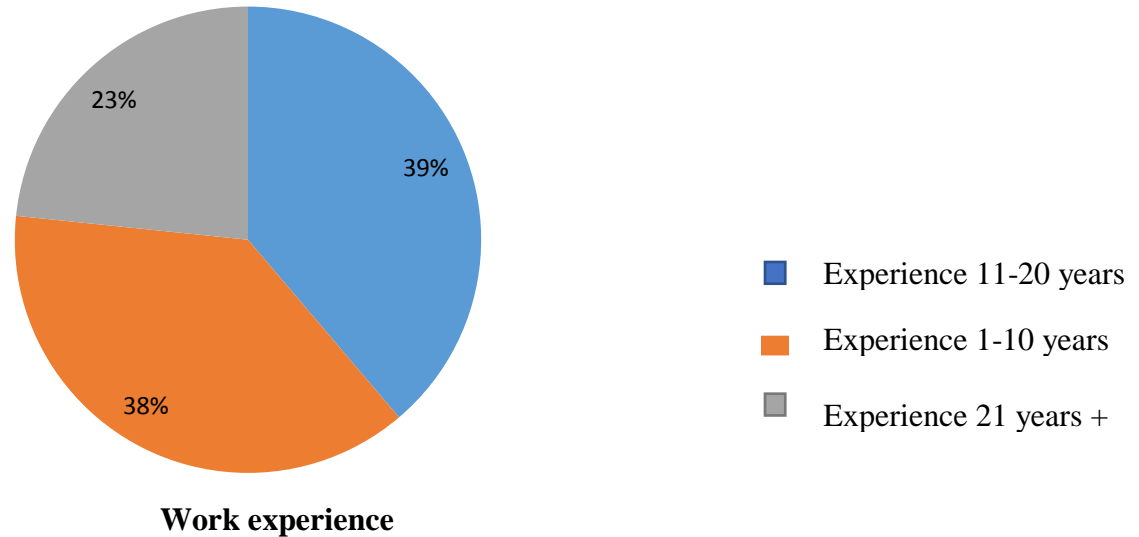


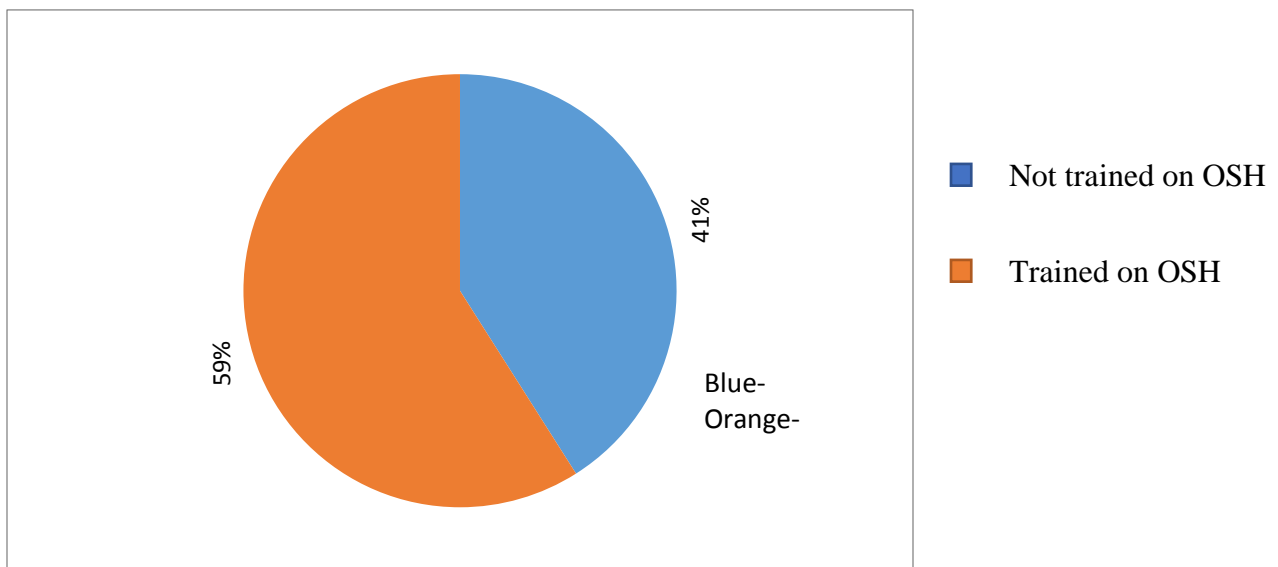
Figure 4.6: Knowledge on occupational health risks and safety hazards and work experience

The findings presented in Figure 4.6 reveal important insights into how work experience influences occupational safety and health (OSH) awareness among employees in the vehicle body manufacturing industry. Workers with 11 to 20 years of experience demonstrated the highest level of OSH knowledge (39%), closely followed by those with 1 to 10 years of experience (38%). This distribution suggests that years of service play a significant role in shaping safety awareness, as employees with longer tenure are more likely to have encountered various workplace hazards and undergone safety training over time. Given that the majority of workers in this sector fall within these experience brackets, the results underscore the positive correlation between accumulated work experience and familiarity with OSH practices.

However, while experience contributes to safety knowledge, the study highlights the need for continuous training and reinforcement of safety protocols, as even seasoned workers may

develop complacency or overlook evolving risks. These findings differ from a study by Adim and Mezeh (2020), which examined the impact of health and safety awareness on employee performance in Nigerian oil companies. Their research conceptualized workplace safety training primarily in terms of induction programs and measured performance based on task accomplishment. Using correlation analysis, they found a significant positive relationship between safety training and productivity, reinforcing the value of structured OSH education. However, unlike the current study, Adim and Mezeh did not explore how work experience itself influences safety awareness, leaving a gap in understanding whether long-term exposure to hazards naturally enhances knowledge or if formal training remains the primary driver of compliance.

Together, these contrasting findings suggest that while experience enhances hazard recognition, structured training is essential to ensure consistent safety practices. Organizations in high-risk industries like vehicle manufacturing should therefore adopt a dual approach, leveraging the practical knowledge of experienced workers while maintaining rigorous, up-to-date training programs to mitigate risks and improve overall workplace safety.



Training/awareness of workplace safety and health

Figure 4.7: Knowledge on occupational health risks and safety hazards and training received

The findings presented in Figure 4.7 reveal a strong positive relationship between occupational safety training and workers' knowledge of health risks and safety hazards. The data shows that 59% of employees who received formal safety training demonstrated significant awareness of workplace dangers, compared to just 41% of untrained workers. This substantial 18-percentage-point difference clearly illustrates how targeted training programs effectively enhance workers' ability to recognize and respond to occupational hazards. The results suggest that systematic safety education provides employees with both the theoretical framework and practical skills needed to identify potential risks in their work environment.

These findings are consistent with earlier research by Onajole and colleagues (2004) conducted in Nigeria, which identified three primary pathways for developing occupational safety knowledge. Their study found that workers acquired hazard awareness through formal professional training during their education, through hands-on experience gained while performing job duties, and through continuing education provided in post-employment workshops. The current study builds upon this foundation by quantifying the measurable impact of training interventions, demonstrating that structured safety education programs can significantly raise workers' hazard recognition capabilities beyond what they might learn through experience alone.

The implications of these findings are particularly relevant for industries with high-risk work environments. Organizations should implement comprehensive training strategies that begin with thorough new-hire orientations and continue through regular refresher courses. Effective programs should incorporate practical, scenario-based learning opportunities that help workers apply safety principles to real workplace situations. Additionally, companies may benefit from developing incentive systems that encourage active participation in safety training initiatives. By making safety education an ongoing priority rather than a one-time requirement, employers can foster a workplace culture where hazard awareness becomes second nature to all employees, ultimately leading to fewer accidents and injuries.

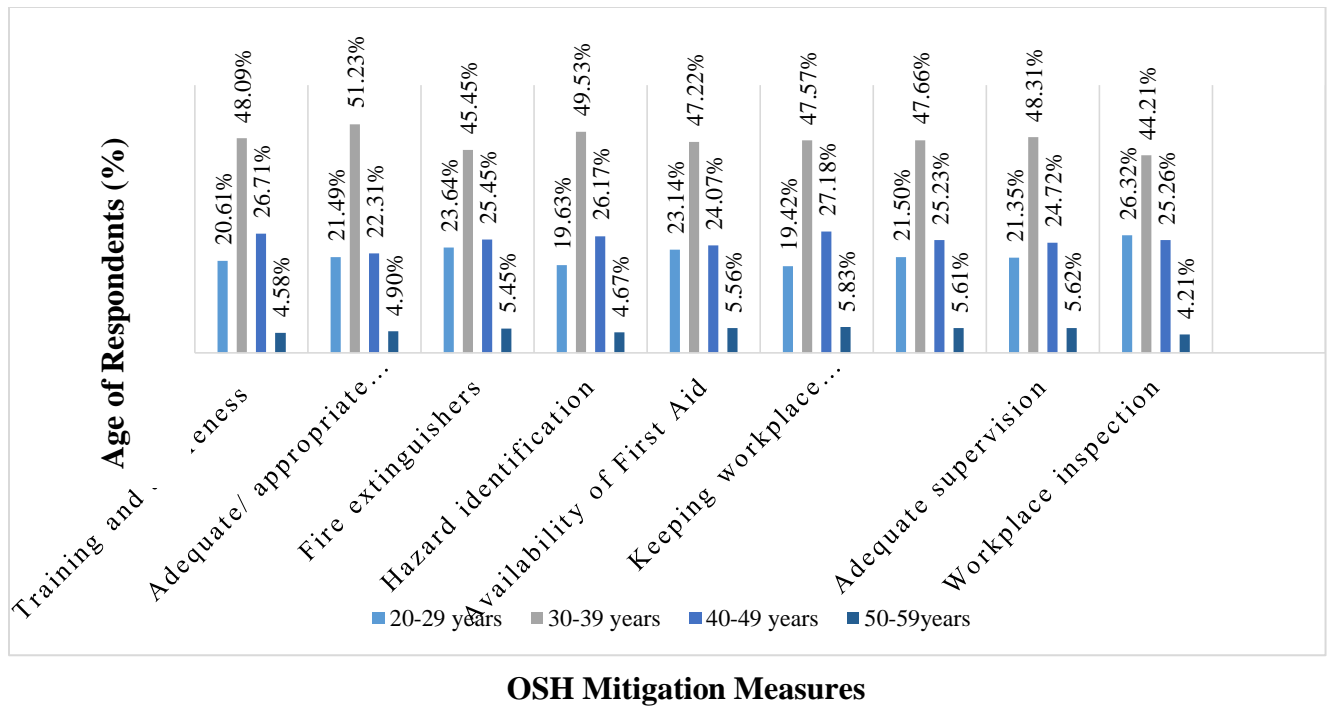


Figure 4.8: Knowledge in the mitigation of hazards and age of the respondents

Analysis of occupational safety knowledge by age group reveals important patterns in hazard mitigation awareness. The data demonstrates that workers aged 30-39 years show particularly strong understanding across key safety measures, with 48.09% proficiency in training concepts, 51.23% in proper PPE usage, and 49.53% in hazard identification. This cohort's comprehensive safety knowledge likely results from their optimal combination of work experience, physical capability, and recent training exposure. Their performance suggests this age group represents the most safety-conscious demographic in vehicle manufacturing environments.

In contrast, employees over 50 displayed significantly lower safety awareness, averaging just 5% across all measured categories. This disparity may reflect both the smaller population of older workers in this physically demanding industry and their typical transition into less hands-on managerial roles. The physical requirements of production work may naturally limit older workers' direct exposure to operational hazards, potentially reducing their engagement with daily safety practices.

These findings contribute to existing safety training research while highlighting an understudied dimension. Previous studies by Ravindran (2021) and Huang *et al.* (2022) established the effectiveness of safety training in improving hazard recognition and productivity, but did not examine age-related differences in training outcomes. Our results suggest that training programs may need age-specific adaptations to maintain effectiveness across all worker demographics. For mid-career workers (30-39), the combination of experience and training produces optimal safety knowledge, while older employees may require different engagement strategies to sustain their safety awareness as they transition to supervisory roles. These insights can help organizations develop more targeted approaches to maintaining a uniformly safety-conscious workforce across all age groups.

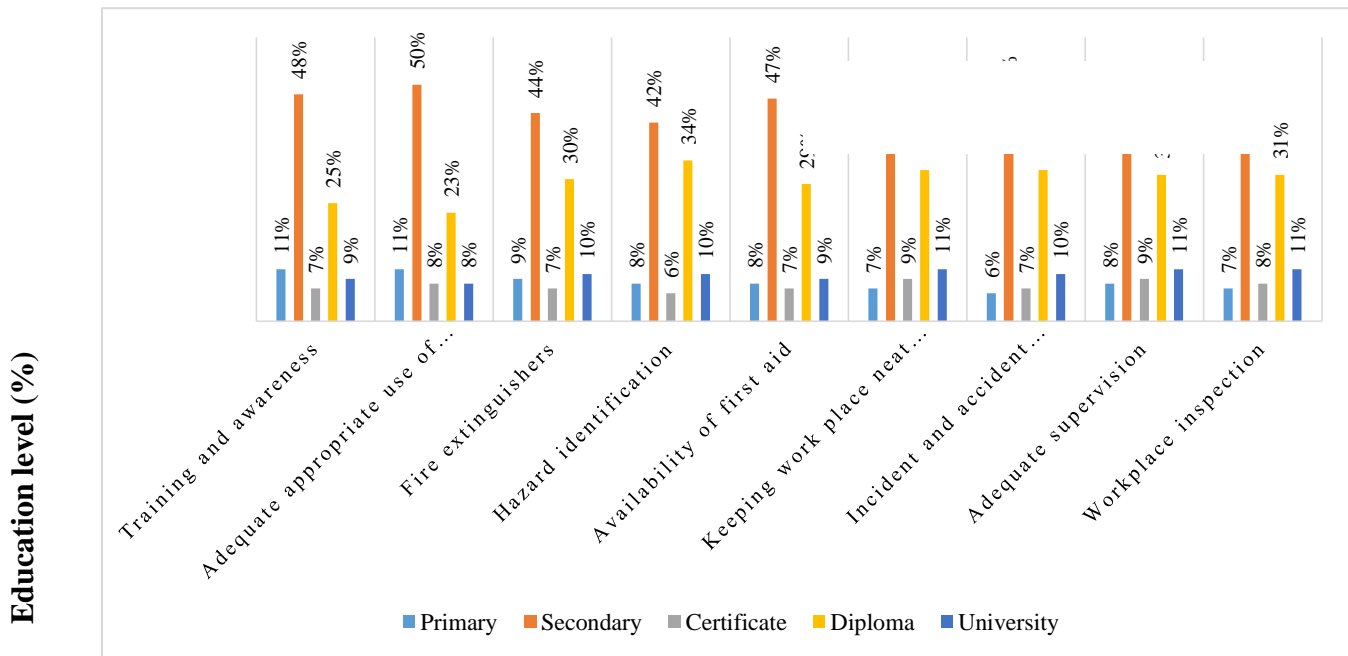


Figure 4.9: Knowledge in the mitigation of hazards and education level of respondents

The analysis of workers' educational attainment in relation to occupational safety knowledge reveals significant variations in hazard mitigation awareness. As illustrated in Figure 4.9, employees with secondary education demonstrate markedly stronger comprehension of safety protocols, exhibiting 48% competency in safety training concepts and 50% proficiency in proper personal protective equipment usage. These findings suggest that secondary-level

schooling effectively equips workers with fundamental safety principles that translate to improved workplace practices. In contrast, personnel possessing only primary education or basic certificates display substantially weaker safety awareness, particularly in critical functions like incident reporting where knowledge levels fall between 6-7%. This pronounced disparity highlights the pivotal role formal education plays in developing occupational health and safety competencies. The results align with broader research on safety training efficacy while introducing an important educational dimension not previously examined in studies like Huang *et al.*'s (2022) investigation of truck driver safety behaviors. These insights underscore the need for organizations to implement differentiated training approaches that account for workforce educational disparities, potentially through enhanced visual training materials for less-educated staff or supplemental safety education programs.

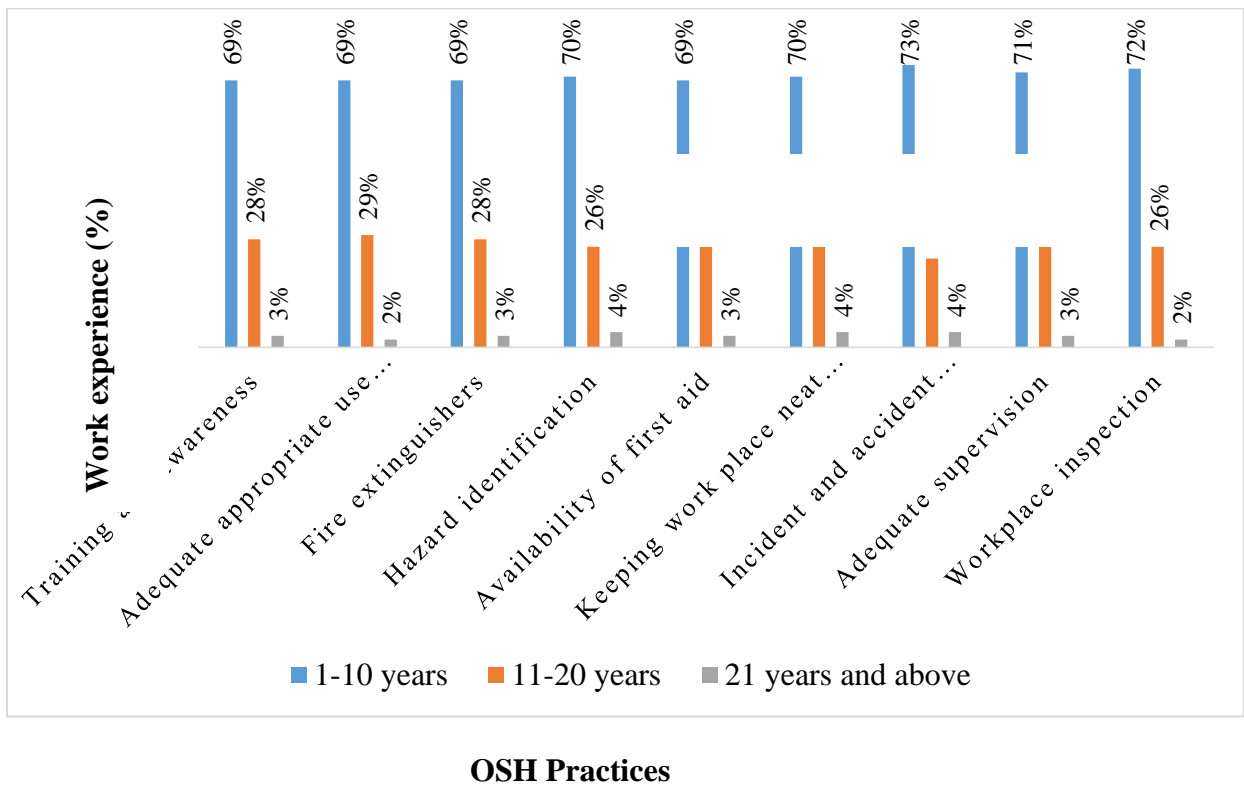


Figure 4.10: Knowledge in the mitigation of hazards and work experience

The analysis of occupational safety knowledge relative to work experience reveals important patterns in hazard mitigation awareness. Workers with 1-10 years of experience demonstrate consistently strong understanding across all measured safety domains, with knowledge levels ranging from 69-73% in areas including proper PPE usage, hazard identification, incident reporting, and workplace inspections. This cohort's comprehensive safety proficiency likely stems from receiving contemporary training while accumulating sufficient practical experience to apply these concepts effectively. Their performance suggests this experience range represents peak safety awareness in the industry. In contrast, employees with over 20 years of experience show dramatically lower safety knowledge (2-4%), potentially due to workforce attrition in physically demanding roles and the natural transition of senior workers away from hands-on positions.

These findings corroborate Onajole *et al.'s* (2004) identification of experiential learning as a key knowledge source while advancing the field by quantifying how safety competence evolves throughout a career. The results underscore the need for organizations to implement knowledge-preservation strategies, such as pairing experienced workers with mid-career employees for mentoring, while ensuring all personnel receive regular safety training updates regardless of tenure. This approach would help maintain high safety standards across an organization's entire workforce demographic.

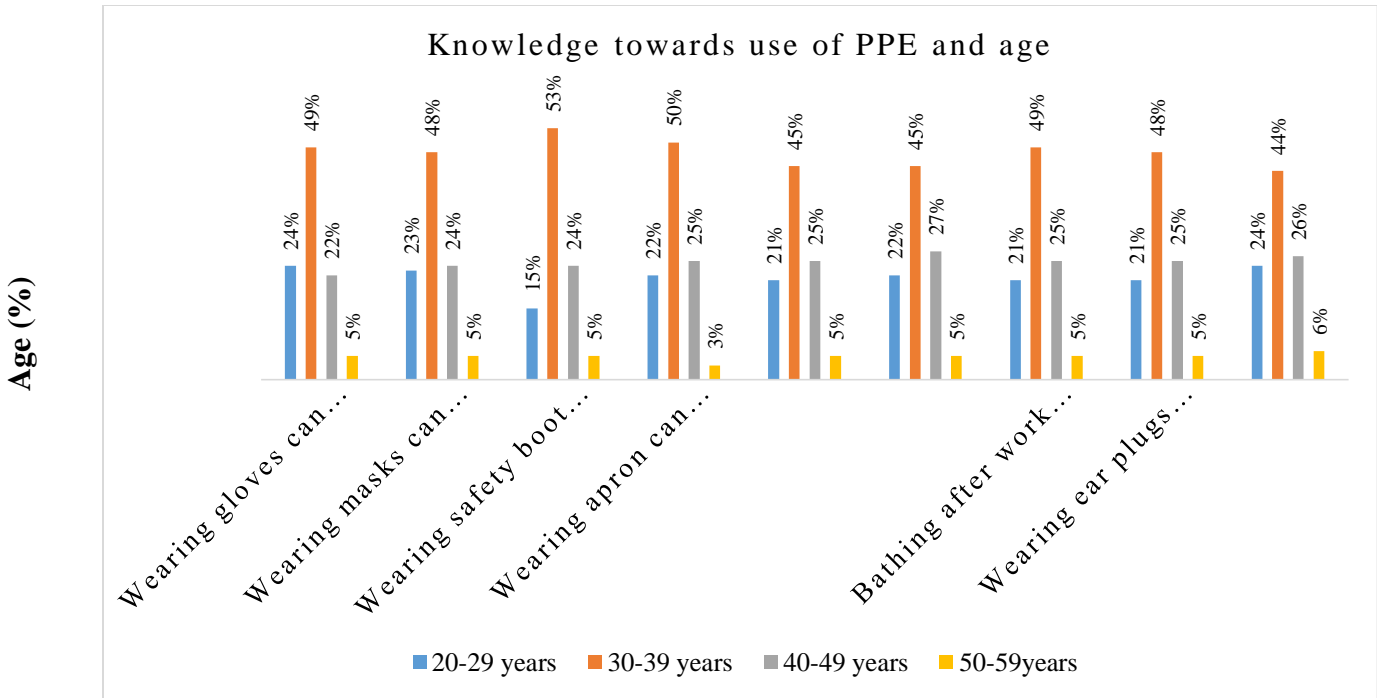


Figure 4.11 Knowledge on OSH practices and age of respondents

OSH Practices

The data presented in Figure 4.11 demonstrates a clear relationship between worker age and knowledge of personal protective equipment (PPE) usage, with employees aged 30-39 years exhibiting significantly higher understanding of occupational safety practices compared to other age groups. This cohort showed strong awareness across multiple PPE categories, including glove usage (49%), mask wearing (48%), safety boot compliance (53%), apron utilization (50%), post-work bathing practices (49%), and ear plug application (48%), indicating that this age range represents peak safety knowledge among the workforce. In contrast, workers aged 50-59 displayed markedly lower safety awareness (5-6%), likely due to both the physical demands of the industry favoring younger employees and the consequently smaller population of older workers in these roles.

These findings complement Obong *et al.*'s (2021) Nigerian manufacturing study which established the positive impact of safety training on worker efficiency through regression analysis, though their research did not examine age-based differences in safety knowledge acquisition. The current results suggest that while safety training generally enhances productivity

and confidence, its effectiveness may vary across different age demographics, highlighting the need for age-tailored safety education programs that address the specific needs and challenges faced by workers at various career stages in physically demanding industries.

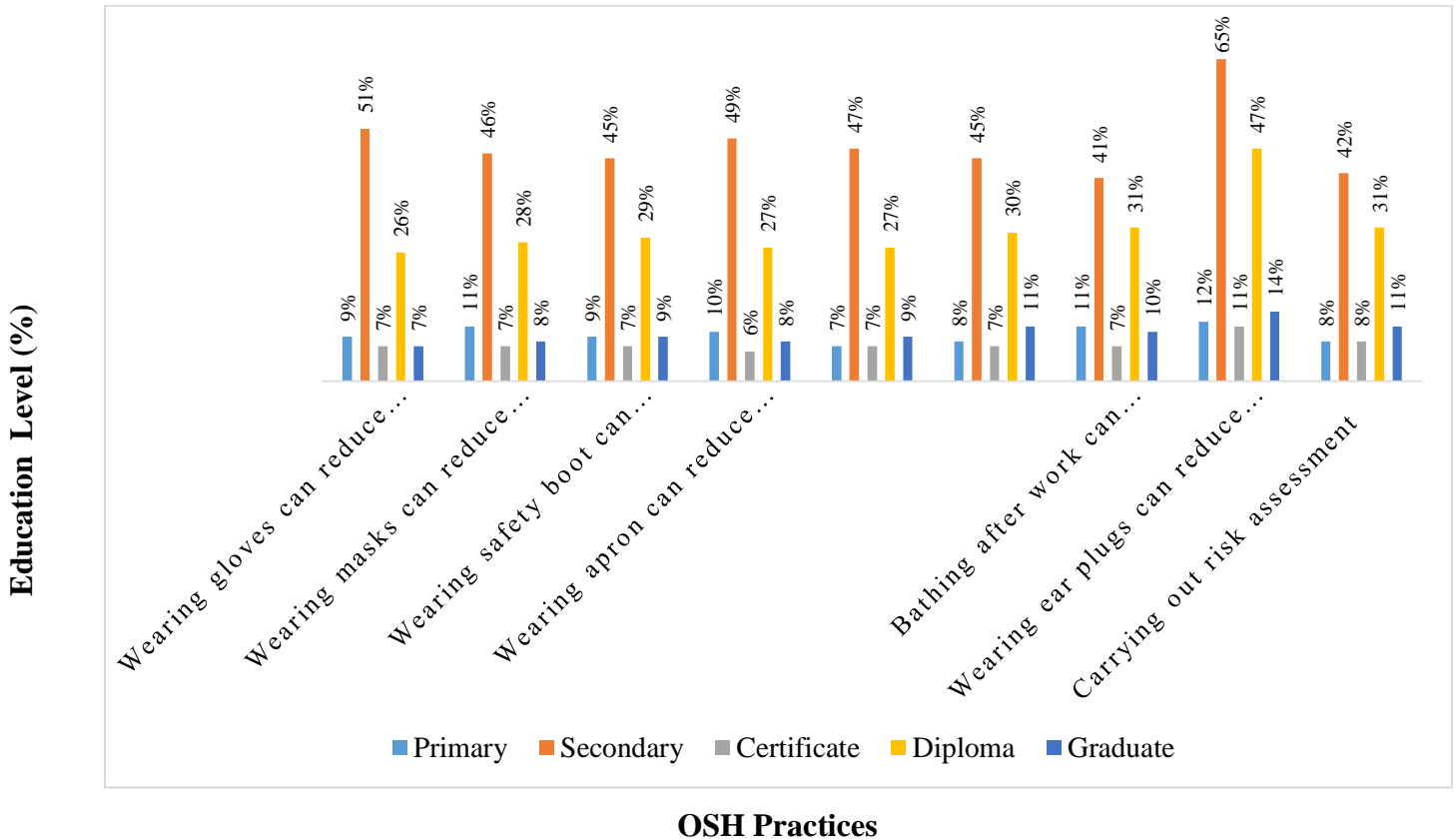


Figure 4.12: Knowledge on OSH practices and education level of respondents

The findings presented in Figure 4.12 reveal a significant correlation between educational attainment and occupational safety knowledge, with secondary-educated workers demonstrating substantially greater awareness of proper PPE protocols compared to other education levels. Specifically, this group exhibited strong comprehension across multiple safety measures: glove usage (51%), mask compliance (46%), safety boot utilization (45%), apron wearing (49%), post-work hygiene practices (41%), and ear plug application (65%). Given that most workers in the sector possess secondary education, their enhanced safety understanding positively influences overall occupational health standards within the industry.

Conversely, employees with only primary education displayed markedly lower safety knowledge (7-12%), potentially compromising workplace safety outcomes. These results

contrast with Aluoch's (2015) Kenyan power sector study, which identified systemic deficiencies in safety training implementation but did not examine how educational background might influence training effectiveness. The current findings highlight the critical role of formal education in establishing foundational safety knowledge, suggesting that workforce educational composition should be considered when designing and evaluating occupational health programs, particularly in industrial settings where proper PPE usage is essential for risk prevention.

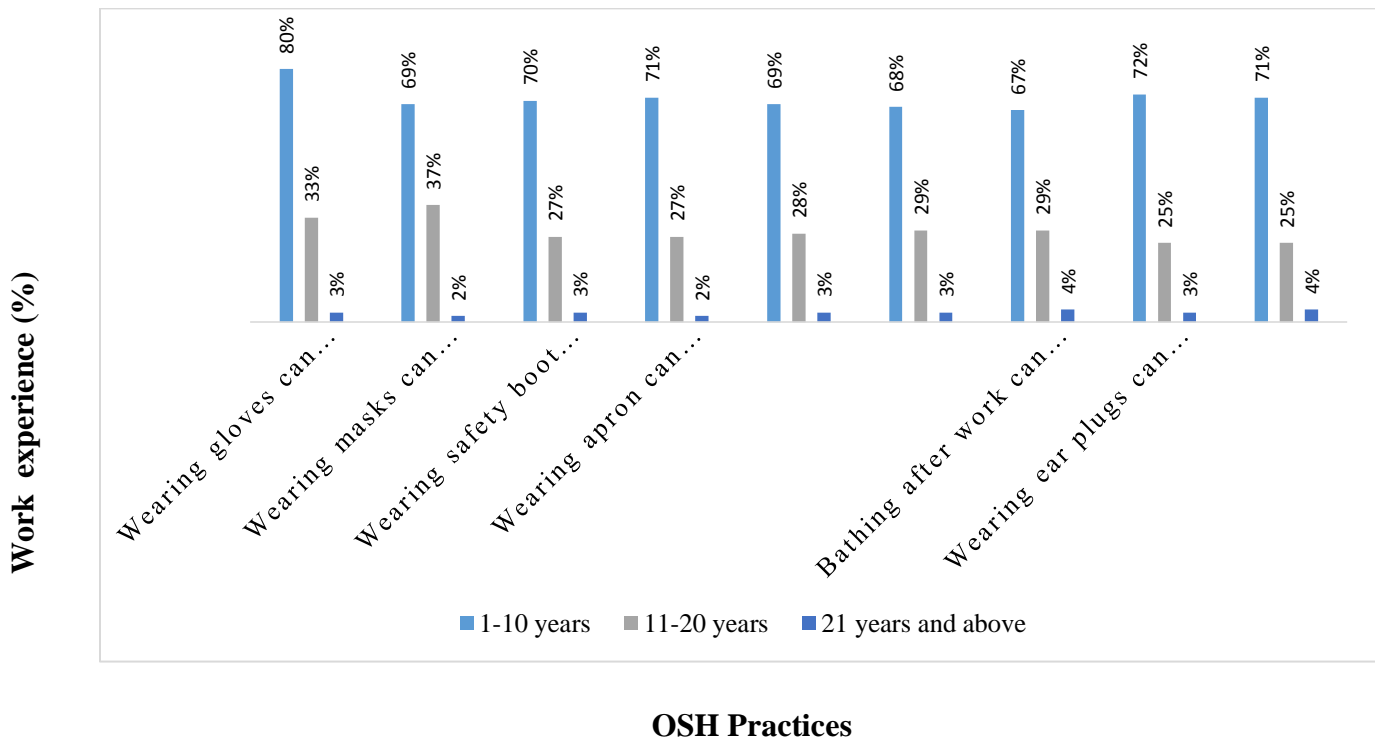


Figure 4.13: Knowledge on OSH practices in prevention of risks and work experience of respondents

The data in Figure 4.13 demonstrates a clear relationship between work experience and occupational safety knowledge, with employees having 1-10 years of experience showing substantially greater understanding of OSH practices compared to other groups. This cohort exhibited strong awareness across multiple safety measures, including glove usage (80%), mask compliance (69%), safety boot utilization (70%), apron wearing (71%), post-work hygiene (67%), and ear plug application (72%), indicating that early to mid-career workers maintain

optimal safety knowledge in this physically demanding sector. In contrast, workers with over 20 years of experience displayed significantly lower safety awareness, likely due to both the natural attrition of older employees from strenuous roles and the consequently smaller population of long-tenured workers remaining in these positions.

These findings complement Bayram's (2022) Turkish study which established a connection between safety knowledge and productivity in certified organizations, while extending the research by specifically examining how safety comprehension evolves throughout a worker's career. The current results highlight that safety proficiency appears strongest during the first decade of employment, suggesting organizations should focus on knowledge preservation strategies for long-serving employees while capitalizing on the safety leadership potential of mid-career workers to maintain consistent safety standards across all experience levels.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this chapter is to summarise, conclude and make necessary recommendations to the relevant stake holders particularly the Ministry of Labour of the Kenya Government, the Directorate of Occupational Safety and Health Services, the Ministry of Education and the vehicle body building companies. Motor vehicle body manufacturing industry is fast growing in Kenya due to the increase in transport of goods and passengers. The study assessed occupational safety and health in the vehicle body manufacturing Nairobi City County, Kenya. Various types of occupational hazards peculiar to the work places, knowledge, attitudes, practices, factors that contribute to non-compliance and affect the implementation of occupational safety and health regulations.

5.2 Summary

The study sought to contribute to knowledge and understanding of occupational safety and health trends in the vehicle body manufacturing industry. The identified hazards were physical, chemical, biological, chemical, mechanical and psychosocial. The workers had reasonable understanding of the hazards with the exception of the psychosocial which was low due to its salient nature. Control measures put in place were fair and use of PPE was found to be in adequate. The main factors affecting occupational safety and health practices were low level of training that contributed to poor awareness, experience of the workers, technical and vocational training. The work places did not have occupational safety and health policy displayed at main areas and the safety signage and notices were scanty. Compliances to occupational and safety regulations was low as this is affected quality of quality PPE, cost of safe modern equipment and machinery. Supervision on the implementation and enforcement of the regulations was poor affected by inadequate capacity of the government agency DOSHS. Suggestions to overcoming the obstacles includes of adequate PPE, comprehensive regular training of staff of occupational safety and health, enhanced supervision and investment on new technology and equipment.

5.3 Conclusions

The occupational safety and health hazard identified included the physical hazards found were arc welding glare that causes harm to the eyes and high level of noise that emanates from the grinding and cutting machines. Additionally, the noted physical hazards include fallen objects on the pathways that could cause trips and falls as well as oil spillage that could lead to slips and falls. The chemical hazards were observed to be due to paint, solvents, thinners and volatile substances that are used in preparing the vehicle bodies for spray painting. Electrical hazards were observed to be associated with hand powered tools that are electrically operated such as arc welding machines, drilling machines, cutting machines and grinders. The underlying hazard is attributed to faulty machines, loose wires and open wires that may cause short circuit and injury to the operator. The mechanical hazards as observed came from the machines used for cutting, shearing, bending of metals, rotating belts, and milling machines that could easily cause injury if not properly guarded. Also identified were of psychosocial mainly stress and fatigue associated with work pressure and long working hours.

The study established that the workers are affected negatively by physical hazards that results in frequent hand injuries. Hand injuries were the most outstanding and this is attributed to manual operation of tools, equipment and machinery that requires exertion.

There were low levels of knowledge on hazards and their control measure among the management and staff in motor vehicle body manufacturing firms although workers took basic measures to prevent accident and injuries from occurring such as use of PPE. The knowledge and attitude of the workers was poor as reflected in the low reporting of accidents and incidents at the workplace. The attitude on occupational safety and health practices was poor although the respondents showed a positive attitude towards training and use of PPE.

The factors affecting occupational safety and health practices were found to be lack of adequate PPE and in cases where PPE were available they were insufficient to provide full protection to the workers. Education level and workers' experience also affected the occupational practices as well as lack of adequate training. The study noted that worker experience affected OSH practices negatively. This can be attributed to more experienced workers who tend to be complacent on adhering to safe work practices.

The study observed the factors that contribute negatively to the compliance of OSH regulations to be lack of PPE and where available were inadequate. There was insufficient information on OSH practices, safety signage, policies and regular relevant training.

5.4 Recommendations

The following recommendations are mainly to the Directorate of Occupational Safety and Health Services, vehicle body manufacturing companies' employers and employees for follow up and implementation.

5.4.1 Recommendation to Ministry of Labour, Department of Occupational Safety and Health Services

- i. Due to poor attitude and inadequate knowledge, arrangements need to be made for training and awareness on occupational safety and health tailored to suit vehicle body manufacturing industries in Kenya.
- ii. In order to enhance compliance to occupational safety and health regulations there is need to increase capacity of the DOSHS officers in order to enhance inspections, audit and enforcement.

5.4.2 Recommendation to Vehicle Body Manufacturing Companies

- i. In order to contribute to a positive attitude, it is recommended that work place occupational safety and health policy be developed and be displayed at strategic locations.
- ii. There is need to carry out a comprehensive training and retooling of experienced workers and to all members of management on occupational safety and health to enhance knowledge.
- iii. To ensure compliance to occupational safety and health regulations, it is imperative to put in place safety committee, workplace annual safety inspection, report on accidents and incidences, and carry out plant inspection and safety audits.
- iv. In order to improve the safety and health of the employees, it is suggested that companies invest in the acquisition of appropriate, suitable and adequate personal protective equipment.

5.5 Suggested Areas for Further Study

There is a need for further research as follows;

- i. Determine the levels of toxins in the air as a result of use of different paint materials that comprises different chemicals.
- ii. Since the study established noise as hazard, a further study that will measure the actual noise levels in decibels and compare this to the maximum allowable with recommendations.
- iii. Medical health surveillance of the staff to confirm if they have a condition that may have been caused by work activities in this industry.
- iv. To establish the cost of injuries and illnesses that result from hazards inherent in these work places.

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APPENDICES

Appendix I: Questionnaire for owners/managers

BUS BODY BUILDING WORKSHOP MANAGER/SUPERVISOR QUESTIONNAIRE ON OCCUPATIONAL SAFETY PRACTICES

Dear Respondent,

My name is Charles Abanga, a Post Graduate student at Egerton University Department of Environmental and Occupational Health. This questionnaire is for collecting data whose broad objective is to assess the ergonomics of among workers in bus body manufacturing firms situated in Nairobi's industrial area with the objective of recommending preventive interventions.

Information provided is used for the intended research only; confidentiality of information provided is guaranteed.

Please be assured that your responses will be treated with utmost confidentiality and you are free to withdraw from the interview if you opt to do so

A. SOCIO-DEMOGRAPHIC DATA

1. Age / Age range)_____
2. Sex
 - (1) Male
 - (2) Female
3. Marital status
 - (1) Single
 - (2) Married
 - (3) Divorced
 - (4) Widowed
 - (5) Other(specify)_____
4. What is the highest level of education attained? _____
(00= no formal education; 01= Primary; 02 = Secondary; 03=Certificate; 04=Diploma; 05=Graduate)
5. How long have you been working in bus manufacturing sector? (Total duration) _____
6. How many hours do you work in a day? _____
7. How many days do you work in a week? _____

8. How many employees do you have? _____
9. What is the gender distribution of your staff Male ---- Female _____
10. Apart from management are you also involved in active bus body construction work?
- 0 No
1. Yes
11. Activities involved in at work place

Activity	Yes	No
Soldering / welding		
Painting		
Cutting, splitting and grinding		
Manual lifting and carrying		
Casting and curing blocks		
Planning and jointing		
Sign writing		
Driving		
Electrician		
Panel beating		
Administration		

B. OSH Legislation

12. Please kindly list any OSH legislation, polices or regulations you are currently using in your workplace
- a) -----
- b) -----
- c) -----
- d) -----
- e) -----
- f) -----
- g) -----

13. Please list what you think are good standards of occupational safety and health

practices at your workplace

- a) -----
- b) -----
- c) -----
- d) -----
- e) -----
- f) -----
- g) -----
- h) -----

C. Identification and knowledge of workplace hazards

14. Do you think you are at risk of any safety and health hazards that can injure you at this work place?

- 0. No
- 1. Yes

15. If yes, what level of risk exposure do you perceive?

- 0. Low risk
- 1. Moderate risk
- 2. High risk

16. Please list 5 (five) Safety and health hazards in your workplace

- a) -----
- b) -----
- c) -----
- d) -----
- e) -----

17. Please list 5 (five) control measures for hazards in 14 mentioned above to make work place free from hazards

- a) -----
- b) -----
- c) -----
- d) -----

e) -----

18. In the last one year have your staff been involved in an accident at work
0. No
 1. Yes, Approximately how many times -----
 2. What kind of work activity were they performing.....?
19. Have your staff suffered any occupational work disease or suspected work related illness
0. No
 1. Yes
20. Which area was affected by the illness
1. Musculoskeletal
 2. Respiratory
 3. Skin
21. Were the staff affected by accident or occupational illness given off day
0. No
 1. Yes, How many days of sick off.....
22. In the last one year, approximately how much money did you spend due to staff occupational illness and accidents?
0. None
 1. Yes, Ksh.....
23. Where do you seek health services when affected at work
0. No where
 1. Recommended health facility within the workplace
 2. Government facility outside the workplace
 3. Private clinic
24. Have your staff ever had any workplace safety and health awareness/ training
0. No
 1. Yes, while at the current job
20. If yes? How many times in the year? =====

D. Attitudes /perception of occupational safety hazards management

.21. Have you ever adopted any OSH practices at your work place?

- 0. No
- 1. Yes

22. Do you agree that the following preventive measures are important in the mitigation of hazards? Please state on a scale of *1-5 by circling appropriate number on the scale below.

** 1= Strongly disagree 2= Disagree, 3= No opinion, 4= Agree, 5= Strongly agree*

Control measures	Response				
Training and awareness	1	2	3	4	5
Adequate/ appropriate use of PPE	1	2	3	4	5
Fire extinguishers	1	2	3	4	5
Hazard identification	1	2	3	4	5
Occupational safety measures	1	2	3	4	5
Good house keeping	1	2	3	4	5
Incident reporting and registering	1	2	3	4	5
Ensure adequate supervision	1	2	3	4	5
Carrying out risk assessment	1	2	3	4	5
Workplace insurance	1	2	3	4	5

24. For the following questions concerning the use of PPE in prevention of risks please state on the scale of *1-5 whether you;

**1= Strongly disagree 2= Disagree, 3= No opinion, 4= Agree, 5= Strongly agree*

PPE attitude question	Response				
Wearing gloves can reduce damage to your hands	1	2	3	4	5
Wearing masks can reduce damage to respiratory organs	1	2	3	4	5

Wearing safety boot can reduce damage to your feet	1	2	3	4	5
Wearing overall can reduce damage to your body	1	2	3	4	5
Wearing goggles can reduce damage to your eyes	1	2	3	4	5
Washing hands can reduce risks from chemicals	1	2	3	4	5
Bathing after work can reduce health risks	1	2	3	4	5
Wearing ear plugs can reduce damage to your ears	1	2	3	4	5
Wearing hard hat can reduce head injury	1	2	3	4	5

C. Occupational safety and health practices

25. Do you have any person in charge occupational safety and health at your workplace?

- 0. No
- 1. Yes
- 2. Doesn't know

26. Please kindly list any practices for managing safety and health at work? *(Please tick whichever is appropriate and prop for control measures*

OSH practices	Yes (1)	No (0)	Adequacy of the measures Good / Bad / None		
Ensure that all employees are trained in safety measures before work					
Ensure that PPE provided is used					
Ensure good house keeping					
Provision of welfare facilities					
Ensure that there are written polices at work place					
Ensure that operating procedures/ manuals are used					
Ensure that signage is pinned on walls					

Ensure that safety procedures/ Security systems are used					
Ensure that Fire extinguishers are available and checked					
Ensure that there is a perimeter fence around the workplace					
Ensure that incidents and unsafe procedures are reported					
Ensure that First Aid box is used					
Ensure that sanitary facilities are available at work place					
Ensure that risks are identified and mitigated(risk assessment)					
Ensure that annual audits are done					

E. Acceptance of occupational safety and health measures

27. For each of the following questions please indicate (comparative ranking of measures

**1= Never 2=Rarely, 3= Sometimes, 4= Often, 5= Always,*

Acceptance of OSH measures	Response				
Always use my PPE for my job	1	2	3	4	5
Always comply with safety practices at work	1	2	3	4	5
Always comply with hazard control measures at work	1	2	3	4	5
I always ask for OSH information					
Comply with reporting incidents and unsafe acts to my supervisor	1	2	3	4	5
I always comply with audit exercises	1	2	3	4	5

28. Indicate whether the following other welfare facilities/utilities are present or absent at the work place

Facilities/Utilities	Present		Absent(0)
	Adequate(2)	Inadequate(1)	
Drinking water			
Toilet/Latrine(25 per stance)			
Resting place(bench /chairs)			
First Aid Equipment			
Fire prevention/control equipment			
Waste disposal(domestic)			
Changing room /cloakroom			
Drainage of workplace			

29. Please indicate on the following questions whether you comply with the following questions in the table below; *1= *Never*, 2= *Rarely*, 3= *Sometimes*, 4= *Often* 5= *Always*,

Acceptance question	1	2	3	4	5
Comply with safety measures at work	1	2	3	4	5
Wear personal protective clothing / equipment	1	2	3	4	5
Report incidents to my superiors	1	2	3	4	5
Record all incidents in the register	1	2	3	4	5
Read all instructions before doing dangerous work	1	2	3	4	5
Avoid unsafe acts at work	1	2	3	4	5
Wash hands after work	1	2	3	4	5
Take special precautions while working with sharp objects / machines	1	2	3	4	5
Use materials hazards sheet / manuals	1	2	3	4	5
Adhere to safety instructions / rules	1	2	3	4	5
Keep the workplace clean and organised	1	2	3	4	5
Follow proper work procedures	1	2	3	4	5

30. What do you think are the main obstacles to safety and health in your work place? Rate

on a scale of *1-5 by circling appropriate number on the scale below

**1 = Not a problem, 2 = Minor problem, 3 = Moderate barrier, 4 = Serious barrier
5 =Very serious barrier*

Obstacles to compliance	1	2	3	4	5
Cost	1	2	3	4	5
Lack of information on safety and health	1	2	3	4	5
Priority to productivity and profits	1	2	3	4	5
Planning difficulties	1	2	3	4	5
Lack of government guidance and support	1	2	3	4	5
Others (specify)-----	1	2	3	4	5

31. What can you suggest as possible solutions to improving safety and health obstacles?
(Indicate its priority by circling the appropriate number based on the scale *1-5 below.

**1= Not a priority, 2 = Low priority, 3= Medium priority, 4= High priority, 5= Essential*

Workplace safety and health training	1	2	3	4	5
Provision of more PPE	1	2	3	4	5
Collaboration with government agencies and other stake holders	1	2	3	4	5
Upgrading equipment / technology	1	2	3	4	5
Vocational / technical training	1	2	3	4	5
Others (specify)-----	1	2	3	4	5

End

Appendix II: Employee questionnaires

ASSESSMENT OF THE OCCUPATIONAL SAFETY AND HEALTH STATUS IN BUS MANUFACTURING COMPANIES IN KENYA

Employee /Work place type and No-----

Dear Respondent.

My name is Charles Abanga, a Post Graduate student at Egerton University Department of Environmental and Occupational Health. This questionnaire is for collecting data whose broad objective is to assess the ergonomics of among workers in bus manufacturing firms situated in Nairobi's industrial area with the objective of recommending preventive interventions. Information provided is used for the intended research only; confidentiality of information provided is guaranteed.

Please be assured that your responses will be treated with utmost confidentiality and you are free to withdraw from the interview if you opt to do so.

A. SOCIO-DEMOGRAPHIC DATA

1. Age (age range) _____
2. Sex
 - (1) Male
 - (2) Female
3. Marital status
 - (1) Single
 - (2) Married
 - (3) Divorced
 - (4) Widowed
 - (5) Other(specify)_____
4. How many years did you spend at school?-_____
5. How long have you been working in bus manufacturing sector? (Total duration)_____ Months

- 6. How many hours do you work in a day? _____
- 7. How many days do you work in a week?_

B. Identification and knowledge of workplace hazards

- 8. Are there any safety and health hazards that can injure you at this work place?
 - 0. No
 - 1. Yes

9. Please list 5(five) safety and health hazards in your workplace

- a) -----
- b) -----
- c) -----
- d) -----

10. Please list 5(five) control measures for hazards in 10 mentioned above to make
Work place free from hazards

- a) -----
- b) -----
- c) -----
- d) -----
- e) -----

11. In the last one year have you been involved in an injury or accident at work

- 0. No
- 1. Yes, Approximately how many times -----

12. Which area of your body was affected?

13. Have you suffered any occupational work disease or suspected work related illness

- 0. No
- 1. Yes, what nature of illness or disease?

14. Did you get off duty from work due to the illness?
0. No
 1. Yes, How many days?
15. Where do you seek health services when affected at work?
0. No where
 1. Recommended health facility within the workplace
 2. Government facility outside the workplace
 3. Private clinic
16. How much money did your treatment take? Ksh.....
17. Have you ever had any workplace safety and health awareness/ training?
0. No
 1. Yes, while at the current job
 2. Yes not at the current job
18. Are you also exposed to any of the hazards listed below?
- | | | |
|--------------------------------------|--------|------|
| a) Extreme noise | 1. Yes | 2.No |
| b) Extreme radiation | 1. Yes | 2.No |
| c) Extreme heat | 1. Yes | 2.No |
| d) Body vibration | 1. Yes | 2.No |
| e) Heavy lifting | 1. Yes | 2.No |
| f) Exhaust Fumes | 1. Yes | 2.No |
| g). Weather extremes (cold/ hot sun) | 1. Yes | 2/No |
| h). Welding Glare (Strong Light) | 1. Yes | 2/No |

C. Attitude / perceptions of safety hazards and health risks

17. Do you think occupational health risks and safety hazards need attention of Employers and government?
0. No
 1. Yes
 2. Doesn't know

18. If yes why do you think so?

- a) -----
- b) -----
- c) -----
- d) -----
- e) -----

19. Do you agree that the following preventive measures are important in the mitigation of hazards? Please state on a scale of *1-5 by circling appropriate number on the scale below

**1= Strongly disagree 2= Disagree, 3= No response, 4= Agree, 5= Strongly agree*

Mitigation measure	Response				
Training and awareness	1	2	3	4	5
Adequate/ appropriate use of PPE	1	2	3	4	5
Fire extinguishers	1	2	3	4	5
Hazard identification	1	2	3	4	5
Occupational safety measures	1	2	3	4	5
Good house keeping	1	2	3	4	5
Incident reporting and registering	1	2	3	4	5
Ensure adequate supervision	1	2	3	4	5
Carrying out risk assessment	1	2	3	4	5

20. For the following questions concerning the use of PPE in prevention of risks please state on the scale of 1-5 whether you

**1= Strongly disagree 2= Disagree, 3= No opinion, 4= Agree, 5= Strongly agree*

Attitude question	Response				
Wearing gloves can reduce damage to your hands	1	2	3	4	5
Wearing masks can reduce damage to respiratory organs	1	2	3	4	5

Wearing safety boot can reduce damage to your feet	1	2	3	4	5
Wearing apron can reduce damage to your body	1	2	3	4	5
Wearing goggles can reduce damage to your eyes	1	2	3	4	5
Wash hand can reduce risks from chemicals	1	2	3	4	5
Bathing after work can reduce damage to health risks	1	2	3	4	5
Wearing ear plugs can reduce damage to your ears	1	2	3	4	5
Carrying out risk assessment	1	2	3	4	5

F. Occupational safety and health practices

25. Have you ever adopted any OSH practices at your work place

0. No

1. Yes

22. Please kindly list any practices for managing safety and health at work? (*Tick whichever is appropriate*)

OSH practices	Yes (1)	No (0)	Adequacy; 1. Good/ 2. Bad/ 3. None			
Training on safety measures						
Use of PPE provided						
Good House keeping						
Provision of welfare facilities						
Written polices						
Operating procedures/ manuals						
Use of safety procedures/ Security systems						
Fire extinguishers						
Perimeter fencing						
Reporting any unsafe procedure /act						
Use of First Aid box						
OSH audits						

E Acceptance of occupational safety and health measures

22. For each of the following questions please indicate whether you comply with the statements below on a scale of *1-5; *1. *Never* 2. *Rarely*, 3. *Often*, 4. *Sometimes*, 5 *Always*,

Acceptance of OSH measures	Response				
	1	2	3	4	5
PPE for my job is always available	1	2	3	4	5
Always comply with safety practices at work	1	2	3	4	5
Always comply with hazard control measures at work	1	2	3	4	5
I always ask for OSH information	1	2	3	4	5
Always comply with reporting incidents and unsafe acts to my supervisor	1	2	3	4	5

23. Indicate whether the following other welfare facilities/utilities are present or absent at the work place

Facilities/Utilities	Present		Absent(0)
	Adequate(2)	Inadequate(1)	
Drinking water			
Toilet/Latrine (25 people/ stance)			
Resting place (seats at workplace)			
First Aid Equipment/box			
Fire prevention/control equipment			
Waste disposal (domestic)			
Changing /cloakroom			
Drainage of workplace			

24. Please indicate on the following questions whether you comply with the following questions in the table below on a scale of *1-5;

**1.Never 2.Rarely, 3. Often, 4.Sometimes, 5 Always,*

Compliance question	Compliance		Non-compliance		
	1	2	3	4	5
Comply with safety measures at work	1	2	3	4	5
Wear personal protective clothing / equipment	1	2	3	4	5
Report incidents to my superiors	1	2	3	4	5
Record all incidents in the register	1	2	3	4	5
Read all instructions before doing dangerous work	1	2	3	4	5
Avoid unsafe acts at work	1	2	3	4	5
Wash hands after work	1	2	3	4	5
Take special precautions while working with sharp objects / machines	1	2	3	4	5
Use materials hazards sheet / manuals	1	2	3	4	5
Adhere to safety instructions / rules	1	2	3	4	5
Follow proper work procedures	1	2	3	4	5

25. What do you think are the main obstacles to safety and health in your work place? Rate on a scale of *1-5 by circling appropriate number below;

**1 = Not a problem, 2 = Minor barrier, 3 = Moderate barrier, 4 = Serious barrier*

5 = Very serious barrier

Cost	1	2	3	4	5
Lack of information on safety and health	1	2	3	4	5
Priority to productivity and profits	1	2	3	4	5
Planning difficulties	1	2	3	4	5
Lack of government guidance and support	1	2	3	4	5
Others (specify)-----	1	2	3	4	5

26. What can you suggest as possible solutions to improving safety and health obstacles?

(Indicate its priority by circling the appropriate number based on the scale *1-5 below.

**1= Not a priority, 2 = Low priority, 3= Medium priority, 4= High priority, 5= Essential*

Workplace safety and health training	1	2	3	4	5
Provision of more PPE	1	2	3	4	5
Collaboration with government agencies and other stakeholders	1	2	3	4	5
Upgrading equipment / technology	1	2	3	4	5
Vocational / technical training	1	2	3	4	5
Others (specify)-----	1	2	3	4	5

End

Appendix III: ILO workplace hazard identification check list

ASSESSMENT OF THE OCCUPATIONAL SAFETY AND HEALTH STATUS IN BUS MANUFACTURING COMPANIES IN KENYA

ILO Workplace hazard Identification Check list

Workplace number----

Location and type -----

[A] Working Premises /space

Yes	No	N/A	Remarks
-----	----	-----	---------

- | | | | |
|---|--------------------------|--------------------------|--------------------------------|
| 1. Type of work environment | | | |
| a) Open | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| b) Closed | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| c) Partially closed | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| d) Premises fenced/ enclosed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 2. Are the following kept clean and free from waste | | | |
| a) Work station? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| b) Floors surrounding the workstation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| c) Passages surrounding the workstation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| d) Stairways giving access to the workstation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| e) Waste containers regularly | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| f) General environment? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 3. Are floors and passages dry and in good repair? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 4. Are floors free from obstruction? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 5. Appropriate roof used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 6. Appropriate walls used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 7. Are exits including emergency exits free from
obstruction, properly marked and unblocked? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 8. Are electric lights and fittings in good working order | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 9. Are there any adequate sanitary facilities (25 people stance)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 10. Are there any resting facilities at the work place (Bench/chairs)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 11 Is there running water on the premises? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |

[B] Type of activity

- | | | | |
|------------------------------------|--------------------------|--------------------------|--------------------------------|
| 12. a) Soldering and welding | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| b) Painting | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| c) Cutting, splitting and grinding | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| d) Manual lifting and carrying | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| e) Planning and jointing | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| f) Sign writing | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| g) Panel beating | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| h) Electrician | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| i) Administration | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |

[C] Fire precautions

- | | | | |
|---|--------------------------|--------------------------|--------------------------------|
| 13. Are the routes and exits kept free from obstruction? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 14. Are fire extinguishers available and serviced regularly | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |

[D] Workplace hazards

Control Measures

- | | | | |
|--|--------------------------|--------------------------|--------------------------------|
| 15. Extreme heat at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 16. Extreme weather conditions at the Workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 16. Extreme noise at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 17. Excessive optical radiation at the workplace | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 18. Unsuitable lighting at the work place? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 19. Inadequate ventilation at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 20. Body vibration at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 21. Floors slippery at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 22. Metals used at the workplace | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 23. Solvents used at the work place? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 24. Chemicals / paints used at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 25. Dust generated at the workplace? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |
| 26. Gases generated at the workplace | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> ----- |

- 27. Heavy lifting/ carrying at the workplace? []-----
- 28. Workplace a confined space? []-----
- 29. Any repetitive movements at the workplace? []-----
- 30. Working in uncomfortable postures []-----
- 31. Mechanical and sharp parts/ edges []-----
- 32. Insects, viruses, bacteria, []-----

[E] Safety of Machinery

- 33. Eye protection being used? []-----
- 34. Instructions displayed on the machinery? []-----
- 35. Employees using PPE at the workplace? []-----
- 36. Exhaust systems effectively removing the dust/ fumes []-----
- 37. Guards mounted on the machines? []-----
- 38. Tools used clean and sharp? []-----
- 39. Carried in suitable containers? []-----

[F] Availability and use PPE /Clothing

- 40. Overalls? []-----
- 41. Safety boots? []-----
- 42. Hard hat? []-----
- 43. Nose masks? []-----
- 44. Ear plugs ? []-----
- 45. Hand gloves? []-----
- 46. Eye glasses? []-----
- 47. Fire safety equipment? []-----
- 48. First Aid? []-----

[G] Legislation

- 49. Does the workplace possess the OSH policy? []-----
- 50. Does the work place has OSH regulations []-----

51. Machines have certificates of inspection? -----

[H]Existing management practices at work

52. Provision and use of PPE ? -----

53. Risk assessment -----

54. Use Signage? -----

55. Good housekeeping? -----

56. Provision of welfare facilities? -----

57. Written messages pinned on walls? -----

58 Security systems? -----

59. Safety and health induction / training / awareness -----

60. Safety and health audits -----

Appendix IV:Sector Activities in the Study Area

Plate 1: Vehicle body manufacturing sector activities in Nairobi



2.



Source: Field photos by the researcher

3.



Plate 1, 2, and 3 vehicles spray painting in the manufacturing industry.

Plate 4: below shows metal cutting by a craftsman in the vehicle body fabrication.



Plate 4: Metal cutting using the gas welding tool

Plate 5: below shows bus upholstery material preparation in the manufacturing industry and in the background is a new bus chassis frame.



Plate 6: below shows cutting of heavy metals in the industry



Plate 6: Metal cutting machine in preparation for vehicle body fabrication

Plate 7: below shows a technician drilling points for mounting vehicle body in industry



Plate 8: below shows fitting bus windscreen during body manufacturing



Plate 8: Installation of vehicle windscreen

Plate 9: below shows grinding of metals pieces in the process of body fabrication



Plate 9: Grinding metal parts before assembly in industry.

Plate10: below shows the framing section in bus body manufacturing



Plate 10: Vehicle bodies fitted with frames awaiting panel fitting

Plate 11: below shows the metal cutting and bending machines used in the industry




Plate10: Machines used for metal cutting and bending

Appendix V: Research Permit from National Commission for Science, technology and Innovation

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Determinants of Compliance with Occupational and Safety Regulations in the Vehicle Body Manufacturing Industry in Kenya

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How to cite this paper: Abanga, C., Moturi, W. and Makindi, S. (2023) Determinants of Compliance with Occupational and Safety Regulations in the Vehicle Body Manufacturing Industry in Kenya. *Open Access Library Journal*, **10**, e9912.

<https://doi.org/10.4236/oalib.1109912>

Received: February 23, 2023

Accepted: April 25, 2023

Published: April 28, 2023

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Abstract

The vehicle body manufacturing industry plays an important role in Kenya economic development because the majority of buses are supplied in chassis frame form and the bodies are manufactured in this sector locally. However, this particular sector is faced with occupational safety and health hazards without preventive measures. Therefore, the purpose of this paper is to identify the socioeconomic and work-related factors influencing compliance with occupational and safety regulations (OSR) in the vehicle body manufacturing industry in Nairobi City, Kenya. A cross-sectional survey design was adopted with qualitative and quantitative data collected using a structured questionnaire from 260 firms. Descriptive, inferential and binomial logistic regression analysis was used to analyze the data. The results showed that compliance with occupational and safety regulations was positively influenced by sex, education level, presence of a hazard, involvement in accidents and availability of prevention measures. However, compliance with OSR was negatively influenced by employment experience. The empirical results will be useful for employers, employees and policymakers in developing efficient capacity building models that incorporate occupational safety and health, awareness, supervision, training, inspection and verifications to improve the overall occupational safety and health situation of workers in the vehicle body manufacturing industry in Kenya.



Knowledge, attitudes and perceptions of workers on safety hazards and health risks in vehicle body manufacturing companies in Nairobi County, Kenya

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DOI: <https://dx.doi.org/10.47772/IJRISS.2023.7678>

Received: 28 April 2023; Revised: 24 May 2023; Accepted: 30 May 2023; Published: 09 July 2023

ABSTRACT

The manufacturing of vehicle bodies in Nairobi County, Kenya, exposes workers to a number of safety and health risks. For the purpose of creating efficient safety and health programs, it is essential to comprehend the knowledge, attitudes, and perceptions of employees about these hazards. Therefore, this paper intended to investigate the knowledge, attitudes, and perceptions of employees regarding health and safety hazards in Nairobi County, Kenya where majority of vehicle body manufacturing companies are situated. A structured questionnaire was used to obtain qualitative and quantitative data from 260 firms using a cross-sectional survey approach. The data was analyzed using descriptive and inferential statistics. The results showed that the knowledge, attitudes and perception of workers on safety hazards and risks in the vehicle body manufacturing companies was highly affected and dependent on the need for occupational health risks and safety hazards being reported to the administration. Within this, majority respondents argued that improved personnel management would be essential in improving knowledge, attitudes and perception of workers on the OSH. The results will provide insight into the level of workers' awareness of health and safety problems, their attitudes toward safety precautions, and their opinions of how effective current safety programs are. These findings will help to establish targeted safety measures and policies that will lessen the impact of health and safety concerns on workers in Nairobi County, Kenya's vehicle body manufacturing sector.

Keywords: Knowledge, Attitudes, Perception, Vehicle Body Manufacturing