OCCUPATION-RELATED HEALTH CHALLENGES OF WELDERS AND WOOD WORK ARTISANS IN IMO STATE, NIGERIA

BY

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CERTIFICATION

This is to certify that this work **"Occupation-Related Health Challenges of Welders and Wood Work Artisans in Imo State, Nigeria"** was carried out by Agwah, Eunice Ifeyinwa, Reg. No. (20174082728) in partial fulfillment of the requirements for the award of the degree of Ph.D in Public Health (Environmental Health and Safety Option) in the Department of Public Health of the Federal University of Technology, Owerri.

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DEDICATION

I dedicate this work to my beloved parents of blessed memory, Chief Levi and Mrs Joy Agubesi, whose inspiration led me thus far.

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ABSTRACT

Artisans constitute a substantial proportion of the nation's labour force, but they are vulnerable to occupation-related health challenges. A descriptive cross-sectional study was conducted from October, 2022 to April, 2023 in Okigwe, Orlu and Owerri, Imo State, which aimed at assessing health challenges of welders and wood work artisans. A total of four hundred (400) artisans, comprising one hundred and eight-four (184) welders and two hundred and sixteen (216) wood workers participated in this study. Their selection was via multi-stage stratified random sampling technique based on informed consent, with all the ethical requirements obtained. Validated questionnaire, physical examination tools and workplace air quality assessment tools were used for data collection. Ocular, respiratory, hearing, skin, musculoskeletal and blood pressure work-related health conditions were assessed. Data collected were analyzed using chi square, t-test and logistic regression method. Results obtained showed prevalence of ocular (welders: 74.5%; woodworkers: 71.8%), respiratory (welders: 57.1%; woodworkers: 70.4%), hearing (welders: 46.5%; woodworkers: 50.5%), skin (welders: 57.6%; woodworkers: 70.4%), musculoskeletal (welders: 85.3%; woodworkers: 89.4%) and blood pressure (welders 39.7%; woodworkers 40.2%). Commonly reported ocular symptoms included itching and tearing, while respiratory symptoms were chest pain and cough. Hearing symptoms were ear heaviness and humming sensation, while skin symptoms included irritation and itching. Musculoskeletal symptom was waist pain, while arterial pressure symptom was headache. The most prevalent ocular problems detected included conjunctivitis (139: 34.8%) and arc eye (60: 15.0%), with wood workers at increased risk of conjunctivitis (109, 50.5%), and welders at higher risk of arc eye (60, 32.6%). The mean peak expiratory flow rates were 396.2±47.3l/min (for welders) and 385.1±52.4l/min (for woodworkers), indicating a decline in lung function of both artisans, with wood workers at more risk. Most artisans had hearing problems (welders: 105, 57.1%; wood workers: 123, 56.9%), with welders at higher risk. Coarse and scaly palms were the most prevalent skin problems, with welders at more risk of coarse palms (welders; 60, 32.6%), and woodworkers at higher risk of scaly palms (woodworkers: 50, 29.2%). Greater proportion of artisans had musculoskeletal issues (welders: 157, 85.3%; woodworkers: 190, 88.0%), with wood worker at more risk. Substantial proportion of both artisans were hypertensive (welders: 73, 39.7%; wood workers: 88, 40.7%), with wood workers at higher risk. Significant difference existed between welders and woodworkers in their respective ocular (P=0.0001, likelihood ratio=160.3); respiratory (difference in mean PEFR, P=0.027, t=2.224); and skin health conditions (P=0.0001, chi q=169.23). No significant difference was found between welders and wood artisans in their respective hearing (P=0.981, chi sq=0.006); musculoskeletal (P=0.438, chi Sq=0.601) and arterial pressure health conditions (P=0.828, chi sq=0.042). Work-related hazards encountered by artisans included physical hazards of noise (welders: 181, 98.4%) and wood particles (wood workers: 208, 96.3%); chemical hazards of metal fumes (welders: 119, 64.7%) and wood dust (woodworkers: 198, 91.7%); ergonomic hazards of manual lifting of objects (welders: 144, 78.3%; wood workers: 130, 60.2%); biological hazard of insect bite (welders (102, 55.4%; wood workers: 132, 61.1%); and psycho-social hazard of stress (welders: 144, 78.3%; woodworkers: 130, 60.2%). Air quality assessment in artisans' workplace showed significant mean values far above the WHO tolerable limits for parameters measured. Age, years at work and daily income were found to be significantly associated with occurrence of health challenges. Increased sensitization and education towards health protection as well as provision of functional occupational safety and health services were therefore recommended for this economically viable category of artisans to safeguard their health.

Key words: Occupation, Health challenges, Welders, Woodworkers, Artisans

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The state of one's health affects his overall performance in the environment where he works, lives and in the greater society. Good health, a positive concept and resource for everyday-living, encompasses social and physical capabilities. It is one's real wealth, in that without it, an individual cannot perform to his maximum potential. Work is an essential part of everyday living and a sine qua non for one's survival, his family and the greater society (Svalastog et al., 2017). A healthy worker is energetic, active and performs optimally in his respective occupation. Work and health are inseparably linked and each affects the other maximally (Gupta and Kaur. 2019; Buijs et al., 2012). Good health leads to positive work effects, while unhealthy work conditions result in work-related health challenges with their consequences to the affected worker, his family, enterprise and the greater society (WHO/ILO, 2017).

Occupational health care deals with all aspects of health and safety at workplace, with primary aim of preventing work-related hazards and health disabilities and has a positive economic impact both on individual, enterprise and the society at large. According to the World Health Organisation (WHO), there are many workplace risk factors that can lead to occupational health challenges (Gupta et al., 2019). These risk factors are often higher in unorganized sector and small-scale industries whose activities falls outside the purview of governmental regulations (Afolabi et al., 2021).

Craft-workers, workmen and tradesmen who produce objects partly and/or entirely with hands, and at times make use of tools, constitute the substantial proportion of the nation's labour force,

but they are particularly vulnerable to work-related health problems (Balogun et al., 2016). This category of workers include artisans in welding and wood enterprises. Their occupational health challenges are often due to exposures to hazardous work environment, precarious working conditions and unsafe work practices/habits (Afolabi et al., 2021; Nduka et al., 2019). Hazards of physical, chemical, psycho-social, ergonomic and organizational factors are common with artisans in low and middle-income countries of the world including Nigeria and have resulted in increased rates of work-related accidents, injuries, diseases and even death (Wu et al., 2018; Hamalanein et al., 2017). These health issues often exert profound effects not only on artisans' health and productivity, but on their socio-economic well-being and that of their families (Adei et al., 2021; Appiah, 2019; Wang et al., 2018).

Occupational health challenges among artisans is a public health issue, yet an under-exposed problem particularly in the developing countries of the world. They contribute to a substantial disease burden and economic loss of about 4 – 6% Gross Domestic Product for most countries of the world (WHO/ILO, 2017). In Nigeria, welders and wood artisans form the substantial proportion of the labour force, but there is little or no occupational services involving social protection, health care and regulatory enforcement for occupation health and safety standard for them (Hamilton, 2020; Balogun et al., 2016). Majority of them perform their activities for long hours (>8hours) with obsolete tools and machines, without adequate personal protective equipment due to poor finances and difficulties in obtaining credit facilities, and are therefore highly exposed to risks of work-related health challenges (Afolabi et al., 2021; Ojo et al., 2020). Interaction between work hazards and their poor living conditions often aggravate their health problems, making them at increased risk of occupational morbidity and mortality (Johnson and Bassey, 2016; Oranusi et al., 2014, Rockefeller, 2013). Work-related health

disorders such as chronic obstructive pulmonary (respiratory) disorders, musculoskeletal disorders, noise-induced hearing loss, eye problems and skin problems are the most common occupational health disorders among artisans (Wanjari and Wankhede, 2020; Moug et al., 2018; Agu et al., 2016).

International Labour Organisation (ILO, 2019), reported 340 million cases of occupational accidents and 160 million yearly occurrences of work-related illnesses globally. According to ILO, a total of 2.3 million deaths occur annually due to work-related diseases, while 6,300 workers die as a result of occupational accidents. One worker dies every 15 minutes, while 153 workers are involved in work-related accidents every 15 minutes world over. Available data from low-and middle-income countries (LMICs) though scanty and of varying quality, show increased incidences of work-related morbidity than in high-income countries of the world (Adei et al., 2021; Wu et al., 2018).

Numerous studies have been carried out to ascertain health problems of artisans in different parts of the world (Afolabi et al., 2021; Gupta et al., 2019; Balogun, 2016). Findings from these studies point towards increased prevalence of health problems. But of these studies, only few have been carried out in the eastern part of Nigeria, hence this study to ascertain the occupation-related health challenges of artisans in Imo State. Findings from this study will not only serve as screening for work-related health challenges of artisans, but will provide baseline data for diagnosis of these health issues, that will lead to provision of occupational health care services for artisans in Nigeria.

1.2 Problem Statement

Increased prevalence of work-related morbidity and mortality among artisans have become a global public health issue, yet an under-exposed problem particularly in the developing countries of the world, including Nigeria.

In Nigeria, artisans constitute the majority (90%) of the labour force, contribute immensely to the nation's Gross Domestic Product (GDP), but they are particularly vulnerable to occupational health challenges (Afolabi et al., 2021; Balogun et al., 2016). They perform their activities under unhealthy work environment, precarious working conditions, practices and habits without adequate consideration to work safety (Appiah, 2019; Johnson and Motilewa, 2016). Majority of them have no training about their work, while the rest learn from their job experience. Occupational health care services, and resources to implement health and safety measures are often scarce among artisans in Nigeria. Majority of them are unable to obtain loan because their activities fall outside the purview of governmental regulations. Homes of some artisans, double as their workplaces thus increasing their propensity towards increased health challenges (Itiakorit et al., 2021).

Up-to-date Occupational Health and Safety databank is scanty in Nigeria, but for 2014 and 2016 ILO records which showed 3,461 occupational accidents and injuries, 311 disabilities and 238 fatalities for the same period. These health issues are huge and gulp 4 - 6% of the nation's Gross Domestic Product, yet are under-estimated globally particularly in Nigeria ((WHO/ILO, 2017).

Reliable national data on occupational health challenges of artisans are few and of varied quality in Nigeria. Therefore, findings from this study will add to available data, form the basis for more predictive studies on artisans' occupational health issues, as well as aid the

development of effective intervention strategies for the prevention of occupational health challenges of artisans in Nigeria.

1.3 Objectives of the Study

The main Objective of the Study was to assess the occupation-related health challenges of welders and wood work artisan in Imo State.

The specific objectives include the following:

i. To assess the prevalence of occupation-related health challenges among welders and wood work artisans in Imo State
ii. To ascertain the occupational hazards exposures among welders and wood artisans in Imo State
iii. To determine the workplace environment air pollution among welders and wood work artisans in Imo State
iv. To identify the level of awareness of occupation-related heath challenges among welders and wood work artisans in Imo State
v. To evaluate the level of adherence towards occupational safety and health protection among welders and wood work artisans in Imo State
vi. To verify the relationship between socio-demographic factors and occurrence of occupation-related health challenges among welders and wood work artisans in Imo State.
vii. To ascertain the category of artisan at increased risk of occupation-related health challenges among welders and wood work artisans in Imo State.

1.4 Research Hypotheses

$H_{O:}$ There is no prevalence of occupation-related health challenges among welders and wood work artisans in Imo State.

$H_{O:}$ Welders and wood work artisans do not encounter occupational hazards in Imo State.

$H_{O:}$ There is no significant workplace environment air pollution among welders and wood work artisans in Imo State.

$H_{O:}$ There is no significant influence of awareness on occurrence of occupation-related health challenges among welders and wood work work artisans in Imo State.

There is no significant adherence towards safety and health protection practices among welders and wood work artisans in Imo State.

$H_{O:}$ There is no significant relationship between socio-demographic factors and occurrence of occupation-related health challenges among welders and woodwork artisans in Imo State.

$H_{O:}$ There is no category of artisan at increased risk of occupation-related health challenges among welders and wood work artisans in Imo State.

1.5 Justification of Study

The safety and health of workers in all occupations is the primary concern of occupational health services, which is aimed at preventing occupation-related hazards and health challenges among workers. This study which was aimed at assessing the occupation-related health challenges of artisans will firstly provide enormous data to researchers, government and other health stakeholders equipping them for proactive intervention strategies that will benefit artisans.

The study will also sensitize artisans on the health challenges and hazards obtainable in their respective occupations. Findings from the study will not only create awareness, but educate

artisans on the need for health protection, with emphasis on occupational health and safety practices such as medical checks, safety training and use of appropriate protective measures during their work activities.

Findings from the study will update the national data on occupational health challenges of artisans which has been scanty and of varying quality in Nigeria.

The study will as well add to available data, form the basis on which more predictive studies on artisans' health status can be done. It will also aid the development of effective intervention strategies for the prevention of occupational health challenges of artisans in Nigeria.

The study will further enrich existing literature on occupational hazards and resultant health challenges, specifically hazards and health challenges associated with artisanal activities and their preventive measures.

It will also provide useful information and guide in diagnosis, treatment and management of occupational health challenges of artisans. Findings from the study will serve as tool of advocacy to government towards the development of occupational health services for artisans in Nigeria.

1.6 Scope of Study

The general purpose of this study was to assess the occupation-related health challenges among welders and wood work artisans, aged 18 years and above, who have lived in Imo State for not less than two years, and have been actively involved in their respective artisanal activities. The study was focused on artisans of both sexes drawn from two (2) selected artisan categories of welders (automobile and arc welders) and wood workers (saw millers, wood carvers and carpenters/furniture makers). The independent variable was assessment, while dependent variable was occupation-related health challenges. The research design is descriptive cross-

sectional. The choice of this design is due to its timely provision of results without drop-out of participants, measurement of health outcome and exposure at the same point in time, and usefulness in assessing health problems and needs of participants. The study lasted for a period of six (6) months.

CHAPTER TWO

LITERATURE REVIEW

This chapter dealt with divergent literature and works carried out by previous researchers which were related to the present study. It was done under the following headings:

- Conceptual Review
- Theoretical Framework
- Empirical Studies

2.1 Conceptual Framework

2.1.1 Concept of Health

Health is a complex multifaceted term that lack single definition. Several attempts have been made to define it by individuals, professionals and organizations. To some, "health is wealth"- in that without health, an individual or society cannot perform to its maximum potential. Health is therefore necessary for productivity and good living (Oleribe et al., 2018).

World Health Organization (WHO) gave the most established definition of health as "the state of complete physical, mental and social well-being of an individual and not merely an absence of disease or infirmity" (WHO, 1948).

Modern concepts recognize health as a holistic expression of wholeness of an individual including physical, mental, social and spiritual aspect as well. Health therefore is a relative state in which one is able to function well physically, mentally, socially and spiritually to express one's potentialities within his environment where he lives and work (Svalastog at al., 2017).

The word “health” as derived from an old English word “hale” means “wholeness” that is being whole and sound. Health is therefore a condition of being sound in body, mind or spirit; especially freedom from physical disease and pain (Oleribe et al., 2018).

Felman (2017) in his definition of good health, opined that health is a positive concept which emphasizes social and personal resources, as well as physical capacities, and that good health is a resource for everyday life. This means that health is a resource to support human’s function in the society, rather than the end in itself. A healthy lifestyle therefore provides the means to live a meaningful and purposeful life.

Researchers in the Lancet (2009) defined health as the ability of the body to adapt to new threats and infirmities. They based their definition on the idea that modern science has experienced significant strides in the awareness of diseases in the past few decades. And that with understanding of how diseases work and discoveries of new ways of slowing or stopping them, it has been acknowledged that absence of pathology may not be possible (Books, 2009).

Health is also defined as one of the fundamental human rights of every human being, a precondition for prosperity and quality of life indicator for measuring progress and the basis of steady economic growth (Masic, 2015).

Health is multifactorial. An individual is often affected by combination of factors which is determined by one’s circumstances and environment. To a great extent, factors such as where one lives, the state of one’s environment, genetics, income and educational level, his relationship with friends and family, all have substantial impacts on his health, whereas more commonly considered factors such as access and use of health care services often have less impact (WHO, 2017). These factors interact and these interactions may be health – promoting

or deleterious. Health of an individual is therefore a result of many interactions. Hereditary (genetics), environment, lifestyle, socio-economic conditions, health and family welfare services are the most important health determinants (Pescud et al., 2015).

2.1.2 Work and Health

Work is the pursuit of productivity in order to satisfy social and biological needs. It is referred to as an 'activity of some purpose' or in a more definite term as time apportioned to a job for which a person receives remuneration (Anderson, 1961). As stated by Braude, work is that which an individual does in order to survive (Braude, 1975). It is the way in which a person earns a living. A person's regular work or principal job activity with similar characteristics is referred to as occupation. Occupation therefore, is a set of jobs that are sufficiently similar in work performed (Reed et al., 2013).

Occupational health promotes and maintains the highest degree of physical, mental, and social well-being of workers in all occupations through prevention of departures from health, control of risks and adaptation of work to workers, and workers to their jobs (ILO/WHO, 1950). For optimal performance of workers in their various occupations, an interplay must exist between workers physical, mental, social, and psychological well-being and factors of work.

Health and work are interdependent. Working conditions exert profound effect on workers health, while health of workers is an important prerequisite for household income, productivity and economic development. Conducive work conditions provide social protection and status, personal development opportunities, protection from physical and psycho-social hazards as well as enhance social relationship and self-esteem leading to positive health effects. Unhealthy work environment results in work place accidents, injuries and illnesses with their great pains,

severe consequences to the affected workers, their families, enterprises and the greater society Economically, active people spend on an average about one third of their time at the workplace. (WHO/ILO, 2017).

Workplace environment consists of the total work surroundings, prevailing factors and conditions of work. It does not consist of adequate structures, systems and availability of hazard free equipment/tools only, but also human relations which affect workers' physical and psychological well-being (Amadi, 2022).

Basically, three interwoven factors affect workers in their various work environments. They are:

worker and physical, chemical and biological hazards; worker and machines of work; worker and other workers, Physical factors of heat, cold, humidity, radiation, light, noise, vibrations, working space, sanitary and hygienic facilities act either singly or in different combinations to affect the health of workers. Chemical agents of dusts, fumes and gases are also potential hazards to workers. Biological factors of virus, bacteria and parasitic agents often encountered by workers in their work environments, as well exert negative effects on workers health. Some of theses hazards cause acute injuries or illnesses, while others result in severe or chronic health effects on organs and systems of workers even years after their exposures (Park, 2015).

Increased use of machines due to emphasis on enhanced output and mass production, have heightened the ergonomic hazards of repetitive activities, fixed or awkward postures, manual lifting of heavy materials of work in industries. These, with poor installations, unguarded, protruding, moving parts and poor maintenance of the machines and lack of safety measures have led to massive turn out of accidents in workplaces (Afolabi et al., 2021). Prolonged/long

working hours has also been reported as the chief culprit for fatigue, backache, waist pain, diseases of the joint and muscles(musculoskeletal disorders) and decline in the efficiency of most workers (Balogun et al, 2016).

Relationship among workers on one hand, and those in authority over them on the other hand, go a long way to affect the psychological health of workers. Other factors of work type and rhythm, work stability, work condition, job satisfaction, leadership style, position in work hierarchy, job security, workers participation, communication, payment system, welfare conditions, degree of responsibility, trade union activities, incentives, work under stress and other precarious conditions act singly or in combination to increase workers propensity towards work-related morbidity (Amadi, 2022).

Domestic and work environment has close tie with each other. And both are complementary, making up the essential part of worker's life. Prolonged stress no matter the origin (either work or home), produces serious physical or mental symptoms which disturb the efficiency of workers. Some work incidences can be traced to domestic disturbances and vice versa. Workplace incidents though unintentional and undesired events, yet they occur from time to time, hampering completion of work activities and often lead to injuries and other health challenges. Most work-related incidents are preventable, if only adequate preventive/precautionary measures are observed (Adeoye et al., 2015).

Globally, more than 50% of workers engage in activities marked by non-existent of regulatory enforcement for occupational health and safety standards. As a result, occupational hazard exposures affect about 2.9 billion workers leading to diverse consequences according to the World Health Organization (WHO). In the developing countries, about 12.2 million people of

working age die from non-communicable diseases and injuries annually. Certain occupational risks, such as injuries, noise, carcinogenic agents, airborne particles and ergonomic risks account for a substantial part of the burden of chronic diseases. These include 37% of all musculoskeletal injuries, 16% of hearing loss, 13% of chronic obstructive pulmonary disease, 11% of asthma, 9% of lung cancer, and 8% of injuries, 2% of leukaemia and 8% of depression (WHO, 2017).

World over, work-related accidents, injuries and diseases have continued to increase especially in developing countries, due to little or lack of attention given to work-related health issues (Adei et al., 2021). Report has it that about 268 million non-fatal workplace accidents including 160 million new cases of work-related illnesses occur annually, resulting in severe socioeconomic consequences on workers (Berhan and Pham, 2020).

According to International Labour Organization/World Health Organization statistics (2017), there are about 340 million work-related accidents and 160 million victims of occupational diseases annually, with corresponding 651,279 deaths from hazardous substances with younger and older workers being particularly vulnerable. The toll of accidents and deaths has continued to rise according to updates (Hamalanein et al., 2017; Santos et al., 2017).

A report from World Health Organisation (WHO), 2014, showed that an estimated 12.6 million people die annually from diseases and injuries attributable to environments where they live and work.

In Africa, where work place hazards of dust and noise have been prevalent, the introduction of new technologies, chemical substances and materials has led to increased burden of occupational injuries and diseases (Eijkemans, 2004; Berhan, 2020). It is estimated that over

120 million occupational accidents with over 200,000 fatalities occur each year in developing countries with sub-Saharan Africa appearing to have the greatest rate, followed by Asia (Tadesse et al., 2016).

In sub-Saharan Africa, more than 57,000 total work-related fatalities and 55,000 injuries resulted in the loss of about 4% GNP (Adei et al., 2021; Hamalanein et al., 2017). According to Nenonen and Saarela (2014), there were over 350,000 occupational accident fatalities and over 1.9 million work-related disease fatalities in 2010.

In Nigeria, though up to date OHS databank is not available, ILO reported that fatalities were formally recorded between 2014 and 2016. According to the record, there were 3,461 occupational accidents and injuries, 311 disabilities and 238 fatalities for the same period, with the peak year being 2015 and construction industry/sector, having the highest number of occupational accidents/injuries (ILO, 2016).

2.1.3 Artisans

These are skilled workers, variously referred to as servicemen, craft-workers, workmen and tradesmen. They make objects and materials partly and/or entirely with hands, while displaying dexterity in the use of tools and machines. These workers learn mostly through experience and aptitude, and currently account for half of the global employment and as much as 90% in some developing countries of the world (BOI, 2018).

Artisans make up informal employment of up to 48% of the non-agricultural employment in North Africa, 51% in Latin America, 65% in Asia and 72% in sub-Africa while estimates for developed countries are around 15% (Hassan et al., 2018). In South Africa, statistics have it that artisans accounted for 52% of South African's GDP in 2015 and employed 2461000

workers (17% of all employed). Other estimate put the account as high as 15 – 18% of GDP in 2016 (Hamilton, 2020).

In Nigeria, artisans constitute a significant proportion of workforce (Afolabi et al., 2021; Balogun et al., 2016; ILO/WHO, 2017) and accounted for 65% of 2017 Gross Domestic Product (GDP) according to International Monetary Fund (IMF).

Artisans include agricultural workers, construction workers, domestic and home-based workers, manufacturing workers, street vendors and hawkers, transportation and waste pickers (Rockefeller Foundation, 2013).

They are reported to have more propensities towards work-related challenges due to unhealthy environment and unsafe working conditions. Great number of artisans do not have training on work safety, while the rest are unaware of occupational hazards and the resultant health problems (Appiah, 2019; Johnson and Motilewa, 2016).

For some of them, their homes double as their workplaces, increasing the vulnerability to diseases and poor health. Interaction between work-related hazards and poor living conditions of artisans often exacerbate their health problems (ILO/WHO, 2017; Theuri, 2012).

The number of artisans has continued to rise due to ongoing global job crisis and low level/unspecialized industrial and manufacturing concerns especially in developing countries (Amfo-Otu and Agyemang, 2019).

Craft-workers, servicemen, workmen and tradesmen mostly seen in urban cities of Nigeria include auto-repair workers (mechanics, auto-electricians, auto-welders (panel beaters), and vulcanizers), arc & gas welders, wood workers (saw millers, carpenters/furniture makers),

bricklayers/masons, tilers, painters, tailors, hair dressers, shoe makers, food vendors, security-guards and many more. Of these artisans, workers in automobile repair and building/construction enterprises are more in population and are at high risk of work-related injuries from occupational hazards (Rockefeller, 2013).

Artisans that are in high demand in Nigeria are those in automobile repair and building/construction sector namely; auto mechanics and welders, bricklayers/masons, iron benders, block moulders, roof carpenters, tillers, painters. Others are food vendors, hawking artisans (Olorinola et al., 2014) and those in wood enterprises/industries namely sawmillers, wood carvers, carpenters and furniture makers. Categories of artisans include: Welders and Wood artisans.

2.1.3.1 Welders

Welding is a fabrication process used to join materials, usually metals together. It produces a coalescence of materials by intense heating or application of pressure, or both. Welding involves a wide range of joining techniques that includes fusion welding, solid state welding, weld bonding, diffusion welding, brazing, and soldering (Osagiede et al., 2020)..

According to International Standard Classification of Occupation (ISCO-88), welders fall into the major group seven (7) craft and related trade. The International Standard Classification of Occupation (ISCO) defines welders as workers who cut and join metal parts together through the use of flame or electric arc and other sources of heat (Hassan et al., 2018). LABORSTA, an international Labour Office Database on Labour statistics operated by the International Labour Organization (ILO) department of Statistics enumerated the total number of persons in welding occupation to be 7,461,000 globally.

Welding process include electric welding, gas welding, energy beam welding, and solid state welding. But the common and the most widely employed welding process in Nigeria is arc welding (Megbele, Lam, Sandra, 2012). Welding is associated with numerous health hazards which result in short-term and long-term health consequences. Short-term consequences include burns, electric shock, lacerations and cut by sharp metals, and eye injury (photokeratitis) due to intense glare (from UV radiation) and flying metal particles. Long-term consequences include hearing impairment due to high noise level, ocular disorders including cornea opacity, cataract and retinal damage as well as respiratory dysfunctions due to metal fumes containing zinc, copper, cobalt, nickel, chromium, platinium and their oxides (Hassan et al., 2018).

Hazards affecting welders include physical, chemical, mechanical and ergonomic. Physical hazards of noise, vibration, radiation, excessive heat, cold and physical trauma can lead to physical injuries to welders exposed to them (Osagiede et al., 2020).

When a welder strikes an arc, the heat of the arc vaporizes a small quantity of metal, releasing physical hazard of ultraviolet radiation (UV) and a chemical hazard of small, solid particles into the air creating a plume referred to as “welding fume”. The contents of the welding fumes depend on the components of the base metal, coatings and/or filler materials and the temperature used in the welding process. These fumes adversely affect the health of welders as well as those in the immediate area. With absorption of emitted ultraviolet radiation (UVR) into the eye, a very painful but seldom permanent eye injury, referred to as arc eye, arc flash or welder’s flash results. This is marked by redness of the eye, foreign body sensation or grittiness, tearing and pain, if appropriate protective devices are not worn (Chukwuoha et al., 2018).

The excessively high temperature generated by electric current during arc welding produces intense heat which can cause burns or electric shock. Lacerations and cuts from sharps or pointed metal panes, high-velocity flying metal chips/particles may also occur. Welding machines produce vibrations which may give rise to soft tissue injury which affect digital circulation of the hand and arm, resulting in a condition referred to as Hand-Arm Vibration Syndrome (HAVS), with symptoms similar to that of Reynaud's Syndrome (blanching of the fingers). Reports have it that welding machine produces sound as high as 120 decibels, which has serious health effects on the ear. Exposure to noise level above 90decibels for eight hours or more is likely to cause noise-induced hearing loss (NIHL). Nose-induced hearing loss results from damage of the sensory hair cells of the cochlea (Ebe et al., 2019).

Chemical hazards of welding include noxious metal fumes containing a cocktail of metals like zinc, copper, chromium, platinum, cobalt, nickel and their oxides which may lead to various respiratory dysfunction and influenza-like condition known as metal fume fever. Inhalation of welding fumes into the lungs, blood stream, brain nerve cells, spinal cord and other organs, can cause both short- and long- term health effects. Of the many welders who work in construction, ironwork, automobile repair enterprises, most suffer from some sorts of respiratory illness or pulmonary disorders. In recent times, however, the effect of manganese welding fumes exposure on welder's health has warranted a closer study. In addition to steel, manganese is found in many different types of welding rods and wire, and is considered the most harmful metal present in welding fumes. Even when used properly, manganese welding rods can still emit manganese fumes. Manganese is a naturally occurring metal and the twelfth most abundant element on earth. It is a high reactive gray – white metal that resembles iron, and is often added to increase hardness, stiffness and strength. Reports have shown that exposure to

high levels of manganese welding fumes for only few months can cause sickness, and since welders are exposed to these fumes on a regular basis, they are at an increased risk of developing manganism or "welder's disease" (Andruska and Racette, 2016; NIOSH, 2023).

Physical morbidity profile of welders estimated 562000 employees to be at risk of exposure to chemical and physical hazards according to Occupational Safety and Health Administration Research (Wanjari and Wakhnede, 2020).

Ergonomic hazards of welding include job repetitions, uncomfortable postural conditions, manual handling activities and many more. These often lead to work-related musculoskeletal disorders (WMSDs), with back discomfort and joint injuries as the prevalent WMSDs linked to muscular tension from manual handling activities. Fatigue from job repetitions and uncomfortable postural conditions often increase the sprains and strains (Nedohe et al., 2023).

Categories of welders include: Auto welders and Arc welders.

Automobile Welders often referred to as panel beaters, are automobile, motor/car repairmen or workers skilled in the diagnosis, repair and maintenance of damaged automobiles/vehicular bodies (for instance after being involved in a collision) (Panel Beater Job Guide, 2009). They are trained through apprenticeship which lasts for three years or less to use wide range of tools on various kinds of vehicle models. Auto welders repair automobile bodies by making use of skills such as planishing and metalwork techniques, welding, use of putty fillers, and other skills. Accident vehicular repair may require the replacement of affected parts and these parts may be made from various metals including steels and alloys, many different plastics, fibre, glass and others, thereby exposing panel beater or auto-welders to numerous health hazards which often affect their health or aggravate existing health problems (Nduka et al., 2019).

Arc Welders are metal or construction welders who employ fusion welding process to join metals. They use a continuous supply of electric current (either AC or DC) to create an arc (between a consumable or non consumable electrode and the base material) that generates intense heat to melt metals. The arc converts electrical energy to heat energy, at a temperature of about 10,000°F (5,500°C) by forming a mixture of ionized (charged) particles, emitting ultravoilet radiation mostly in the UV-A region (Chukwuoha, Nwoke, Esenwah, Azuamah & Nwaigwe, 2018). Welding arc gives off radiation over a broad range of wavelengths - from 200 to 1,400 nanometres (or 0.2 to 1.4 micrometres). These ranges include ultraviolet (UV) radiation (200 - 400nm), visible light (400 - 700nm), and infrared (IR) radiation (700 - 1,400nm). The UV radiation has three (3) ranges - UV-A (315 - 400nm), UV-B (280 - 315nm), and UV-C (100 - 280nm). Almost all UV-B and UV-C are absorbed in the cornea of the eye. UV-A passes through the cornea and is absorbed in the lens of the eye. Some UV radiation, visible light, and Infra red can reach the retina (CCOSH, 2023)

2.1.3.2 Wood Work Artisans

These are craftsmen or tradesmen, skilled in making products from wood. Wood is a material of great economic importance found throughout the world. It can be sustainably managed as a renewable resource in contrast to coal, ores and petroleum which is gradually being exhausted (Mbegue, Sow and Houndjo et al., 2018). By means of its harvest from forests, its transportation, processing and its trade and use, wood provides jobs and supports economic development. Indicative of this importance is the continued high demand of wood and wood products in both local and export markets (Mumuni, 2015). Three main types of wood are Soft wood, Hard wood and Engineered wood.

Soft woods, scientifically known as Gymnosperms are those woods and lumbers milled from conifer trees which have needles and produce cones. Examples of soft wood trees used in wood working and construction are pine, cedar, fir, spruce and red wood. The distinction between hard and soft wood is based on their botanical characteristics and has little to do with the actual softness or hardness of such wood (Desai, 2019).

Hard woods, scientifically referred to as Angiosperms are woods of deciduous trees which produce leaves and seeds. Common hard wood species include oak, maple, cherry. Mahagony. Bambo and Palms are hard woods which are not deciduous in nature. A significant difference exists between the classes of wood with respect to the health effects of the dust created during handling, as high exposure to the dusts of hardwoods has been reported to cause nasal cancer (Diwe et al., 2016).

Engineered woods, does not occur naturally. They are known as composite wood and are often made from waste wood of sawmills. Through treatment with chemicals or heat process, engineered wood produces wood products of different sizes which are difficult to be produced naturally. Popular examples of engineered woods are plywood, oriented wood strand board, medium density fibre and composite wood board. Wood veneers are sometimes classified as engineered wood since it often needs manipulation either through specialized cutting or joining techniques to achieve specific size or wood grain patterning (Kara, 2019).

The most important wood products, produced, consumed and traded in the country are sawn-wood, plywood, wood panels printing and writing paper and paper boards (Richard et al., 2017).

Varieties of wood are Alder, Ash, Aspen, Balsa wood, Bamboo, Bass wood, Beech wood, Birch wood, California red wood, Cedar wood, Cherry, Douglas fir, Ebony. But the tree species mostly used for timber and pole production include; C. lusitanica, (Cypress), Eucalyptus grandis and Pinuspatula. Wood products as products from renewable and sustainable environmental sources are used in construction, decoration, cooking fuel and many more (Klein et al., 2016).

Artisans in wood industries and small scale wood enterprises include saw-millers, wood carvers and carpenters/furniture makers etc.

Saw-millers are workers in saw-milling section of mechanical wood industries, where wood are sawn, planed, curved and grooved with various types of machines such as sterner, scantry, compass etc. Saw-millers include machine operators, saw technicians, dust packers, overseers, wood loaders, machine off loaders and administrative staff. In saw milling process, timbers are broken down into further different sizes of boards after passing through various machines in the saw plant (Agbana et al., 2021). Saw milling is a gainful means of livelihood not only in Nigeria but world over. Nigeria was once the largest exporter of wood in West Africa with different sawmills enterprises that employed great number of workers (Elechi and Daingo-Warmate, 2019).

Wood carvers: Are skilled craftsmen who create intricate designs and sculptures from wood. They use various tools such as chisels, knives, mallet, and gouges to shape and refine wood into desired forms. Wood carvers design wide range of items, including decorative sculptures, furniture, and even functional objects like utensils and bowls. This set of wood workers often have a deep understanding of different kinds of wood and their properties, enabling them to

choose suitable materials for their works. Wood carving can be a traditional craft passed down through generations or a contemporary art work practiced by persons with passion for carving. Products of wood carvers are usually wooden figures or figurines, or in the sculptural ornamentation of a wooden object.

Carpenters/furniture makers cut and join wood in order to construct, install, and repair various structures and objects. They also produce households and office furniture such as tables, chairs, cabinets, bookshelves, desks, counters, beds, upholstery and many more. Carpentry/furniture making activities require the use of various machines and tools, such as saws, drills, and hammers, to measure, cut, shape, and join wood to create functional and aesthetically appealing structures. Furniture makers, similar to carpenters are skilled craftsmen who specialize in creating custom-made furniture. They design, build, and finish furniture pieces using a combination of traditional woodworking techniques and modern tools. Furniture makers often have deep understanding of various wood types, joinery techniques and furniture design principles. They create wide range of furniture items including tables, chairs, cabinets, beds and more.

Activities in wood enterprises are verse with lots of human involvement. Here, series of manual handling of wood and wood products expose wood workers to various allergenic, immunotoxic, pernicious, noxious, carcinogenic and toxic substances that originate from wood dust, bacteria and fungi that grow on wood as well as chemical substances — adhesives and coatings used in the treatment and preservation of woods (Mumuni, 2015).

Exposures to chemical substances result in lungs and nasal cancer, bronchitis, rhinitis, bronchial hyper responsiveness, asthma, allergic alveocolitis and contact dermatitis (Elechi and Daingo-Warmate, 2018). Technology used in most wood industries are old and obsolete. Here,

tractor engines, electric motors and saws are mostly used, while employing intensive manual labour methods, hence great number of accidents are often recorded in small-scale and medium-sized wood industries (Charles et al., 2017).

2.1.4 Occupational Hazards of Welders and Wood Work Artisans

Occupational hazards are potential sources that can cause injuries or damages to workers' health (Canadian Center of Occupational Health and Safety, 2020). Gambhir et al. (2011) elaborately described them as work materials, substances, processes or situations that predispose workers to or can directly cause accidents or diseases to workers in their workplaces, even years after the worker have left the work place. International Labour Organization literature refer to occupational hazards as potentials to cause harm – including substances or machines, methods of work or other aspects of organization. Occupational risk is identified as one of the contributing factors to the global burden of diseases (Fingerhut et al., (2019).

Work-related hazards affect considerable number of welders and wood workers in their various occupations and indirectly impact the economy especially in developing countries, where workers take for granted work-related health and safety issues due to poor awareness and fundamental understanding of the interactions between work and health (Diwe et al, 2016; Uwakwe et al., 2019). Wanjari in his physical morbidity profile of welders, estimated 562000 employees to be at risk of exposure to chemical and physical hazards according to Occupational Safety and Health Administration research (Wanjari et al. (2020). An estimation of 1.53 million deaths (about 2.8%) and 3.2% disability-adjusted life years (DALYs) lost globally are attributable to occupational risk factors (Driscoll et al. (2020).

Welding and wood work have their specific hazards, and the resultant health challenges - injuries, disabilities or diseases, depending on the work type and activities engaged in (Joesph et al., 2017). Small-scale and medium-sized welding and wood enterprises (SMEs) have better organized settings in the developed countries, but in developing countries of the world, for instance Nigeria, artisans are found in unorganized and unregulated clusters with little attention to safety precautions. Little wonder there is more fatal work-related accidents in developing countries than in industrialized nations (Agu et al., 2016). According to International Labour Organisation (ILO), physical, chemical, biological, ergonomic, psycho-social and organizational hazards are encountered by workers in their different workplaces. Because of these occupational hazards and the overall lack of attention given to health and safety, occupational-related accidents and diseases have continued to be serious problems among welders and wood artisans all over the world. Some of these hazards exert immediate harmful effects on the workers involved, for instance injuries due to accidents (e.g., dislocations or fractures due to falls). However, others are more hidden and not easily noticed, due to time lag between hazard exposure and onset of harmful consequences (e.g., low back pain due to repetitive bending) (ILO, 2015).

2.1.4.1 Physical Hazards of Welding and Wood Activities

Physical hazards of welding include thermal and electrical energy which generate intense heat, electromagnetic radiation which occurs in the visible, ultraviolet, and infrared frequencies from welding arc, vibration and noise from machines (Tadesse et al., 2019). Others are hot and flying metal chips and wood particles generated during cutting, joining, sawing and planing processes as well as electric shock and electrocution from electrical energy. Sparks and flying metal particles during welding activities, occasionally produce ignition source where

flammable chemical and gases are used in close proximity. Damaged electrical cords in the auto welder's workshop also lead to electric shock. Compressed and liquefied gases in vessels under pressure used in workshops as fuel, source of oxygen or shielding gas in certain types of welding often times result in fire or explosion due to gas leakage, with ignition source as a spark from angle grinder being used nearby.

Direct contact with electric current by stepping on or touching naked wire (Wanjari et al., 2020; Mgonja, 2017) often leads to electric shock or electrocution. Excessive high temperature generated by the hot electric current at times result in skin burn to welders. Electrical equipment not properly earthed or maintained can lead to electric shock, serious burns or even death of auto-welder (Osagiede et al., 2020).

Ultraviolet Radiation (UVR) is a serious physical hazard encountered by welders on daily basis. Welding arc gives off radiation over a broad range of wavelengths - from 200 nm (nanometres) to 1,400 nm (or 0.2 to 1.4 µm, micrometres). These ranges include ultraviolet (UV) radiation (200 to 400 nm), visible light (400 to 700 nm), and infrared (IR) radiation (700 to 1,400 nm). Ultraviolet (UV) and visible radiations are the main components of optical emission in welding processes, and the type and extent of optical damage depends on the energy absorbed, the wavelength of radiation and the duration of exposure. Some UV radiation, visible light, and IR radiation can reach the retina (Canadian Center for Occupational Health and Safety, 2018).

UV-radiation has three ranges - UV-A (315 to 400 nm), UV-B (280 to 315 nm) and UV-C (100 to 280 nm). The eyes act as a filter and these rays are selectively absorbed by the different structures present in the eyes. UV radiation is absorbed by the cornea and lens, with the lens absorbing more of the radiation at wavelengths approaching 400 nanometer. UV-C and almost

all UV-B are absorbed in the cornea of the eye. UV-A passes through cornea and is absorbed in the lens of the eye. This absorption causes chemical changes in the lens, leading to cataract formation (Megbele et al., 2012).

The most common of these UVR related problems is photokeratitis or arc eye or welder's flash. It is an acute reversible eye condition, marked with redness, sensation of foreign objects, discomfort with light, intense pain, profuse tearing and persistent twitching (Yustheresani et al., 2020). Photokeratitis usually disappear after few days with permanent effect on the deeper structures of the eye, with continuous exposure (Chukwuoha et al., 2018); Esenwah et al., 2017; Nwala et al., 2017; Mgonja, 2017; WHO, 1960). The amount of time required to cause these effects depends on several factors such as the intensity of the radiation, the distance from the welding arc, the angle at which the radiation enters the eye, and type of eye protection that the welder or bystander is using. However, exposure to just a few seconds of intense UV light can cause arc eye. Symptoms may not be felt until several hours after exposure. Wavelength, high duration, and frequency are factors of UV radiation exposure that can impact the severity of corneal reactions and disorders. Studies have it that exposure over 30 minutes, put welders at risk of photokeratitis. Short-term UV exposure to the cornea irritates the superficial corneal epithelium and inhibit the mitotic process. However, long-term exposure to UV light can produce cataracts in some persons. Exposure to infrared light can heat the lens of the eye and produce cataracts over the long term (Mgonja, 2017). Visible light from welding processes is very bright and can overwhelm the ability of the iris of the eye to close sufficiently and rapidly enough to limit the brightness of the light reaching the retina. The result is that the light is temporarily blinding and fatiguing to the eye. UV radiation in a welding arc can also burn

unprotected skin just like UV radiation in sunlight. Long-term exposure to UV radiation can cause skin cancer (CCOHS, 2018).

Noise is another physical hazard artisans in small-scale and medium-sized welding and wood enterprises encounter in the course of their activities. it is an unwanted sound emanating from machines and tools of work, and result in serious acute/chronic health problems with prolonged exposures. Persistent exposure to noise leads to reduced life quality among workers (Ebe et al., 2019; Elechi et al., 2019). Health effects of noise are of two types: auditory which involves temporary or permanent hearing loss and non-auditory effect which consists of nervousness, fatigue, interference with communication by speech, decreased efficiency and annoyance. High noise level can lead to cardiovascular effects on workers and an increase in coronary artery disease (Elenwo, 2018; Munzel et al., 2018; Agu et al., 2016).

The degree of injury from exposure to noise depends on a number of factors such as intensity and frequency range, duration of exposure and individual susceptibility. Intensities above 90 decibels damage the ear drum and results in hearing loss, especially in high frequency range (Kadiri, 2006). Wood processors and welders are occupationally exposed to high intensity noise (Osanyingbemi, 1987).

Vibration is often called a vector quantity, meaning that the vibratory motion has both a negative effect in itself and a magnitude or intensity component (Yale, 2018). Repeated exposure to high levels of vibration is known to cause injury to workers over time. Vibration injuries are classified into hand-arm and whole-body vibration, with both types having different sources, affecting different areas of the body and producing different symptoms. Hand-arm vibration syndrome (HAVS) is caused by power hand or pneumatic tool or work piece which transmits movement resulting in pulsation, shaking or tremors of the hands and fingers. Hand-

arm vibration exposure (HAV), besides being a known contributing factor to carpal tunnel syndrome and other ergonomic-related injuries, causes direct injury to the fingers and hand, affecting feeling, dexterity, and grip (Yale, 2018).

Vibration especially in the frequency range of 10 to 500 Hz, are often encountered with sawing machines in wood industries, pneumatic tools such as drills and hammers as observed among welders. They affect hands and arms after some months or years of exposure, making the fine blood vessels of the fingers to become increasingly sensitive to spasm (white fingers). Exposure to vibration may also produce injuries of the joints of the hands, elbows and shoulders (WHO, 1960). The pathophysiological changes of Hand-Arm Vibration Syndrome (HAVS) include changes in the blood vessels, sensory corpuscles and nerves. After years of exposure, this commonly leads to symptoms of of white fingers, numbness, and tingling and reduced sensory function. Subjective neurological symptoms such as numbness and tingling of the fingers are linked with increased vibration perception threshold (VPT) of the fingers. This often lead to reduced hand performance. Exposure limit value (ELV) and exposure action value (EAV) for HAVS are in most countries set at an acceleration level of respectively $5m/s^2$ (A8) and $2/5\ m/s^2$ as time-weighted average for 8-hour working day (Aaarhus etal., 2019).

Evidences of physical hazards encountered by welding and wood workers have been reported in several studies done in and outside the country.

2.1.4.2 Chemical Hazards of Welding and Wood Activities

Welders and wood artisans are also exposed to chemical hazards of some sort either directly or indirectly in their work activies. Introduction of newer and more complex chemicals in recent times, have increased the exposure of wood workers and welders to these hazards. Fumes,

mists, vapours, gases, liquids, dusts emanating from chemicals substances of work have continued to impact negatively on the health of these artisans. Based on their nature, some chemicals are toxic, flammable, corrosive, carcinogenic, teratogenic and mutagenic. And their health effects may be acute or chronic on artisans involved.

Chemical hazards act in three ways: local action, inhalation and ingestion. The ill-effects produced depend upon the duration of exposure, the quantum of exposure and worker's susceptibility. Some chemicals cause dermatitis, eczema, ulcers and even cancer by primary irritant action; some cause dermatitis by allergic action. Some chemicals, particularly the aromatic nitro and amino compound such as aniline is absorbed through the skin and cause systemic effects. Occupational dermatitis is a big problem in many industries world over (Park, 2015).

Gases and fumes are potential chemical hazards to automobile and arc welders (Nduka et al., 2019; Ojo et al., 2017: Adeoye et al., 2015). There are simple gases －oxygen, hydrogen, and asphyxiating gases － carbon monoxide, carbon dioxide, cyanide gas, sulphur dioxide and nitrogen dioxide. Carbon monoxide and carbon dioxide are hazards frequently encountered by auto welders. Welding fume (consisting of chromium, manganese, cadmium, copper, iron oxide, zinc, nickel, and lead) is also a serious hazard among both auto and arc welders, resulting in severe respiratory health issues. Ingestion of metal particles occur once in a while among welders but the ill-effect depends on the duration, dose or concentration of exposure. Unlike pneumoconiosis, most chemical intoxication from metal ingestion respond favourably with cessation from exposure and medical treatment (Tadesse, 2019).

Wood dusts generated during cutting, sawing, sanding, smoothing, loading and unloading of wood materials, pose serious threat to wood workers. They are finely divided solid particles ranging from 0.1 to 150 microns in size. Wood dust larger than 10 microns settle down from the air rapidly, while the smaller ones remain suspended indefinitely. “Respirable dust” (less than 5 microns), being organic (insoluble) in nature, get directly inhaled into the lungs and are retained permanently there causing allergic respiratory symptoms, mucosal and non allergic symptoms often leading to pneumoconiosis and other respiratory disorders (Agwah et al., 2016).

Hardwood and softwood dusts have different airborne permissible exposure limits. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends an exposure limit of 1 milligram per cubic meter for hardwoods and 5 milligram per cubic meter for softwoods. Wood dust is found to be a nuisance dust and confirmed human carcinogen by the United States Occupational Safety and Health Administration (OSHA) (Diwe et al., 2019). Among the hardwoods, beech and oak used in furniture making present severe health hazards than softwoods but the extent of these hazards have not been clearly established (Kespohl et al., 2022).

2.1.4.3 Biological Hazards of Welding and Wood Activities

Biological hazards of wood work emanate from bacteria, molds and fungi that grow on the bark of wood. Climatic changes have promoted increased fungal infection of maple trees with *Cryptostroma corticale*, the causative agent of sooty bark disease. Exposure of workers to these infective agents, result in organic dust toxic syndrome, occupational asthma and hypersensitivity pneumonitis (HP), and a host of others respiratory disorders (Kespohl et al., 2022; Adhikari et al., 2015).

2.1.4.4 Ergonomic Hazards of Welding and Wood Activities

These are associated with dis-balance of machines and tools of work with workers' anthropometric characteristics. Ergonomic hazards arise from excessive force, repetition, forced activity, manual & heavy lifting of objects and materials of work, adopted awkward or fixed work postures (Adeyemi et al., 2016), long hours of work (>8 hours)(Balogun et al., 2016; Saliu et al,. 2015) as observed among welding and wood artisans. They affect the muscles, tendons, ligaments, and nerves resulting in musculoskeletal disorders (MSDs) with back pain, neck pain, joint pain, muscle stiffness and carpal tunnel syndrome. Additionally, welders and some wood artisans (carpenters) work at heights, on scaffolds or ladders, and this often result in falls and other serious injuries.

2.1.4.5 Mechanical Hazards of Welding and Wood Activities

These hazards centre round machines used in welding and wood work processes. Implements, tools and machines of welding and wood work because of their pointed edges, high-powered force, exert stress, injure artisans exposed to them. Report has it that about 10% of accidents in industries are due to mechanical causes. Others are unguarded moving belts and rotating wheels, obsolete material of work, sharp tools and machines that cut, burn, and cause other injuries to wood and welding artisans (Amadi, 2011).

2.1.4.6 Psycho-Social Hazards of Welding and Wood Activities

These workplace stressors are due to workers inability to cope with poor work organization (example, problems with work demands, time pressure, decision latitude, reward and recognition, workloads, support from supervisors, job clarity, job design, job training, poor communication), organizational culture (example, lack of policies and practice related to dignity or respect for all workers, harassment and bullying, discrimination on the basis of ill

health, ethnicity, religion, lack of support for healthy life styles), command and control management style (example, lack of consultation, negotiation, two way communication, constructive feedback), shift work issues and fear of job loss and many more (Amadi, 2022).

Emotional tension, fear, frustration, lack of job satisfaction, insecurity, poor interpersonal relationships also cause psychological health problems, determining both physical and mental health of workers. Capacity and ability of adapting to different working environments are often influenced by educational, cultural, and family life background, social habits, and worker's expectations from employment. Hostility, aggressiveness, anxiety, depression, tardiness, alcoholism, drug abuse, absenteeism are some psychological and behavioural health effects of psycho-social hazards while psychosomatic ill health include fatigue, headache, pain in the shoulders, neck and back; propensity to peptic ulcer, hypertension, heart disease and rapid aging (Park, 2015).

Report of Occupational Safety and Health Administration Research, (2020) in India, showed the physical morbidity profile of welders to be at an estimated 562000 at risk employees to chemical and physical hazards.

2.1.4.7 Organizational Hazards of Welding and Wood Activities

Hazards originating from inadequate safety and health standards for instance, poor housekeeping, are particularly evident among artisans in Nigeria due to inadequate supervision and lack of occupational health services (Afolabi, 2021). Non-compliance and non-usage of personal protective devices (Elenwo, 2018; Balogun et al., 2016). Unsafe work-practices such as touching hot surfaces, sucking petrol with one's mouth and washing hands with fuel, treating

injuries with hydraulic (Adeyemi et al., 2016; Ojo et al., 2017) are also factors that have been reported to have caused health problems among artisans in Nigeria.

2.1.5 Occupation-Related Health Challenges of Welders and Wood Artisans

Welders and wood artisans face numerous health challenges due to their exposure to physical, chemical, biological, mechanical, psycho-social, ergonomic and organisational hazards of work. These occupational hazards exert deleterious effects not only on their health and productivity, but on their socio-economic well-being as well as that of their families (Adei et al., 2021; Appiah, 2019; Wang et al., 2018). Artisans existing health conditions are often aggravated with persistent exposures to these hazards, resulting in low life quality, even years after retirement from active work (Wu et al., 1997). Work-related incidents though unintentional and undesired events, yet they occur from time to time (Adeoye et al., 2015).These contribute to a substantial disease burden and economic loss of about 4 – 6% Gross Domestic Product for most countries of the world including Nigeria (WHO/ILO, 2017). According to International Labour Organization (ILO), 278 million workers die annually from work-related accidents or diseases globally, while 374 million suffer from non-fatal work-related accidents (ILO, 2019). It is estimated that lost work-days gulp about 4% of the global Gross Domestic Product. Although morbidity and mortality data of artisans in low- and middle-income countries (LMICs) of the world are limited and of diverse quality, however available reports point towards increased rates of health challenges in LMICs than in high-income countries (Hamalainen et al., 2017). Wu et al. (2018) reported that 92% of occupational injuries and death occur in low- and middle-income countries (LMICs). Work-related mortality and morbidity result in not only colossal social and economic burden for enterprises and countries, but also large human and financial losses for artisans and their families (Wang et al., 2018).

Welding and wood work are risky occupations (Wanjari and Wankhede, 2020; Chukwuoha et al., 2018), and workers engaged in them have almost the same kind of heath challenges. Work-related health disorders such as chronic obstructive pulmonary (respiratory) disorders, musculoskeletal disorders, noise-induced hearing loss, eye problems and skin problems are the most common occupational health disorders among artisans (Moug et al., 2018; WHO/ILO, 2017; Agu et al., 2016). Others are burns, cuts, lacerations and bruises, electric shock, electrocution, asphyxiation, hand-arm vibration and many more (Osagiede et al., 2020; Mgonja, 2017; Amfo-otu and Agyemang, 2016; Johnson and Bassey, 2016).).

Work-related health challenges encountered by welders and wood workers are either short-term, long-term or fatal (death). Short-term health issues include burns, electric shock (from excessive heat and current generated during work activities), bruises, cuts and lacerations (from sharp edges, protruding and rolling parts of machines), and eye injuries (from flying metal chips and wood particles). Long-term consequences include hearing impairment from high noise level (Wanjari and Wankhede, 2020; Sabitu et al., 2009; Ebe et al., 2019), eye (ocular) disorders such as corneal opacity, cataract and retinal damage (Yustheresani et al., 2020; Megbele et al, 2020), and respiratory dysfunctions (Mgonja, 2017; Bradshaw et al., 1998). Fatal health issues often lead to severe disabilities and death. Dysfunction of the immune system, also result from welding fumes. With immune dysfunction, there is inability to fight off pulmonary infections and increased risk of pulmonary infection. This result from diminished functionality of local and circulating immune cells associated with altered immune-related cytokine and antibody production as well as impaired resolution of local inflammation (Ziedler et al., 2012). Metal-induced asthma, is also a major respiratory illness among welders (Bala and Tabaku, 2010). Carbon monoxide, ozone, nitric oxide, nitrogen dioxide, phosphine and

phosgene produced during welding activity cause headache, drowsiness, and pulmonary edema (Adeniyi and Isah, 2023). Lung cancer result from welding fumes of iron and its compounds, nickel, chromium or chromium VI, and other possible carcinogens (Siew et al., 2008) are also reported from welding fumes. Skin pathologies and ocular malignancies are documented from welding fumes, with exposure to high-frequency ultraviolet rays as the chief culprit agent (Dixon and Dixon, 2004).

Wood and their products create various health effects to artisans at every stage of their supply chain (Adhikari and Ozarska, 2018). The nature of work done by wood workers and types of equipment they handle present many on –the – job hazards. Table saw planning machines, mortising and grooving machine, filing machines and most importantly the spindle (Sterner) machine often lead to accidents and injuries of crushed hands, severed fingers, amputations and eye injuries due to their rotating devices, cutting or shear blades, especially if personal protective equipment are not used (Ayuk, 2019). Other health challenges include falls, musculoskeletal disorders, burns and many more (Osagiede et al., 2020; Mgonja, 2017). Allergenic, immunotoxic. pernicious, noxious, carcinogenic and toxic agents that originate from wood dust, bacteria and fungi that grow on wood, other chemical substances from adhesives and coatings used in the treatment and preservation of woods (Mumuni, 2015) are known to cause nasal and lung cancers, bronchitis, rhinitis, bronchial hyper responsiveness, asthma, allergic alveocolitis and contact dermatitis (Elechi and Daingo-Warmate, 2019). Old and obsolete technology used in most small-scale saw mills in Nigeria, use tractor engines, electric motors and saws, with intensive manual labour methods (Charles et al., 2017). These activities often lead to burns, cuts, bruises, lacerations and at times amputation of hands of wood artisans.

Globally, there are at least 250 million occupational accidents annually. Of these, 335,000 results in death. Occupational hazards of heat, noise, air borne particles (fumes, dust, volatile gases), carcinogenic agents and ergonomic risks have accounted for a substantial part of chronic disease burden: 37% of all cases of back pain, 16% of hearing loss, 13% of chronic obstructive pulmonary disease (COPD), 11% of asthma, 8% of eye injuries, 9% of lung cancer, 2% of leukaemia and 8% of depression (WHO, 2017).

In Nigeria, several studies among categories of artisans in different parts of the country have confirmed high prevalence of injuries, illnesses and diseases among welders and wood artisans. Common work–related health challenges reported among welders and wood artisans include: Eye injuries and disorders, Respiratory problems, Hearing loss, Dermatitis, Musculoskeletal disorders. Others are Cuts, Bruises, lacerations, Electric shock/electrocution and asphyxiation (Wanjari and Wankhede, 2020; Appiah, 2019; Mbulingwe, 2014; Aguma – Acon, 2012; Theuri, 2012; Okuga et al., 2012).

2.1.5.1 Ocular (Eye) Health Problems Among Artisans

Ocular injuries do not occur as random events. Rather, great number of them have direct connection with occupation and nature of activities at the time of their occurrence. Eye injury is one of the most common work-related injuries among welders and wood artisans. This injury results in visual morbidity, with some leading to preventable blindness. Ocular injuries represent 8% of all unintentional injuries and lead to more than 3.9 million deaths worldwide. Globally, about 2.5 million people sustain eye injuries annually with 500,000 cases leading to blindness (Ihekaire et al.,, 2017). They are particularly prevalent in low- and middle-income countries (Ezinne et al., 2021). Approximately, 10 - 20% of the gross national product is lost

annually as a result of 270 million work-related injuries and 160 million occupational-related diseases (Tetteh et al., 2020; Prabhu et al., 2017).

Exposure to metals particles and ultravoilet radiation are major risk factors to eye injuries and disorders among welders (Tetteh et al., 2020). Activities such as cutting, soldering, and in some cases brazing of metals, pose exceptional risk to welders, thus making them a group of artisans at high risk of ocular injuries. Prevalence of eye injuries among welders have been reported by Wanjari et al., (2020); Mgonja, (2017); Esenwah et al., (2017); Nwala et al., 2014).

Ultraviolet (UV) and visible radiations are the main components of optical emission in welding processes, and the type and extent of optical damage depends on the energy absorbed, the wavelength of radiation and the duration of exposure. The eyes act as a filter and the rays are selectively absorbed by the different structures present in the eyes. UV radiation is absorbed by the cornea and lens, with the lens absorbing more of the radiation at wavelengths approaching 400 nanometer. This absorption causes chemical changes in the lens, leading to cataract formation (Megbele et al., 2012).

Physical hazard of ultra-violet radiation also causes inflammation of the cornea, variously referred to as arc eye, welder's flash or photokeratitis. It is an acute reversible eye disorder, resulting from irritation of the superficial corneal epithelium and inhibition of its mitotic process. This irritation causes an inflammatory response and swelling which increases the corneal thickness, causing changes in the corneal bias strength and visual obscurity (. Photokeratitis often result from corneal epithelial cells damage, which cause them to slough off after several hours, while leaving the underlying corneal nerves exposed and damaged. This is marked by intense pain, discomfort with light (photophobia), sensation of foreign object or grittiness, profuse tearing, redness and persistent twitching. Recovery usually occur

approximately 72 hours after mild exposure, while leaving permanent effect on the deeper structures of the eye with continuous exposures (Chukwuoha et al., 2018; Esenwah et al., 2017; Nwala et al., 2014).

Previous studies reported that over 30 minutes exposure to UV radiation put welders at risk of photokeratitis. The wavelength, high duration, and frequency are some of the factors of ultravoilet radiation exposure that can impact the severity of corneal reactions and disorders (Mgonja, 2017). Other researches have also opined that symptoms of photokeratitis can last for 6–12 hours and then disappear within 48 hours. However, UV radiation cumulative exposure can lead to corneal epithelium damage, while high-intensity radiation exposure can result in visual paralysis or vision loss, even blindness ((Kulshrestha and Mishra, 2021).

2.1.5.2 Respiratory Health Problems Among Artisans

Respiratory or pulmonary disorder, a medical term that encompasses pathological condition of organs and tissues that make gas exchange possible, is one of the health risks artisans are faced due to their occupational exposure to metal fumes, gases and wood dusts originating from work activities. It includes dysfunction of the lungs, pleural cavity, bronchioles tubes, trachea, upper respiratory tract (nose, throat and mouth e.tc.) and of the nerves and muscles of breathing. Respiratory dysfunctions among welders and wood workers range from mild and self limiting conditions such as catarrh (common cold) to life-threatening conditions such as bacterial pneumonia or pulmonary embolism and lung cancer. They are common and important cause of illness and death among these workers and are traditionally divided into upper respiratory and lower respiratory tract disorders. The most common upper respiratory tract disease is catarrh (common cold) however, disease of specific organs of the upper respiratory tract such as rhinitis, sinusitis, tonsillitis, pharyngitis, and laryngitis are also considered upper respiratory

tract diseases. Others are chronic obstructive pulmonary disease (COPD), asthma, bronchitis, alveolitis etc. Lung function tests such as Spirometry and Peak expiratory flow (PEF) are some of the tests that help in the detection of respiratory disorders (Agwah et al., 2015).

Exposure to respiratory hazards (irritants, toxic chemicals and fumes) are dangerous, even lethal causing inflammation or other adverse reaction of the airways after they are inhaled, leading to damage of upper and lower airways with symptoms of nose and throat irritation, cough, shortness of breath, dysponea and resultant decline in lung functions. More dangerous is acute inflammation of the pulmonary parenchyma, as in chemical pneumonitis or non-cardiogenic pulmonary edema. Airborne particulates such as metal fumes, wood dusts and gases (generated during welding and wood work activities) are potent respiratory irritants. Exposure to these chemical hazards often lead to irritation of upper and lower air way structures, with their eventual damage (Saliu et al. 2015; Johnson and Bassey, 2016; Adejumo et al., 2017). Irritation of the nose, respiratory tract, tightness of chest, metal fume fever, and transient effect on lung function are various acute health effects that result from inhalation of metal fumes and dusts (Bakri et al., 2019; ILO, 2011). Bronchitis, asthma, pneumonia, decreased lung capacity, pneumoconiosis, and lung cancer are chronic effects of welding fumes and wood dust exposures.

Majority of airborne particulates (dusts and fumes) cause oxidative damage to the respiratory system primarily by lipid peroxidation, and there may be other mechanisms. On cellular level, there is initially a fairly specific loss of ciliated cells of the airway epithelium and Type 1 alveolar epithelium cells, with subsequent violation of the tight junction interface between epithelial cells. This leads to sub epithelial and sub mucosal damage, with stimulation of smooth muscle and parasympathetic sensory afferent nerve endings causing

bronchoconstriction. An inflammatory response follows, and neutrophils and eosinophils release mediators that cause further oxidative injury resulting in respiratory disorders (Agwah et al., 2015).

The presence of respiratory irritants in the workplace can be unpleasant, distracting, leading to poor morale, decreased productivity and numerous health challenges. Certain exposures are dangerous, even lethal. In either extreme, the problem of respiratory irritants and inhaled toxic chemicals is common; welders and wood workers face daily threat of these exposures. These compounds cause harm by a variety of different mechanisms, and the extent of injury can vary widely, depending on the degree of exposure and on the biochemical properties of the inhalant. However, they all have characteristic of non specificity; that is, above a certain level of exposure virtually all persons experience a threat to their health. There are other inhaled substances that cause only susceptible individuals to develop respiratory problems; such complaints are most appropriately approached as diseases of allergic and immunological origin. Certain substances provoke respiratory symptoms in sensitized individuals at very low concentrations (Esteban-Gorgojo et al., 2018).

Respiratory irritants include substances that cause inflammation of the airways after they are inhaled. Damage may occur in the upper and lower airways. More dangerous is acute inflammation of the pulmonary parenchyma, as in chemical pnuemonitis or non-cardiogenic pulmonary oedema. Compounds that can cause parenchymal damage are considered toxic chemicals. Many inhaled toxic chemicals also act as respiratory irritants, warning workers of their danger with their noxious odour and symptoms of nose and throat irritation and cough. Most respiratory irritants are also toxic to the lung parenchyma if inhaled in sufficient amount. Many inhaled substances have systemic toxic effects after being absorbed by inhalation.

Inflammatory effects on the lung may be absent, as in the case of lead, carbon monoxide or hydrogen cyanide. Minimal lung inflammation is normally seen in the inhalation fevers (e.g., organic dust toxic syndrome, metal fume fever). Severe lung and distal organ damage occurs with significant exposure to toxins such as cadmium and mercury.

The physical properties of inhaled substances predict their deposition sites as well as symptoms at these sites. Large particles (10 to 20µm) deposit in the nose and upper airways, smaller particles (5 to 10µm) deposit in the trachea and bronchi, and particles less than 5µm in size may reach the alveoli. Particles less than 0.5um are so small, they behave like gases. Toxic gases deposit according to their solubility. A water soluble gas will be absorbed by the moist mucosa of the upper air way, while less soluble gases will deposit more randomly throughout the respiratory tract. Respiratory irritants cause non-specific inflammation of the lung after being inhaled. Irritant gases tend to be more dangerous when they have a high irritant threshold; that is, there is little warning that the fume is being inhaled because there is little irritation.

The nature and extent of reaction of an irritant depends on the physical properties of the gas or aerosol, the concentration and time of exposure, and on other variables as well, such as temperature, humidity and the presence of pathogens or other gases. Host factors such as age, prior exposure, level of antioxidants and presence of infection may play a role in determining the pathological changes seen. This wide range of factors has made it difficult to study the pathogenic effects of respiratory irritants in a systematic way (Baur et al., 2012).

The best understood irritants are those which inflict oxidative injury. The majority of inhaled irritants including the major pollutants, act by oxidation or give rise to compounds that act in this way. Most metal fumes are actually oxides of the heated metal; these oxides cause

oxidative injury. Oxidants damage cells primarily by lipid preoxidation, and there may be other mechanisms. On cellular level, there is initially a fairly specific loss of ciliated cells of the airway epithelium and Type I alveolar epithelial cells, with subsequent violation of the tight junction interface between epithelial cells. This leads to subepithelial and submucosal damage, with stimulation of smooth muscle and parasympathetic sensory afferent nerve endings causing bronchoconstriction. An inflammatory response follows with neutrophils and eosinophils release mediators that cause further oxidative injury (Mokra, 2020). Type II Pneumocytes and cuboidal cells act as stem cells to repair. Other mechanisms of lung injury eventually involve the oxidative pathway of cellular damage, particularly after damage to the protective epithelial cell layer has occurred and an inflammatory response has been elicited (Chow et al., 2020).

Workers exposed to low levels of respiratory irritants may have subclinical symptoms traceable to mucous membrane irritation, such as watery eyes, sore throat, runny nose and cough (Gorguner and Akgun, 2010). With significant exposure, the added feeling of shortness of breath will often prompt medical attention. It is important to secure a good medical history in order to determine the likely composition of the exposure, the quantity of exposure, and the period of time during which the exposure take place. Signs of laryngeal oedema, including hoarseness and stridor, should be sought, and the lungs should be examined for signs of lower airway or parenchymal involvement. Assessment of the airway and lung function, together with chest radiography is important in short-term management. Larnygoscopy may be indicated to evaluate the airway.

If the airway is threatened, the worker may undergo intubation and supportive care. Workers with signs of laryngeal oedema should be observed for at least 12 hours to insure that the process is self-limited. The overwhelming majority of patients who survive the initial insult

recover fully from irritant exposures. The chances for long-term sequelae are more likely with greater initial injury. The term reactive airway dysfunction syndrome (RADS) has been applied to the persistence of asthma-like symptoms following acute exposure to respiratory irritants. This condition is thought to result from persistent inflammation with reduction of epithelial cell layer permeability or reduced conductance threshold for sub-epithelial nerve endings.

High-level exposures to alkalis and acids can cause upper and lower respiratory tract burns that lead to chronic disease. Ammonia is known to cause bronchiectasi, chlorine gas (which becomes HCl in the mucosa) is reported to cause obstructive lung disease. Chronic low-level exposures to irritants may cause continued ocular and upper airway symptoms, but deterioration of lung function has not been conclusively documented. Studies of the effects of chronic low-level irritants on airway function are hampered by a lack of long-term follow-up, confounding by cigarette smoking, "healthy worker effect," and the minimal, if any, actual clinical effect. After a patient recovers from the initial injury, regular follow-up by a physician is needed. Clearly, there should be an effort to investigate the workplace and evaluate respiratory precautions, ventilation and containment of the culprit irritants.

Chemicals toxic to the lung include most of the respiratory irritants given enough high level of lung exposure, but there are many chemicals that cause significant parenchymal lung injury despite possessing low to moderate irritant properties.

One group of inhalable toxins is termed asphyxiants. When present in high enough concentrations, the asphyxiants, carbon dioxide, methane and nitrogen, displace oxygen and in effect suffocate the victim. Hydrogen cyanide, carbon monoxide and hydrogen sulphide act by inhibiting cellular respiration despite adequate delivery of oxygen to the lung. Non-asphyxiant

inhaled toxins damage target organs, causing a wide variety of health problems and mortality (Gorguner &and Akgun, (2010).

Wood dusts in form of inhalable particulates penetrate the lung and result in a negative health effect of respiratory system to wood workers. This include cough, phlegm production, chest pain, bronchitis, rhinitis, asthma, allergic alveocolitis, nasal and lung cancers leading to decline in lung function (Awoke et al., 2021).

Wood artisans due to their exposure to these air borne particulates are at increased risk of developing respiratory health problems. Also, mould from logs of wood, exposure to chemicals, solvents, paints, adhesives and coatings used in the preservation of wood have their own effects on the respiratory heath of wood workers (Elechi et al., 2019; Moug, Mburu et al., 2018; Richard et al., 2017; Adeoye et al., 2015).

Welders on their part, due to exposure to metal fumes and oxide of metals produced during welding activities, develop short term and long term respiratory dysfunctions over time from persistent exposures (Wanjari and Wankhede, 2023; Mgonja, 20217; Al-Otaibi, 2014).

2.1.5.3 Hearing (Ear) Health Problems Among Artisans

Hearing loss is a significant disabling condition worldwide. Currently, over 1.5 billion people (20% of the global population) live with hearing loss, with 430 million of them have disabling hearing impairment. It is expected that the number could rise to over 2.5 billion by 2050, with over 700 million people having disabling (WHO, 2022). Estimates of unaddressed hearing loss and deafness in developing countries costs the global economy US$ 980 billion annually due to health sector costs (excluding the cost of hearing devices), costs of educational support, loss of productivity and societal costs according to World Health Organization.

Among the various causes or aggravating factors of hearing loss, workplace noise exposure is one of the primary agents. Noise-induced hearing loss (NIHL) is a permanent sensorineural deficiency caused by exposure to excessive sound. It is an important concern throughout the world. Previous studies confirmed that exposure to noise levels of more than 85dB can lead to increased risk of hearing loss. Noise related hearing loss, according to OSHA, has been listed as one of the most prevalent occupational health concerns in the U.S. for more than 25 years, and more than 30 million workers are exposed to hazardous levels of noise in the workplace. Over the last decade, nearly 125,000 workers have experienced significant, permanent hearing loss due to these hazards. High level s of noise in the workplace, according to OSHA, can also cause other health and safety issues, create physical and psychological stress, reduce productivity, interfere with communication and concentration, and contribute to workplace accidents and injuries by making warning signals difficult to hear (Occupational Safety and Health Administration, 2015). Globally, about 16% of disabling hearing loss in adults is due to work-related noise (Melese et al., 2022). Exposure to loud noise from machines and tools of work as reported by Wanjari et al., 2020; Elechi et al. (2019), Odibo, Nwaogazie, Achalu & Ugbebor (2018) causes hearing loss or disorientation. Hearing loss is either total or partial. Total loss is inability to hear sounds, while partial (disorientation) is inability to understand speech, especially when there is a lot of noise around.

Normal hearing function involves arrival of sound waves at the auricle, passing through the external auditory canal and causing the vibration of the tympanic membrane. Vibration is then transmitted via the ossicles (malleus, incus, stapes) to the cochlea. Subsequently, hair cells inside the cochlea stimulate the cranial nerve eight which transfers the stimuli to the brain. Repeated noise at or in the excess of 90 decibels for eight hours or more causes noise –induced

hearing loss (NIHL) to welders and wood workers. This results in damage to the sensory hair cells of cochlea causing permanent threshold shift or deafness (Osagiede et al., 2020; Felman, 2018).

The main pathological change in noise-induced hearing loss (NIHL) is the mechanical damage to the cochlea, which occurs as a result of high intensity of noise. The hair cells in organ of Corti are directly affected by the high intensity of continuous sound causing the constriction of cochlear blood vessels. This leads to a decrease in the flow of blood to the cochlea and causes ischaemia and hypoxia of hair cells (Fettiplace and Kim, 2014). Hearing loss can also result from damage or rupture of ear drum from sudden release of compressed air into the ear . This can even penetrate deeply into the skin resulting in an air bubble in the blood stream (an embolism) which is very fatal.

2.1.5.4 Musculoskeletal (MS) Health Problems Among Artisans

Musculoskeletal disorders (MSDs) often referred to as overuse syndrome, repetitive strain injury or cumulative trauma disorder is an umbrella term for health conditions that affect the bodily movements, involving the muscles, tendons, ligaments, nerves, spinal discs, blood vessels (Aiggan et al., 2020; Canadian Centre for Occupational Safety, 2015; Caleb et al., 2012). They occur in the neck, shoulders, forearms, elbows, lower back, waist, wrists, thigh and knees with diverse rate across the parts of the body (Hamid and Mohammed, 2017).

MSDs are marked with low back, waist and joint pains (including hands and fingers), fatigue, muscle weakness, stiffness and limitation of movements, sensory loss and numbness, or local swelling and increased heat due to inflammation. These disorders are often caused or aggravated primarily by work activities or effects of immediate work environment. Work-

related musculoskeletal disorder (WMSD) is an important public health problem and is prevalent among workers whose job activities involve repetition, force, awkward, extreme or fixed postures, vibration, bending, lifting of heavy objects as well as psychosocial factors (Etana et al., 2021; Aiggan et al., 2020). Globally, WMSD is a significant health problem, an important cause of morbidity and disability in many occupational populations (including welding and wood work), with low back pain being the single leading cause of disability (Gibiri et al., 2012). It greatly limit mobility and dexterity, causing significant economic burden including loss of work time or absenteeism, increases work restriction, transfer to other jobs, early retirement, lower levels of well-being and reduced ability to participate fully in the society among workers (Sirajudeen et al., 2018). Due to population growth and aging, the number of people living with musculoskeletal conditions and associated functional limitations has continued to increase. The proportions of WMSD are higher in the aging group compared to the younger group and common in high-income countries than in low-income countries (Kibret et., 2020). WMSDs are the most expensive form of work disability, attributing to about 40% of all costs towards the treatment of work-related injuries (Yasobant and Rajkumar 2014). According to Great Britian Labour Force Survey (2016), work-related musculoskeletal disorders (WRMSDs) constitute 41% of the total work-related illnesses and are accounted for 34% of absenteeism due to work-related illnesses (Sirajudeen et al., 2018). World Health Organization in their report, put the number of people living with musculoskeletal conditions globally at approximately 1.71 billion (WHO, 2022).

Origin of most musculoskeletal disorder lies in mismatch between the external load (work) and the capacity of worker's body to resist bio-mechanical and physiological strain. Excessive forces trigger different pathophysiological processes depending on the tissues affected

(muscles, tendons, joints, bones and nerves). The magnitude, duration, frequency of loading and time for recovery determine the physiological effect. Symptoms on different body parts depends on how far the processes have advanced and capacity depends on individual factors such as body build and size, gender, age, and general health. The capacity varies with time and workers body adaptation to the loading (example, training effects/weakening). It is important to note that while bending, muscles are no longer active and only soft tissues play a role. The above tasks generate load on the spine that exceed failure load thereby causing musculoskeletal disorder.

Ergonomic hazards of awkward and fixed postures, repetitive bending and manual lifting of heavy objects during work activities have been reported to greatly affect welders and wood workers leading to musculoskeletal disorders (Adei, Mensah, Agyemang-Duah & Kankam, 2021; Wanjari *et al*., 2020; Balogun *et al*., 2016; Gibiri *et al*., 2012). These workers often experience musculoskeletal problems in the course of their work activities. Auto welders who work inside vehicle cabins, under bonnets, under vehicles making use of different machines and equipment, expose themselves musculoskeletal health challenges. Working inside the confined and awkward spaces within vehicle cabins, often for long period, result in body-stressing injuries. And working under vehicles has its associated hazards of poor lighting, cramped working conditions, awkward or sustained postures, hot engine parts and hazardous substances (like fuel, oils and fluids). Arc welders on their own part, often perform their work activities in a fixed or awkward position leading to musculoskeletal disorders.

Wood workers are not left out in the issue of work-related musculoskeletal disorders due to manual handling of wood and their products (Rahman et al., 2019).

2.1.5.5 Skin Health Problems Among Artisans

Dermatitis simply referred to as skin inflammation, embraces a range of ailments, with early stages characterized by reddish, dry, and itchy skin, while advanced stage is marked by crusty scales, painful cracks, or blisters that ooze fluid (Gardener, 2021). Skin sensitization is often associated with chemical substances and materials used in workplace activities according to International Labour Organization, (2015). Skin contact with irritants and allergenic materials of work causes inflammatory responses resulting in dry skin and hand dermatitis to affected workers in their various places of work.

Occupational contact skin diseases include irritant contact dermatitis (ICD), allergic contact dermatitis (ACD), and contact urticaria. Occupational contact dermatitis accounts for 95% of all occupational diseases. ICD accounts for 70% of all occupational dermatitis; the majority (68%) of cases are caused by wet work. Athough dermatitis can occur anywhere on the body, hands are the most frequently affected location. Long term or repetitive exposure to allergens or irritants leads to chronic dermatitis resulting in significant reduction in quality of life (Carøe et al., 2010).

Contact dermatitis, an inflammatory eczematous skin disease is caused by chemicals or metal ions that exert toxic effects without inducing a T - cell response (contact irritants) or by small reactive chemicals that modify proteins and induce innate and adaptive immune responses (contact allergens). Contact dermatitis includes irritant contact dermatitis and allergic contact dermatitis. Irritant contact dermatitis is a non specific response of the skin to direct chemical damage that releases mediators of inflammation predominantly from epidermal cells, while allergic contact dermatitis is a delayed (type 4) hypersensitivity reaction to exogenous contact

antigens. Immunological responses are due to the interaction of cytokines and T cells (Litchman et al., 2023).

Exposure to irritants (such as fuels, solvents, various oils and skin cleaning agents as well as used gasoline engine oil) and allergic factors (such as metals, rubber, preservatives and additives is common with both automobile and arc welders (Sahkvidi et al., 2019). This increases their propensity towards occupational contact dermatitis and allergic hand dermatitis (Warshaw et al., 2017).

Chemicals used in wood production, especially in preservative treatment, adhesive application and coating of final products, though they play positive roles in enhancing the life span of wood products, contribute to hazardous chemicals encountered by wood workers in wood industries and small-scale enterprises (Adhikari and Ozarska, 2018).

Wood adhesives such as phenol-formaldehyde (PF) and urea-formaldehyde, although good for bonding wood components into wood products, have deleterious effects on health. Other wood curing agents like aliphatic amines and cycloaliphatic amines cause irritation and damage to the skin, resulting in hand dermatitis (Zhang et al., 2013). Allergic skin reactions from chemical substances used in wood treatments manifest as dry, reddish and itchy skin.

With occupational skin problem, the skin becomes swollen, cracked, scaly or thickened, at times with blisters (Elechi et al., 2019).

Other skin (dermatology) problems include burns, bruises, cuts and lacerations. These are work-related injuries resulting from implements and tools of work. Some machines used in welding and wood work activities, because of their pointed edges, high-powered force, exert stress and injure artisans exposed to them. Excessive heat generated by machines and tools of work during welding and wood work activities often cause burns to involved artisans. Sharp

edges of vehicle parts and tools used in loosening and replacing vehicle parts, occasionally result in injuries of the hands and fingers (bruises, cuts and lacerations) to auto welders. At times, angle grinder once in a while, can become a dangerous power tool as kickback can result in severe cuts to auto welders. Discs sometimes disintegrate or shatter and fragments released may cause cuts or become lodged in welder's body. An auto or arc welder who operates/maintains unguarded or inadequately guarded machines and equipment often sustain abrasions, burns, cuts and at times more severe injuries such as lacerations, crushing, fractures or even amputation (Oche, 2020; Johnson and Bassey, 2016; Amfo-otu and Agyemang, 2016). Cuts, abrasions, and lacerations can also result from handling wood pieces and/or by using tools or equipment of wood work (Ayuk, 2019: Agu et al., 2016; Richard et al., 2017).

2.1.5.6 Arterial (Blood) Pressure Health Problems Among Artisans

Hypertension as defined by European guidelines, is an office systolic blood pressure (SBP) of ≥140 mmHg and/or diastolic blood pressure (DBP) of ≥90 mmHg. It is an increasing global health issue, estimated to affect 1.13 billion people worldwide, with 1 in 4 men and 1 in 5 women. In comparison with other WHO regions, Africa has the highest prevalence of hypertension with an overall prevalence of 46% in adults aged 25 years and above for both sexes combined. Analytical review of the prevalence of hypertension among Nigerian adults showed an estimated prevalence of 28.9% with range of 6.2 - 48.9% for men and 10.0 - 47.3% for women as well as 30.6% and 26.4% among urban and rural dwellers respectively (Adeloye et al., 2015). In low and middle-income countries of the world, hypertension has been described as increasing health issue and is predicted to increase by 15–20% by 2025 (Hunter et al., 2021).

Hypertension (ICD10 110 - 115) is a common chronic non - communicable disease and the major risk factor for cardiovascular disease world wide. Apart from its high disability and

mortality, hypertension creates great burden to the concerned worker as well as the family and the society. Global Burden of Disease Study 2019, reported that there were about 10.85 million deaths caused by hypertension globally in 2019, accounting for 31% of all causes of death. The prevalence of hypertension increases with age, affecting >60% of people older than 60 years, and is a leading cause of premature death worldwide (Zhang et al., 2022).

According to the World Health Organization (WHO), 2019, an estimated 38% of adults in Nigeria, between the ages of 18 years and above, had hypertension. From data culled from fifty-three (53) studies, covering almost 80,000 people across the six geopolitical zones of Nigeria, the age-adjusted prevalence of hypertension increased from 8.6% (representing 4.3 million of the total population) in 1995 to 32.5% (representing 27.5 million of the total population) in 2020 (Adeloye et al., 2022). This covers a significant portion of the workforce in Nigeria; of which 93.5% of employed Nigerians were engaged in informal employment in the fourth quarter of 2022, according to the National Bureau of Statistics (2023).

Some of the factors that contribute to hypertension among artisans include occupational stress, poor working conditions, irregular working hours, limited access to healthcare, and unhealthy lifestyle choices. Artisanal activities often involves physical labor, long hours, and exposure to environmental stressors. Demands of artisan job also contribute to chronic stress, a known risk factor for hypertension. Many artisans work in environments devoid of proper ventilation and safety measures and prolonged exposure to factors like noise, dust, and harmful fumes contribute to the development of hypertension over time. Irregular working hours common among artisans often disrupt sleep patterns and lead to an unhealthy lifestyle. Poor sleep and irregular routines are associated with hypertension. Artisans, especially those in informal sectors, face challenges in accessing regular healthcare, leading to undiagnosed or untreated

hypertension. Poor dietary habits, lack of physical exercise, and tobacco use are prevalent among some artisan communities. These lifestyle factors contribute significantly to the development and exacerbation of hypertension. Implementing health education programs that raise awareness about hypertension, its risk factors, and preventive measures can empower artisans to make informed lifestyle choices. Promoting healthy working conditions, including proper ventilation, safety measures, and regular breaks, will help in reducing stress and preventing hypertension. Efforts to improve access to affordable healthcare, especially in informal sectors, can ensure early detection and management of hypertension.

Encouraging artisans to adopt healthier lifestyles through programs that focus on diet, exercise, and stress management can contribute to hypertension prevention and control. Building a supportive community network that emphasizes the importance of regular health check-ups and encouraging healthy behaviors are some of health strategies that could play vital roles in addressing hypertension among artisans.

2.1.6 Awareness of Occupation-Related Health Challenges Among Artisans

Every occupation has its specific health problems but the level of awareness and knowledge of such health issues go a long way in minimizing and/or preventing them. However, level of awareness and knowledge of occupational health challenges among artisans in Nigeria is quite low. This has lead to increased incidences of workplace injuries and other health problems among artisans (Agbana et al., 2016).

Evidence from numerous studies have it that level of awareness and knowledge of occupational health problems have great influence on the attitude of artisans towards protection of occupational hazards. Awareness gap regarding occupational health issues and their control is a

major factor contributing to high rate of occupational injuries and illnesses among workers word over. There is therefore need for improved education and training on occupational health and safety in order to increase this level of awareness and knowledge of occupational health challenges among artisans. Employers should also provide regular training on the proper use of safety equipment and the importance of occupational health and safety. Additionally, public awareness campaigns can be conducted to promote the importance of workplace safety among artisans (Marahatta et al., (2018); Oboh and Ofagbor, (2019); Agbana et al., (2021) Adeniyi and Isah, (2023).

2.1.7 Occupational Safety and Health Practices Among Artisans

Occupational Health and Safety (OHS) issues have not been accorded necessary and adequate attention by government and safety professionals of Nigeria. Although Nigeria signed the 1981 ILO's Geneva Convention on Occupational Safety and Health (OSH), it is still struggling with the implementation and enforcement of OSH policies and regulations (Umeokafor et al., 2014). Most artisanal activities in Nigeria have often failed to meet decent work criteria as evident in the way artisans earn their livelihood under insecure and precarious working conditions (Afolabi, 2021). Like in most low and middle-income countries of the world, there is lack of occupational safety and health regulation and enforcement, lack of occupational health facilities and inadequate health care professionals trained in the recognition of work-related diseases among artisans in Nigeria (Akinwale et al., 2014; Adeogun and Okafor, 2013; Kalejaiye, 2013; Diugwu et al., 2012).

Other relevant factors responsible for poor occupational health and safety among artisans in Nigeria is low level of awareness of National Health Insurance Scheme which has prevented artisans from benefiting from the programme (Asakitikpi, 2019). There is also ignorance of

occupational safety and health issues among artisans (Adeoye et al., 2015; Adeogun et al., 2013). A cause of great concern is the poor knowledge of occupational hazards and their prevention, the abysmally low level of compliance with occupational health and safety regulation among different categories of artisans in Nigeria. Reports of studies conducted in Nigeria and other Sub-Saharan African countries showed that majority of these artisans never had training on occupational health and safety, and were either unaware, or become aware of occupation–related health challenges after experiencing them (Ashamah-Lomotey, 2018; Richard et al., 2017; Hassan et al., 2018; Ojo et al., 2020). For instance, Richard et al. (2017) study among sawmill workers in Nakuru County, Kenya, has it that most (80%) of the workers had no occupational health and safety training. Also, a cross sectional descriptive study carried out by Hassan et al. (2018) in Lahore, Pakistan to assess the level of awareness of occupational health hazards among 70 welders, discovered that 45.7% of respondents regarded welding profession as one with no major health risk.

Several studies in Nigeria and other sub-saharan African countries have reported poor adherence towards health protection among workers. In a study in Nakuru County, Kenya by Richard et al. (2017), findings showed that sawmill workers were not adequately provided with face shields (16.0%), nose mask (46.0%), earplugs (21.0%) and helmets (44.0%). And this led to majority of accidents (45.1%), at sawmill workshops and production areas. In Nigeria, studies by Elechi et al., 2019; Elenwo, 2018; Agu et al., 2016; Afolabi et al., 2021, all pointed point towards low compliance to occupational health and safety standards among artisans. These have resulted in high incidences of work-related health challenges with increased lost-work days and low productivity among artisans in Nigeria (Afolabi et al., 2021).

There is therefore need for functional occupational health and safety services which will involve proper health and safety education for this economically viable group of workers on workplace hazards, the types and proper use of personal protective devices in order to safeguard their health.

Also, connections between occupational health services and health care centers should be established to cater for the health challenges of artisans as well as their return to work after long-term absence due to work-related morbidity (WHO-ILO, 2021).

There is also need for various artisan unions to make adequate and proper representation to the appropriate tier of government. The Ministry of Labor and Productivity in conjunction with the Ministry of Health should collaborate to provide health care for informal workers, as close as possible to where they live and work, in keeping with one of the principles of the primary health care program and Sustainable Development Goals 8 and 3 of decent work and economic growth, well-being promotion and good health to all (United Nations, 2015).

2.1.8 Personal Hygiene and Sanitation Practices Among Artisans

Hygiene and sanitation practices are fundamental for preventing and controlling diseases, their spread as well as maintenance of health and well being of artisans. Keeping oneself, one's environment (both living and working) clean in order to prevent illnesses and diseases should be the priority for workers (Saleem et al., 2019). Cleaning the body through- bathing, hair grooming, care of the teeth, feet, eyes, skin, ears, nose, hands and nails should be upheld by artisans, in order to minimize their vulnerability to health challenges (Better Health Channel, 2015)**.** All activities and actions aimed at preventing diseases, staying healthy, and keeping fit among workers should be enforced in line with Sustainable Development Goal 6.2 which calls for universal access to adequate and equitable sanitation hygiene by 2030 (Hutton et al., 2016).

Sanitation practices among artisans entail all processes geared towards collection and safely disposal of all kinds of wastes within the work environment, with intention of protecting, promoting health and enhancing quality of life of workers. These practices generally should include provision of facilities and services for safe disposal of waste, maintenance of hygienic condition and prevention of diseases.

Sanitation and hygiene practices being key public health interventions are essential for social and economic development, leading to improvement of health and well-being of workers (Abubakar., 2017). Though a study conducted by World Health Organization (WHO) in 2012 indicated a return of 5.5 USD with respect to lower health costs, more productivity and fewer premature death for every 1 USD invested in sanitation, yet about 10% of the global disease burden and one third of all annual death in low- and middle - income countries, resulting from inadequate water, sanitation and hygiene is believed to be due to poor sanitation (WHO, 2017). Presently, about 700 million people lack adequate sanitation and this has been a clog in the achievement of target 10 of Millennium Development Goals (MDGs) which involves halving the proportion of people lacking sustainable access to basic sanitation, by close to three-quarters of a billion people (UN, 2015).

Safe sanitation is the key to socio-economic well-being and sustainable development of any society. However, about 32% of the global population (about 2.4 billion people) do not have access to improved sanitation. Of these, about 1 billion people defecate in the open (UN, UNICE/WHO, 2015). In Nigeria, with a population of 186 million, access to improved sanitation declined from 38% of the population in 1990 to 29% in 2015. Within the same period, the proportion of open defecators increased from 24% to 25%. Poor sanitation

perpetuates vicious cycle of disease transmission and has been linked with increased incidences of sanitation-related illnesses such as hepatitis, dysentery, cholera, typhoid fever and neglected tropical diseases such as schistosomiasis, trachoma, ascariasis, helminthiasis, poliomyelitis and many more. These have been linked with loss of income and production time among workers, making Nigeria to lose about #455 billion annually or about 1.3% of its GPD, in addition to sanitation-related illnesses (WSP, 2012). Artisans in welding and wood industries, are somehow contributing to these losses since there is poor house keeping in their workplace environment, indiscriminate disposal of wastes as well as neglect of personal hygiene: bathing, hair grooming, care of the teeth, hands and nails by the majority of these workers (Diwe et., 2016). In some welding and wood enterprises, there is lack of functional sanitation facilities, indicating that open defaecation thrive among them. This also would have added to their already affected health conditions, thus increasing the morbidity and mortality among welding and wood artisans in Nigeria.

2.1.9 Attitude towards Occupation-Related Health Protection Among Artisans

Attitude of artisans plays an important role in their safety and well-being at work. It is the index of their behaviour, mental state of readiness, organized through experience, which exerts a direct influence on all their responses to situations of work. Keith Harrell (2018), posited that attitude is everything, affecting and influencing workers behavior which in turn impacts their feelings, opinions and dispositions towards work hazards.

Positive attitude towards work hazards enhances efficiency, productivity as well as health and well-being of artisans. But negative attitude exert deleterious effects not on artisans' health and well-being alone, but also on that of their families and the greater society(WHO, 2017).

Negative attitude towards health hazard is often expressed in comments such as "I don't feel comfortable using eye googles", or "coverall is too heavy".

Poor attitude of artisans towards health protection has been reported by several studies in Nigeria and other sub-saharan African countries. In a study in Nakuru County, Kenya by Richard et al. (2017), reported poor attitude towards health protection among workers. From the findings, sawmill workers were not adequately provided with face shields (16.0%), nose mask (46.0%), earplugs (21.0%) and helmets (44.0%). And this lead to majority of accidents (45.1%), at sawmill workshops and production areas. A study in Nigeria by Oboh and Ofagbor (2019), on predominant ocular challenges and protective eyewear compliance among welders in mechanic and steel villages in Port Harcourt, Rivers State, also reported low attitude of welders towards compliance with the use of protective eyewear. Of 103 respondents used for the study, only 5.8% of welders complied regularly with use of protective eyewear, 60.2% complied occasionally, 28.2% complied sparingly while 5.8% never used protective eyewear before.

2.1.10 Factors Influencing Occupation-Related Health Challenges Among Artisans

Workplace incidents though unintentional and undesired events, yet they occur from time to time, hampering completion of work activities and often lead to injuries and other health challenges. Most work related incidents are preventable, if only adequate preventive/precautionary measures are observed (Adeoye et al., 2015).

There are some contributory factors to occupational health dysfunctions. Hazards originating from inadequate safety and health standards for instance, poor housekeeping, are particularly evident among artisans in Nigeria due to inadequate supervision and lack of occupational

health services (Afolabi, 2021). Non-compliance and non-usage of personal protective devices (Elenwo, 2018; Balogun et al., 2016). Unsafe work-practices such as touching hot surfaces, sucking petrol with one's mouth and washing hands with fuel, treating injuries with chemical substances are some of the factors that have been reported to have caused health problems among artisans in Nigeria (Adeyemi et al., 2016; Ojo et al., 2017).

Certain socio-demographic characteristics of artisans influence their risk of health challenges. Socio-demographic factors of age, gender, educational level, income, years (duration) at work, work schedule, work habits and practices among others act either singly or in combinations to affect the health of artisans. Age of an artisan is a significant factor that influences workplace accidents, injuries, diseases and disabilities. According to European Agency for Safety and Health at Work, younger workers are 50% more likely to be involved in work related accidents due to lack of adequate work experience and relative work maturity. As the agency posited, some young workers may feel uncomfortable to ask for help or information from older workers.

According to a study conducted by Oranusi et al. 2014 on assessment of Occupational Diseases among Artisans and Factory Workers in Ifo, Nigeria. Result of distribution of the respondents by age, showed that majority (52) of the respondents (34.62%) were young, between 30-39 years of age. Also, the study of Ibeneme et al. (2015), supported that of Oranusi et al. 2014 by stating that younger artisans are more likely to sustain work-related injuries than older artisans. That is because, based on his study, younger artisans are more likely to engage in risky behaviour and are less likely to use protective equipment.

Gender is another demographic factor that influences the risk of health challenges among artisans. A study by Ezinne et al. (2021) on occupational ocular injuries and utilization of eye protective devices among sawmill workers in Ojo local government of Lagos State, Nigeria, revealed that majority of sawmill workers were male (93.7%). This may be due to the fact that most artisanal activities are male dorminated, since male engage in physically demanding work than females. In the study conducted by Oranusi et al. 2014 on assessment of Occupational Diseases among Artisans and Factory Workers in Ifo, Nigeria. Findings of distribution of the respondents by sex indicated that majority of all the workers were males while minority were females.

Educational level is also an important factor that can influence the risk of health challenges among artisans. Ibeneme *et al*. (2015), in his study revealed that artisans with higher level of education are more likely to use protective equipment and less likely to engage in risky behavior. This suggests that education can play a crucial role in promoting safety among artisans.

Another important socio-demographic factor that influence the risk of health challenges is the income level of the artisans. Ogbuagu et al. (2019) in his study, found out that artisans with lower income levels are more likely to experience work-related injuries than those with higher income levels. This may be due to the fact that artisans with lower income levels may not have access to the same level of safety equipment and training as those with higher income levels.

In the development of strategies to promote workplace safety and mitigate the risk of health challenges among artisans, it is important to consider these socio-demographic factors as they play vital roles in influencing the risk of hazards at work.

2.1.11 Artisans At High Risk of Occupation-Related Health Challenges

Though artisans encounter different health challenges in their individual work environments, but certain group(s) of artisans may be at higher risk of these health challenges than others due to peculiar occupational hazards associated with the nature of their work (Afolabi et al., 2021; Nduka et al., 2019). Welders are a group of artisans at high risk of health challenges in Imo State, Nigeria. According to a study by Ogbuagu et al. (2019), welders are more likely to experience work-related injuries and health problems than other groups of artisans. This may be due to the fact that welding involves exposure to harmful fumes and radiation, as well as the use of dangerous equipment.

Construction workers are also at high risk of health challenges in Imo State. A study by Anyanwu et al. (2019) found that construction workers were among the most likely to experience work-related injuries. This may be due to the fact that construction work involves physically demanding tasks, such as carrying heavy loads and working at heights.

Automobile mechanics are another group of workers at high risk of health challenges in Imo State. According to a study by Ibeneme et al. (2015), mechanics were among the most likely to experience work-related injuries an health problems. This may be due to the fact that mechanics are exposed to hazardous chemicals and work with dangerous equipment.

Also, auto electricians are at high risk of health challenges in Imo State. According to a study by Ibeneme et al. (2015), electricians were among the most likely to experience electrical shocks and burns. This may be due to the fact that electricians work with high voltage electrical systems and are exposed to electrical hazards.

Summarily, welders, construction workers, mechanics, and electricians are among the groups of artisans in Imo State, Nigeria, who are at high risk of health challenges. It is important to develop strategies to promote workplace safety and reduce the risk of health challenges among these groups of artisans.

2.1.12 Preventive Strategies Against Occupation-Related Health Challenges

Controlling exposures to health hazards is the fundamental method of protecting workers from workplace accidents, injuries and diseases. And this is the main goal of occupational health care. The use of hierarchy of controls is one of many safety-focused strategies developed by NIOSH and originated from NIOSH's prevention through design initiatives. The purpose behind this hierarchy is to prevent or reduce occupational injuries, illnesses and fatalities through the inclusion of prevention considerations in all designs that impact workers. Traditionally, this has been used as a means of implementing feasible and effective control solutions.

The hierarchy, commonly depicted as an inverted triangle, is divided into five sections: elimination, substitution, engineering controls, administrative controls and personal protective equipment (See Appendix) which are often listed in order of their effectiveness, though they work best when in combination. Following this hierarchy often leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced (Centers for Disease prevention and control, 2015).

2.1.12.1 Elimination and Substitution

Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. When the process is still at the design or

development stage, elimination and substitution of hazards may be inexpensive and simple to implement. But for an existing process, major changes in equipment and procedures may be required for elimination or substitution of hazards to be effective.

2.1.12.2 Engineering Controls

Engineering controls are the most effective at reducing work-related musculoskeletal disorder (WMSD) hazards, but may also be the most difficult to implement for an established work process. Changing the way materials, parts, products, and tools are used can relieve workers from WMSD risks. Engineering controls include mechanical assist devices, fixtures, and lighter-weight packaging materials.

Engineering controls are favored over administrative and personal protective equipment (PPE) for controlling existing worker exposures in the workplace because they are designed to remove hazards at source, before they make contact with workers. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The initial cost of engineering controls can be higher than the cost of administrative controls or PPE, but over the longer term, operating costs are frequently lower, and in some instances, can provide cost savings in other areas of the process.

2.1.12.3 Administrative Controls and Personal Protective Equipment

Administrative controls are practices and policies that workers must follow until engineering controls become feasible. The limit of exposure to the hazard can be reduced by minimizing the length of workers' shifts, implementation of job rotation, scheduling more breaks, varying the

tasks for individual jobs, or training workers on how to minimize exposure to hazard, such as stepping and turning instead of twisting during manual handling.

Personal protective equipment (PPE), such as nose mask, ear muffs, safety goggles, anti-vibration gloves and grip-gloves, may protect workers from immediate hazards. PPE is inexpensive and used frequently where hazards are not under administrative or engineering control.

Administrative controls and PPE are frequently used with existing processes where hazards are not particularly well controlled. Administrative controls and PPE programs may be relatively inexpensive to establish, but over the long term, can be very costly to sustain. These methods for protecting workers have also proven to be less effective than other measures, requiring significant effort by the affected workers.

Previous studies have shown that most work-related accidents and diseases are preventable if exposure to work-related hazards is reduced or eliminated (Hui-Nee, 2014). Prevention could be realized by implementing sector-specific work-related safety guidelines such as those developed by the ILO (e.g., ILO, 2000; Health and Safety Executive, 2009). Work-related safety guidelines include usage of safety devices or equipment, providing adequate barriers that separate workers from hazards, discarding outdated equipment, providing adequate protection against falls and chemical exposures, and encouraging the use of personal protective equipment (PPE) by workers. However, these recommended preventive measures, and the work-related health and safety laws, are targeted mostly at formal organizations where the employers have corporate responsibility for the health and safety of their employees (Lund et al., 2016).

In Nigeria, there are no laws that regulate occupational health and safety for artisans especially in informal sector (Afolabi, 2021). Hence, incorporating work-related health and safety measures in their workplaces is not a legal necessity for these workers (WHO, 2017). Besides the absence of adequate government regulation and surveillance, previous research has identified a number of other barriers to work-related health and safety for artisans in Africa. There is therefore need for proper health education/awareness creation on the occupational hazards among artisans as well as regulatory enforcement on occupational health and safety standards especially consistency on the usage of PPE on the part of government of Nigeria. Also, since different artisan groups are likely to face specific health challenges, it will be relevant to explore the views of specific groups of artisans on how to prevent or reduce these hazards.

2.2 Theoretical Framework

There are great number of theories and models that are used in the explanation of work-related health challenges. These theories and models provide frameworks for understanding causes of workplace accidents and illnesses, as well as strategies for their prevention. Some of the key theories include: Epidemiological Triad Model, and Health Belief Model (HBM) and Hierarchy of Hazard Controls Model.

2.2.1 Epidemiological Triad Model

Epidemiological Triad Model is a widely used framework in occupational health. It was initially developed by scientists to aid in the description of disease dynamics, but has also been extended to other areas such as non infectious diseases, accidents and injury explanation within a given population. The triad tries to explain the causation and spread of disease within a specified population, by answering the questions as to- what, who and where of disease

causation and transmission. The basic principle of epidemiological triad is that health problem does not occur as a random event, but rather brought about by certain conditions. According to the model, every worker within a given population has a set of unique characteristics and risk factors that determine his or her propensity towards certain work-related health problems. Understanding the impacts of these risks factors therefore provides public health officers with the tools to develop policies and interventions for these health problems, their control and prevention for workers as a whole. As an epidemiological tool, the triad is utilized to determine all the factors internal and external to the host (the human), which make them susceptible to the agent and has been used for a long time to determine specific factors that contribute to heath issues.

In epidemiological triad, the three factors or components that are taken into consideration are - the agent, the host, and the environment.

i. Agent: The agent include hazardous factors that can cause harm/ health problem (i.e the "what" of the triangle) to the host. In the context of this study, agents include physical hazards of noise, heat, vibration, radiation, metal and wood particles; chemical hazards of metal fumes, wood dusts and smoke; ergonomic stressors of manual lifting of heavy work material, repetitive movements, fixed and awkward postures. Duration of exposure (years at work) to these agents can affect the likelihood of work-related health problems.

ii. Host: The host refers to human (i.e the "who" of the triangle) who is at risk of developing health problem due to continuous exposure to hazardous conditions or substances in a given population. Factors that influence the host's susceptibility to health problems include age, gender, lifestyle, hygiene practices, health behaviour and underlying health conditions.

iii. Environment: The environment refers to those external factors that allow the health problems to occur, the host having being exposed to them (i.e the “where” of the triangle). They are the physical and organizational characteristics of a given population that interact with the host and agent. In the context of the present study, it includes factors of work such as design and procedures, workspace, safety protocols e.t.c. Environment also include biological and socioeconomic factors such as poor house keeping, poor sanitation, low income, workplace air pollution e.t.c. It plays a pivotal role in the determination of duration and exposure level of the agent as well as the availability and utilization of preventive measures like personal protective equipment (PPE), see fig 2.1 below.

The interconnections between host, agent and environment allows a more comprehensive understanding of health problems manifestation within a given population. Altering any of these components, changes the probability of occurrence of health issues in such population. The goal of Epitriad model therefore, is to break at least one of the sides of the triangle, disrupting the connection between either the environment, the host or the agent and stopping the negative health effects from occurrence. Consideration of these factors, help public health officers and other stakeholders of health to develop targeted interventions and preventive strategies to reduce risks and improve the health and safety of workers.

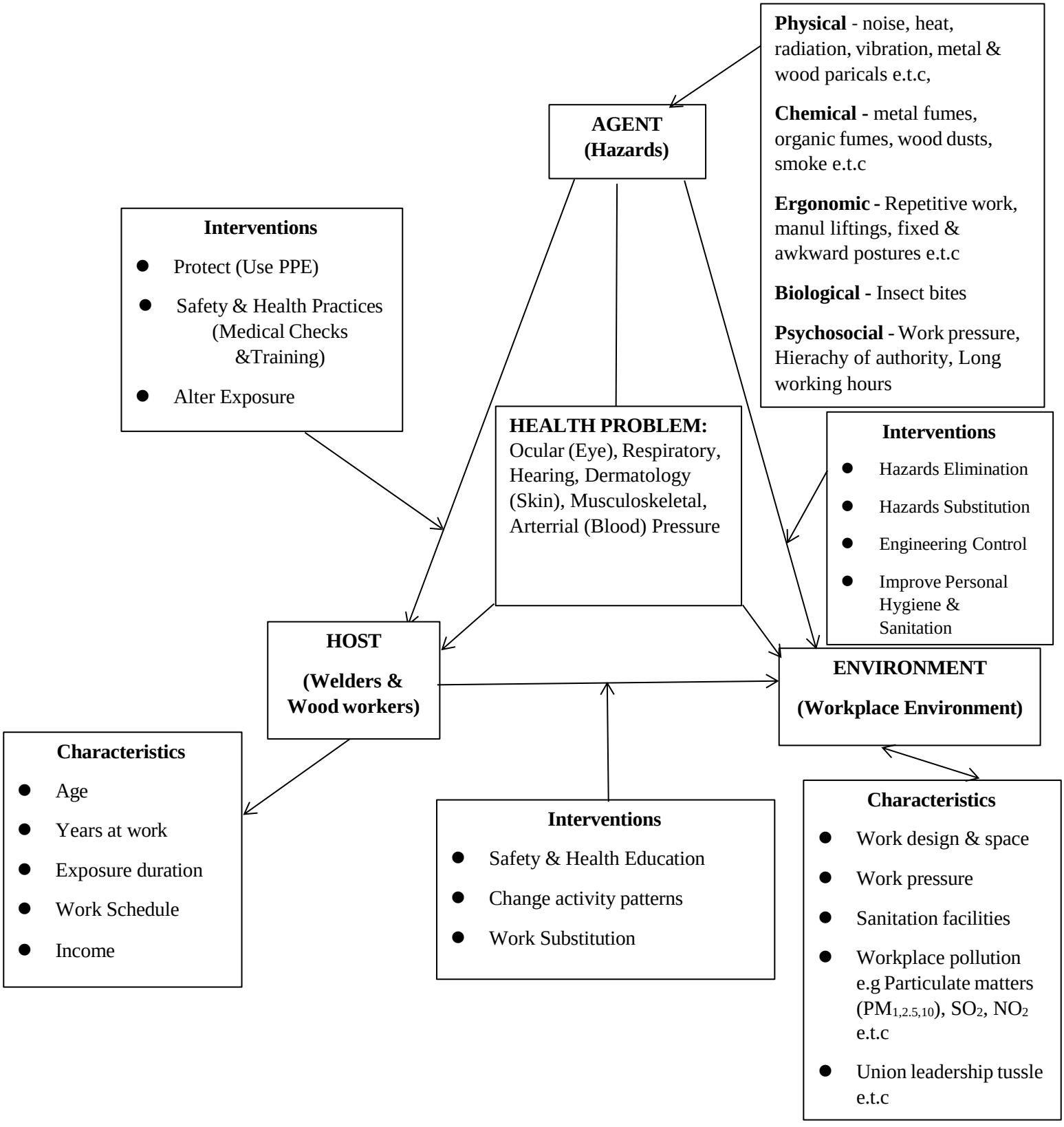

Fig 2.1: Schematic Presentation of Epidemiological Triad Model

This present study is based on the theoretical or conceptual constructs of Epidemiological Triad Model created by Wade Hampton Frost (Morabia, 2013). Being one of the most widely recognized frameworks used in occupational health, it can be applied to assessment of work-related health status of workers. With emphasis on safety and health strategies such as medical checks, safety training, utilization of personal preventive equipment (e.g nose masks, ear muffs, hand gloves, eye goggles, coverall clothing), maintenance of personal hygiene (hand washing, bathing after work), provision of sanitation facilities (urinals and toilet), workers can be protected from hazard exposures and their subsequent health challenges.

Consideration for Implementation

This model can be used to design short- or long-term intervention programs to prevent occupational challenges for workers. Public health officers and other stakeholders in health can achieve this, through provision of functional occupational safety and health services (which will include safety training, health education and awareness creation on the use of personal protective devices). Workers on their part, can improve their personal hygiene and sanitation practices at work, while administratively, sanction could be placed on defaulting workers who fail to observe safety instructions. By so doing, the connectivity between the three components of epitriad (agent, host, environment) will be broken, thus preventing or minimizing health issue occurrences among workers.

Epidemiological Triad Model can either be used alone or in combination with other theories or models. For its effectivity, identification of strategies that are meaningful and appropriate for specific target population is very important. For instance, awareness creation and education of wood workers towards wood dusts will enable them understand the importance of protecting

themselves (using nose masks) from such hazards. Once achieved, this can lead to reduced respiratory health challenges, and improved overall health and well-being.

2.2.2 Health Belief Model (HBM)

Health Belief Model, developed in 1950s, is one of the most widely used theoretical model for understanding health behaviour. The model is often used to guide health promotion and disease prevention programs. HBM tries to explain and predict individual changes in attitude towards health and safety. The key elements of health Belief Model focus on individual belief about health conditions, which predict individual health-related behaviors.

The model defines the key factors that influence health behaviour as individual's perceived threats of potential health issues and consequence of not doing something about it (susceptibility perception and severity), positive benefits and low barriers to such behaviors (perceived benefits and barriers), exposure to factors that prompt individuals to action (cues to action) and confidence in ability to succeed (self efficacy).

Individual Perceptions: This component of the Health Belief Model consists of the following constructs:

a. Perceived susceptibility

Perceived risk or susceptibility is one of most powerful perceptions in prompting individuals to adopt healthier behaviours. The greater the perceived risk, the greater the likelihood of engaging in health behaviours to decrease the risk. Individuals with high risk towards lung disease, for a instance family history of lung disease may likely adopt behaviours that will protect them from the perceived health problem.

b. Perceived severity

This construct speaks to an individual's belief about the seriousness of a disease. This is often based on medical information or knowledge but may also come from the belief an individual has about the difficulties such a disease would create or the effects it would have on his life in general. Knowledge that not using safety googles by an arc welder will result in vision loss due to retinal burn, may make such welder to adopt the use of safety googles (PPE) during work activities.

c. Perceived threat

When the perception of susceptibility is combined with severity, it results in perceived threat. If the perceived threat is to a serious health problem like retina burn for which there is real risk (blindness), behaviour often changes.

Modifying factors: Variables that modify an individual's perception includes the following:

a. Demographic variables

Variables such as age, sex, occupation can modify an individual's perception (Tome et al., 2012). For instance, a young school boy does not perceive the importance of wearing safety goggles or the importance of safety and health training. For this study, age, sex, marital status, occupation which are some the demographic variables used can modify the respondents' perception of work-related health issues.

b. Sociopsyschologic variables

Social pressure from peers or other reference groups (vocation groups), personality or social class may encourage protective behaviour (Tome et al., 2012). In this study, income, work duration (years of work), work schedule could influence occurrence of work-related health challenges.

c. Structural variables

These are variables presumed to influence behaviour such as awareness of work-related hazards or health problems. In this study, awareness towards occupational hazards and health issues would influence the respondents' behaviour towards taking precautionary measures for instance, use of protective equipment (PPE).

d. Cues to action

Cues can be either internal or external. Internal cues include physical symptoms, feeling of fatigue or thoughts about the condition of a sick person who is close. External cues include mass media campaigns, newspaper articles, safety books, advice from regular safety meetings, reminder post cards, signage and feedback on safety performance.

e. Likelihood of action

This depends on perceived benefits of the action minus perceived barriers to the action. This is an individual's opinion of the value or usefulness of a new behaviour in minimizing the risk of developing work-related health problems. People tend to adopt healthier behaviour when they believe the new behaviour will decrease their chances of developing a disease. Examples

include refraining from smoking to prevent lung cancer, eating nutritious foods or avoiding junk foods to prevent obesity, and using personal protective equipment to prevent occupational health challenges.

f. Perceived barriers to action

This is an individual's evaluation of the obstacle in the way of one adopting a new behaviour. Of all the constructs, perceived barriers are the most significant in determining behaviour change (Janz & Becker, 1984). In order for a new behaviour to be adopted, an individual needs to believe that the benefits of the new behaviour outweigh the consequences of continuing with the old behaviour. This enables barriers to be overcomed and the new behaviour to be adopted. Perceived barriers to action can include cost, inconvenience, life-style change (Center of Disease Control & Prevention, 2004). Other considerations include importance of health to the worker and its perceived control.

The importance of health to the worker concerned: Behaviour indicating that health is perceived as something of value includes regular medical check ups, safety and health training attendance, safety and health education sessions participation, safety and health workshops attendance. Participating in screening exercise for occupational health problems among workers indicates that workers overall health and well-being is perceived as something of value.

Perceived control: Individuals who perceive they have control over their health are more likely to engage in protective activities than those who are not. Control over health can relate to such behaviour as not smoking, using safety googles while welding and nose masks or respirators

and hand gloves while cutting wood materials as well as having regular health checks and training.

In summary, The Health Belief Model (HBM) suggests that workers will alter their behaviour if they perceive that (1) they are susceptible to a negative health conditions resulting from their behaviour. (2) that the health conditions resulting from their behaviour are severe, (3) that they possess requisite resources to prevent or mitigate these conditions and (4) that the benefits of changing their behaviour outweigh the costs. Therefore by applying HBM to this study, we may say that workers will alter their behaviour if they perceive that (1) they are susceptible to occupational health problems resulting exposures to hazards of work, (2) that these health problems can cause poor quality of life or even early death, (3) that they have the resources to prevent the occurrence of these health issues, (4) that the benefits of adopting positive health and safety practices outweighs the cost of these exercises.This study therefore lend credence to theoretical construct of Heath Belief Model (Janz & Becker, 1984). As it explains how for instance, a woodworker or welder perceives the threat of wood dusts or metal fumes, and consequent lung disease from exposure to these hazards, and the need for use of personal protective equipment (nose mask or respirator) is considered. The three important constructs of this model are worker's perception about susceptibility to lung disease, modifying factors and variables affecting the likelihood of taking action to change behaviour based on perceived benefits and barriers. Each of these perceptions, either individually or in combination can be used to explain health behaviour.

Recently, some other constructs have been added to Health Belief Model. These include aspects such as cues to action, motivating factors and self-efficacy as presented in fig 2.2 below.

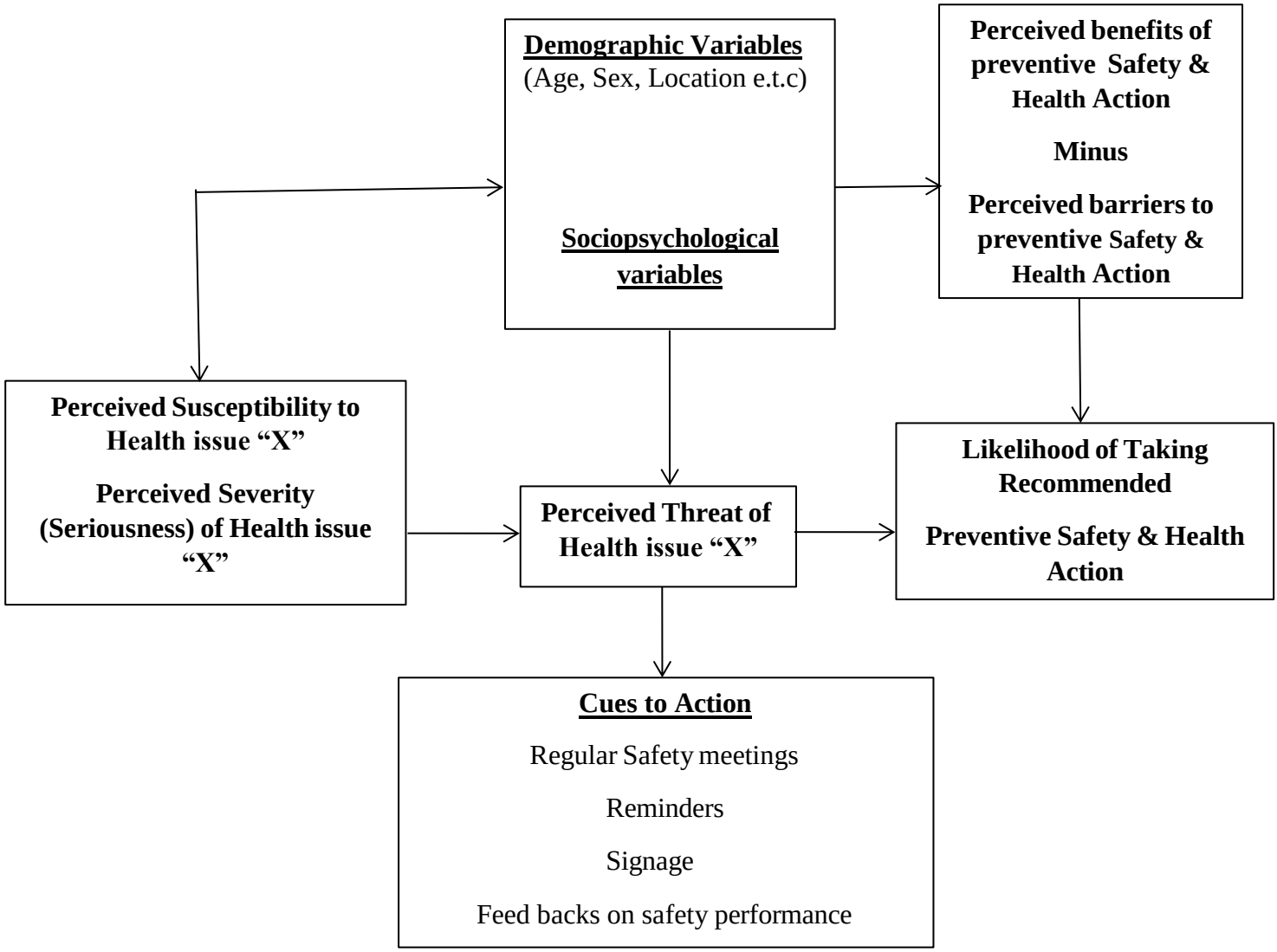

Fig 2.2: Schematic Presentation of Health Belief Model

Consideration of Implementation

Heath Belief Model can be used to design short- and long-term intervention programs. The five key action-related components of HBM determine it's ability to identify key decision-making points that influence health behaviors. The Health Belief Model can either be used alone or in combination with other theories or models. To ensure success with HBM, it is important to identify the "cues to action" that are meaningful and appropriate for the target population.

As concerns this study, awareness creation and education of workers towards occupational hazards make them perceive the threats and severity of hazards they are exposed to as well as the consequences of not protecting themselves from such hazards. Their confidence (self-efficacy) can be boosted through training programs, provision of resources and support, recognizing and rewarding self behavior. By enhancing self-efficacy, workers will more likely believe in their ability to follow safety guidelines and therefore adopt safety and health practices. Stakeholders in health can as well utilize various cues to action, such as regular safety meetings, reminders, signage and feedback on safety performance. Provision of consistent cues to action can reinforce the importance of safety and health in workers as well as remind them to engage in safe behavior. This can lead to reduced health challenges, and improved overall health and well-being in the workplace.

2.2.3 Hierarchy of Hazard Controls Model

This is one of many safety-focused models that help in controlling exposures of workers to occupational hazards. The purpose behind this, is to prevent or reduce occupational accidents, injuries, illnesses and fatalities through the inclusion of prevention considerations in all designs that impact workers. This is the main goal of occupational health. Hierarchy of controls

originated from National Institute for Occupational Safety and Health's prevention through design initiatives.

Traditionally, this has been used as a means of implementing feasible and effective control solutions to occupational health issues. The hierarchy, commonly depicted as an inverted triangle, is divided into five sections: elimination, substitution, engineering controls, administrative controls and personal protective equipment (See fig. 2.3 below) and are often listed in order of their effectiveness, though they work best when used in combination. Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced (Centers for Disease Prevention and Control, 2015).

Elimination

Elimination involves physical removal of hazards and the most effective strategy for reducing workplace health challenges. It is inexpensive and simple to implement at early stage of work process, but may require major changes in equipment and procedures, for its effectiveness in an already existing process.

Addressing elimination at the start enables the designers and planners to make substansive changes easily without needs for retrofit processes. For instance in wood industry, many sawmilling operations may involve manual lifting of large wood materials. This hazard often cannot be completely avoided; however, workers can use extending tools like fork lift to carry the logs of wood. Having workers perform work activities in this way is a common example of elimination in wood industry.

Substitution

Substitution is next in line after elimination, in the best way for controlling workplace hazards. It is replacing work materials or processes with others that are considered less hazardous. To be an effective substitute, the new process or material must remove or at least mitigate the hazard. Like elimination, substitution is most effectively implemented at early stage of work process and tends to be very difficult with already existing work process. For instance, use of water-based paints in place of lead-based paints is a good example of substituting out a potential hazard. Lead paints can cause nervous system and kidney damage, as well as reproductive harm in adults (Center of Disease Control, 2015). Water-based paints used in the substitution can help in reduction of such hazards for exposed workers.

Engineering Controls

Engineering controls entail isolation of workers from hazards. Workplace hazards often cannot be eliminated or substituted, especially when work process is already on going, hence implementation of engineering controls. Installation of machine guards that shield workers from airborne emissions (wood dusts and metal fumes), and use of fork lift as against manual lifting of logs of wood are some of the examples of engineering controls. These are highly effective as they place physical barrier between workers and the hazard. And can be implemented independent of any worker interaction.

Engineering controls are most effective at reducing work-related musculoskeletal disorder (WMSD) hazards, but may be the most difficult to implement for an established work process. Changing the way materials, parts, products, and tools are used can relieve workers from WMSD risks. Other engineering controls include mechanical assist devices, fixtures, and

lighter-weight packaging materials and many more. These control measures are favored over administrative and personal protective equipment (PPE) for controlling existing worker exposures in the workplace because they are designed to remove hazards at source, before they make contact with workers. Well-designed engineering controls are highly effective in protecting workers and may typically be independent of worker interactions to provide this high level of protection. The initial cost of engineering controls may be higher than the cost of administrative controls or personal protective equipment, but over time, operating costs are frequently lower, and in some instances, may provide cost savings in other areas of the process.

Administrative Controls and Personal Protective Equipment

Administrative controls are practices and policies that workers must follow until engineering controls become feasible. Duration of exposure to hazards can be reduced by minimizing the length of workers' shifts, implementation of job rotation, scheduling more breaks, varying the tasks for individual jobs, or training workers on how to minimize exposure to hazards, such as stepping and turning instead of twisting during manual handling.

Personal protective equipment (PPE), such as knee pads and anti-vibration gloves and grip-gloves, safety goggles and ear muffs can protect workers from immediate hazards. PPEs are inexpensive and used frequently where hazards are not under administrative or engineering control domain.

Administrative controls and PPE are frequently used with existing processes where hazards are not particularly well controlled. Administrative controls and PPE programs may be relatively inexpensive to establish but, over time, may be very costly to sustain. These methods of

protecting workers have proven to be less effective than other measures, as they require significant efforts on the part of workers.

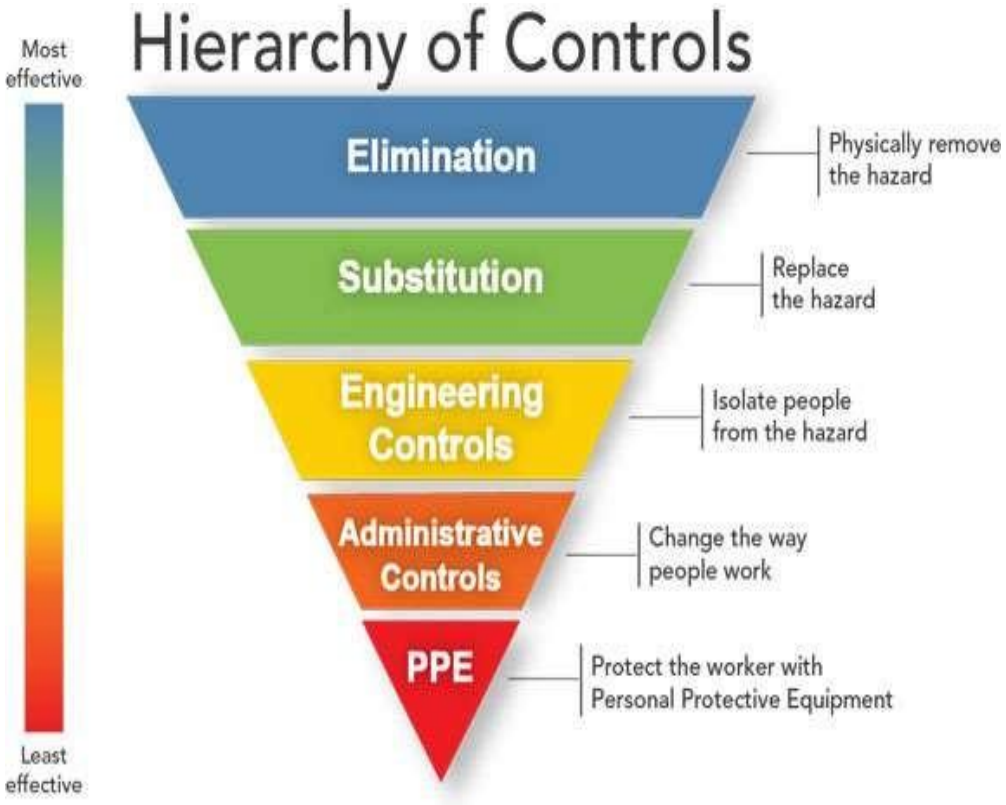

Fig 2.3: Hierarchy of Controls Model

Source: Centres for Disease prevention and control, 2015

2.3 Empirical Review

2.3.1 Occurrences of Occupation-Related Health Challenges Among Artisans

2.3.1.1 Occurrence of Ocular Health Challenges Among Artisans

In a cross-sectional study carried out by Megbele et al. (2012), with the aim of identifying risks of cataract and its associated factors among metal arc welders in Port Harcourt Nigeria, a total of 117 welders and 105 control subjects (not engaged in welding) from five fabrication and construction companies in Port Harcourt were recruited. A self-administered questionnaire and eye examination (carried out in the site clinics) were used to gather information regarding respondents' demography, life style, occupation, medical and ocular histories. Analysis was performed using Stata (Version 11.2, Stata Corp., College Station, TX, USA). Chi square was used to evaluate the difference in characteristics by occupation, while Logistic regression models were utilized to assess the relationship between the presence of cataract and occupation.

Results obtained revealed prevalence of self-reported eye symptoms of pain, tearing, sandy sensation and photophobia, which were significantly higher among welders when compared with controls (all $P < 0.001$). Eye examination revealed pingueculae and pterygia, which were common in both welders and controls, but cataract appeared more prevalent among welders when compared with controls (8% versus 1%; $P < 0.05$). The majority of the eye injuries occurred during welding and grinding operations (72%) and resulted from objects striking the eye which required removal of the impacted foreign body in the majority of cases (68%). However, only 60% of welders were wearing eye protection when the injury occurred. There was a strong association between work-related eye-injury history and cataract, showing that eye

injuries inflicted during metal welding processes, are an important risk factor for cataract among arc welders.

In a descriptive cross-sectional study carried out by Eziechila et al. (2017) on prevalence and pattern of ocular disorders seen among artisans in Owerri, the results revealed a high prevalence of degenerative conjunctival disorders of pinguencula (30.1%) and pterygium (21.8%) mostly among automobile mechanics had the highest prevalence for conjunctival disorders, corneal opacities, and allergic conjunctivitis.

In another study conducted by Okunamiri et al. (2018) among welders in some parts of South-East Nigeria, with the aim of assessing the pattern of eye diseases, a total of 400 welders in Ahiazu Mbaise, Imo State, participated in the study. Their selection was via muti-stage sampling, while 400 welders' workshops were selected via systematic sampling technique. Data collection processes among respondents lasted for three (3) months with administration of structured, pre-tested questionnaire. Eye screening and examination were used to validate questionnaire findings. Analysis was performed with IBM-SPSS Statistics Version 20. Chi square was used to test for associations between socio-demographic characteristics of welders and prevalence of different types of eye disease at 5%significant level.

The result showed that welders suffer from different kinds of eye problem due to their artisanal activities. There was a strong association between age, marital status and educational level and types of eye diseases detected, with correlation coefficients of 0.898, 0.893, 0.930 & 0.865 respectively. The findings also showed that 85.7% of respondents had prior knowledge of eye diseases and that of the respondents who had eye problem, only 19% sought for professional care, 28.6% resorted to self-treatment while 52.4% sought for no treatment at all. It was concuded that exposure to radiations emitted during welding without appropiate protection gear

mainly produceocular conditions, including pterygium, photokeratitis and cataract with their major symptoms, such as burning sensations, photophobia and eye pain. Proper education, awareness and screening of welders were recommended to avoid eye dieases.

According to Ankamal-Lomotey et al. (2018) study on ocular hazards among wood workers in Ashaiman timber market in Ghana, 120 (80%) woodworkers had allergic conjunctivitis, 115 (76.6%) had ocular foreign bodies, 50 (33.3%) had infections, 38 (25.33%) had pinguencula and 71 (47.33%) had pterygia. In the same study, 30% of ocular trauma, 50% cuts/penetrative injuries of the eyes and 31.25% chemical injuries were also reported among the respondents.

Also, in another descriptive cross sectional study carried out by Nwala et al., 2018 on ocular injuries among 110 welders - 65(59.1%) electric welders and 45(40.9%) gas welders) in a rural community of Ekwulobia in Aguata Local government Area of Anambra State, Nigeria, welding was revealed as a high risk group for eye injuries due to their occupational exposures to metal fumes, flying metal particles and ultraviolet radiation. Flying objects (47.3%) were detected as the major cause of ocular injury among 93 (84.5%) of respondents who had ocular injuries. Of the four (4) major types of ocular injuries recorded, superficial foreign body 51(43.6%) was the most common type. From the findings, occurrences of ocular injury increased with years of work as a welder: 4.3% for 1-2 years to 39.3% for 11 years and above. Result of the study also indicated that only 33(35.5%) of the injured welders used protective eyewear. Recommendation for protective devices and educational programmes, stressing the importance of their usage was made.

Douglas and Koroye-Egbe, (2018), in a descriptive cross-sectional study on prevalence of ocular injuries among welders in Yenagoa, Bayelsa State, Nigeria, using 212 respondents via

multi-stage sampling. From the results, 92 respondents (43.4%) reported eye injury with burns (42%) as the commonest, followed by foreign body (32%) and cuts (4%). Majority of the participants (95.6%) had mild or no visual impairment while 2% had blindness of <1/60 (according to WHO classification). Ocular abnormalities found included pinguenculae (47.6%), conjunctiva discolouration (35.4%), pterygium (15.6%) and cataract (15.6%). Knowledge of ocular injuries and prevention was high (96.2%), while use of protective eyewear was poor (28.4%). Increased provision and enforcement of use of PPE at all levels was recommended.

Also, in a descriptive cross-sectional study conducted by Chukwuoha et al. (2018), with the aim of ascertaining the ocular injuries among welders in Nekede, Imo State, Nigeria, a total of 260 welders participated in the study. Questionnaire and eye screening exercise were used for data collection. Analysis was done with Statistical Package for Social Sciences (SPSS) Version 21 computer software using descriptive analysis.

Results detected ocular hazards/injuries of foreign bodies (30.7%), conjunctivitis (20.3%), pterygium (13.4%), arc-eye (12.6%), cataract (10.0%) chemical burn (7.4%), uveitis (4.3%) and corneal abrasion (1.3%), which were due to non-use of eye protectors. As reported, the study showed high rate of ocular injuries occurrence among participants. Enlightenment programmes, health education and improved compliance/adherence to occupational health and safety regulations were recommended for welders.

In another study carried out by Tetteh et al. (2020) on prevalence and factors influencing eye injuries among welders in Accra Ghana, overall prevalence of eye injuries was revealed to be 47.9%. Eye injuries were found to be higher among arc welders (73.3%).

Mengistu et al. 2021 in an institution-based cross-sectional study conducted on prevalence of occupational ocular injury and associated factors among 542 small-scale industry workers in

Gondar town, Northwest Ethiopia, showed the prevalence of occupational ocular injury among these workers to be 31.4%. From the findings, 170 (31.4%) out of 397 respondents used for the study, had ocular injuries during the last 12 months. Among them 49 (28.8%) had more than once. The chief culprit and the most common agent responsible for these injuries was iron chips, which caused 69 (40.6%) of the ocular injuries. Type of employment, having health and safety training, use of eye safety devices, and job category had a significant association with occupational ocular injury.

In a study conducted by Oboh and Ofagbor, 2022 on predominant ocular challenges and protective eyewear compliance among welders in Port Harcourt Mechanic and Steel Villages in Rivers State, Nigeria, the most frequent eye symptoms among welders in order of decreasing proportion were sandy sensation (30.1%), cloudy vision (22.3%), painful red eyes (18.5%), watery eyes (3.9%) and itchy eyes (2.9%). The distribution of ocular surface abnormalities in order of decreasing proportion include pinguecula (31.1%), pterygium (21.4%), conjunctiva discoloration (14.6%) and corneal opacity (3.9%). Also, there was a statistically significant association between age of welders and eye symptoms experienced and predominant ocular surface abnormalities.

2.3.1.2 Occurrence of Respiratory Health Challenges Among Artisans

In a study conducted by Al-Otaibi (2014), on respiratory health of a population of welders in Saudi Arabia, with the aim of identifying the respiratory symptoms and respiratory function among 41 welders and 41 comparable non exposed group. From the findings, sixteen (39%) welders reported bringing up phlegm from the chest first thing in the morning, compared with seven individuals (17.1%) in the non exposed group. The difference is significant (Chi-square = 3.87 odds ratio (OR) 3.11 [1.0-9.9], p = 0.0182). Eleven welders had chronic bronchitis, which

they had experienced most days for as long as 3 months, compared with one person in the non exposed group. The difference was statistically significant, and OR was 1.7 (95% confidence interval 1.19-2.53). On the other hand, the difference in cough, shortness of breath and lung function was statistically insignificant when the welders were compared with the non exposed group. The conclusion showed more respiratory complaints, particularly chronic bronchitis, among welders compared with the non exposed group, which is believed to be the result of welding emissions. Spirometry showed no impairment in lung function in both the welders and the non exposed group.

In another cross-sectional analytical study carried out by Adeoye et al. (2015) in Osun State, Nigeria, with the aim of assessing awareness of occupational hazards and health problems of sawmill workers, a total of 100 sawmill workers (test group) and 100 matched vehicle mechanics (control group) were recruited for the study. Their selection was via multi-stage sampling technique from September 2012 to January 2013. Pre-tested questionnaire, walk-through survey checklist and In-depth interview were used to collect data from respondents. Some pulmonary parameters of respondents were also measured. Data analysis was done, with level of significance set at $P<0.05$, while Chi square, z and t tests were used for comparison.

Results obtained showed mean ages of 33.64±11.0 and 33.1±9.98 for the study and control group respectively. Most of the sawmill workers failed to use personal protective equipment mainly due to unavailability. Respiratory symptoms like cough (53%), phelgm production (39%), and sneezing (54%) as well as dermatitis (8%), conjunctivitis (60%) were significantly higher in sawmill workers than the controls ($P<0.05$). Mean peak expiratory flow was significantly ($P<0.001$) lower among sawmillers (332.6±23ml/min) than the controls (488.7±60.23ml/min). Mean respiratory rates (19.68±2.31) cpm and anterior-posterior to

transverse diameter ratio of chest (1.01±1.06) of sawmillers were also significantly higher than the controls' (18.00±1.35 0.99 ± 0.04) respectively. It was then concluded that respiratory symptoms and injuries in sawmills can be prevented by dust control and the use of personal protective equipment.

Also, in another descriptive cross-sectional study carried out by Agu et al. (2016) among Sawmill Workers in Abakaliki, with the aim of identifying health problems and workplace risks, a total of 204 consented respondents were used for the study. Validated questionnaire and workplace risk assessment template were instruments for data collection, while analysis was done using EPI Info Version 7. Chi square was used to test for associations at $P<0.05$ significance level.

Results showed mean age of 29.3±9.6 years, with majority being males. The most prevalent health problems detected among saw millers were respiratory symptoms and injuries. The workplace risk assessment showed non-safety compliant work environment. As detected, cough (47.5%) and chest pain (42.1%) were the main respiratory issues, while wood dust, unguarded moving parts of machinery, poorly designed workstations, poor house keeping, fire hazards and noise were the major hazards identified in the workplace risk assessment. Risk control measures were found to be inadequate, with majority spending 8 to 10 hours at work (78.4%). From the findings, majority were aware of personal protective equipment (85.3%), but only 39.5% used them always. Hand gloves (74.1%) was the most frequently used personal protective equipment, while non-availability (21.1%) and cost (17.5%) were the reasons for inadequate usage of personal protective equipment.

In a study carried out among wood artisans in Thies, Senegal by Mbegue et al. (2018), wood dust was implicated as the cause of respiratory disorders encountered by carpenters leading to

alterations of their respiratory function parameters. Among seventy average aged (39 years) carpenters that were used, spirometry revealed obstructive respiratory disorder in 32.85% of cases with 17.14% mild; 7.14% moderate; 18.57% pure restrictive and 7.14% of cases as mixed syndrome.

In a cross-sectional study conducted by Awoke et al. (2021) on the assessment of dust exposure and chronic respiratory symptoms among workers in medium-scale woodwork factories in Ethiopia using the British Medical Research Council Respiratory questionnaire with a few modifications, the prevalence of chronic respiratory health symptoms among wood workers was 69.8%, with a prevalence of cough (54.6%), phlegm (52.2%), wheezing (44.6%), breathlessness (42.1%) and chest pain (42.9%). Increased years of work, using of bio-energy as an energy source for cooking, past occupational dust exposure history, and having no occupational safety and health training were identified as risk factors.

Mgonja, (2020) in a study concluded that welders are at increased risk of respiratory dysfunctions.

Wanjari and Wankhede, (2023) concurred with the reports of Mgonja by revealing that welders have high susceptibility to respiratory disorders due to their exposures to metal fumes, dusts and gases emanating from welding activities.

2.3.1.3 Occurrence of Hearing Health Challenges Among Artisans

Akinbode and Olujimi (2014) in a study on effects of Sawmill wastes in Residential areas of Ogbese and Akure Townships, Ondo State, Nigeria, reported noise as one of the by – products of wood processing. Exposures to which causes hearing loss to concerned workers.

Odibo et al. (2018), in a descriptive study on assessment of occupational hazards of sawmills in Delta State, Nigeria, detected noise from machineries, saw dust and unguarded machines as the

major physical hazards. The result revealed that 56.6% of workers were at risk of hearing loss due to noise pollution level which was found to be higher than the accepted limits by National Institute of Occupational Health and Safety.

Elechi & Warmate (2019) in a study on occupational hazards among Saw Mill workers in Port Harcourt Metropolis River State, identified noise from sawing machines (91.1%), exposure to wood dust (88.9%), flying and falling objects like sharp woods (75.6%), vibration from sawing machine (66.7%), fumes and gases from operating machine (62.6% and smoke from burning dust and wood pieces (30.0%) as occupational health hazards of saw mill with noise and wood dust as the major hazards.

Ebe et al. (2019) in a study on assessment of noise exposure among sawmill workers at Ogbosisi Naze and Mbieri Timber and Allied Market in Owerri, Imo State, detected noise as an unwanted sound, which reduces the quality of life and causes serious chronic or acute health problems. Using a digital sound level meter Lutron (Model SL-4030) and a global positioning system (GPS) –NAVA 300 to measure the sound level at the two study locations, results were recorded in Decibel (dB) for morning and afternoon working periods for six (6) days respectively. From the findings, it was observed that all the locations sampled from station A to E were above the standard limits (96.15 to 101.65 dB) for both morning and afternoon in Ogbosisi and similar levels were also observed at industrial Market Umuonyeali Mbieri (93.19 to 94.96).

2.3.1.4 Occurrence of Skin Health Challenges Among Artisans

Johnson & Bassey (2015) in a cross sectional descriptive study on the assessment of work habits and health problems of 151 automobile technicians at Mechanic village in Uyo, Nigeria, reported hand washing with fuel (90.1%), washing vehicle parts with fuel (90.1%) and

treatment of bruises with hydraulic (37.8%) and fuel (8%) as habits which expose automobile technicians to hand dermatitis (40.4%). Health education and adult literacy programs were recommended for them.

Agu et al. (2016), in a descriptive cross sectional study carried out on health problems among sawmill workers in Abakaliki and Workplace Risk Assessment, identified cut by machine (25%) as one of the common health problems of sawmillers. Other findings of the study included injuries from log of wood (57.4%), perceived worsening of health status since employment (95.4%).

In a study carried out among 70 informal auto mechanics in Sekyere, East District of Ghana by Amfo-otu and Agyemang (2016), the workers were found to be exposed to physical hazards of heat and burns, chemical hazards of asbestos and fumes, biological hazards of insect bites and psychological hazards of working under pressure.

Also, in a research carried out by Johnson and Bassey (2016) on the work habits and health problems of 151automobile technicians at Mechanic village Uyo, Nigeria, the most encountered health problems among respondents were cuts (84.1% of respondents), low back pain (78.1%), bruises (72.2%) and hand dermatitis (40.4%). They also reported sucking of fuel (75.5%), hand washing with fuel (90.1%), washing vehicle parts with fuel (90.1%) and treatment of bruises with hydraulic (37.8%) and fuel (8%) as common habits exhibited by mechanics.

Balogun et al. (2016), conducted a community-based study in Ward 3 of Ibadan North Local Government Area of Oyo State, Nigeria, with tha aim of assessing health problems, workplace hazards and health care needs of artisans as a basis of developing occupational health services for these workers. A total of 509 artrisans, comprising of tailors, mechanics, hairdressers,

welders and carpenters were interviewed. A semi-structured interviwer administered questionnaire was utilized for data collection, while analysis was done using descriptive statistics, chi square test and logistic regression at 5% level of significance.

Results revealed cuts and lacerations as the commonest injuries among carpenters (96.7%) and mechanics (90.9%) respectively. According to the report, respondents working for >8 hours per day were found to be more likely to experience occupational injury compared to those working for ≤ 8 hours per day. Occupational health services and health education on control of workplace hazards and accident prevention is therefore needed for this group of workers.

In the research carried out by Sahkvidi et al. (2019) to determine the prevalence of hand dermatitis on 153 male car repair workers in Iran, it was discovered that car repair workers have elevated prevalence of hand dermatitis (19.0%) than office workers (7.9%) that were used as control. In the same study, the risk of developing occupational contact dermatitis was found to be 2.74 in car repair workers due to potential skin hazard exposures.

Oche et al. (2020) in a descriptive cross – sectional study conducted on 205 Roadside automobile workers in Sokoto, Nigeria using a two – stage sampling technique, showed that burns, bruises, headache/dizziness and cuts were the most reported work – related health challenges suffered by autoworkers. The study also reported that majority of the respondents had good knowledge of and attitude toward workplace hazards. 91% of them felt their work was risky, 80.1% ate and 86.1% drank while working.

2.3.1.5 Occurrence of Musculoskeletal Health Challenges Among Artisans

Gbiri et al. (2012) in a cross-sectional study, investigated the prevalence, pattern and impact of work-related musculoskeletal disorders on functional performance of welders in a Nigeria rural-urban center, revealed high prevalence of work-related musculoskeletal disorders among

welders, with negative impact on job performance, leisure activities and family roles. Low-back pains followed by neck and shoulder pains were the most prevalent. Findings of this cross-sectional survey, showed that (98%) of the 177 respondents had work-related musculoskeletal disorders, with low-back pain as the most common, occurring in 60.1% of the cases. Of this number, majority (52.5%) found their job physically exhaustive, while repeatedly lifting heavy objects of work, 87.5% had their jobs affected, 26.2% lost their jobs while 7.4% had to change their jobs due to musculoskeletal disorders.

Johnson and Bassey (2016) in a study on the habits and health problems of 151automobile technicians at Mechanic village Uyo, Nigeria, discovered that 78.1% of the respondents had low back pain.

Report of a study conducted by Balogun et al. (2016) on the health problems, workplace hazards and health needs of 509 artisans (comprising of tailors, mechanics, hairdressers, welders and carpenters) in Ibadan, Nigeria, found musculoskeletal disorders of joint pain (63.3%) and low back pain (54.7%) as the health problems encountered by all the respondents. Respondents working for > 8 hours per day were found to be more likely to experience occupational injury compared to those working for ≤ 8 hours per day. Occupational health services and health education on control of workplace hazards and accident prevention is therefore needed.

Result of a cross-sectional study carried out by Rah man et al. (2019) on work-related musculoskeletal disorders: a case study of sawmill workers in Bangladesh, showed that saw mill workers are at increased risk of musculoskeletal disorders due to manual handling tasks of lifting, carrying, pushing and pulling of wood materials identified as risk factors of musculoskeletal disorders. Using 254 workers from 60 sawmills at the southern part of

Bangladesh, the findings revealed that 70.1% of the respondents had musculoskeletal disorders in at least one body part for at least one year. The average Rapid Entire Body Assessment (REBA)score of four main tasks (Pushing, Pulling, Lifting and Carrying timber) was found to be 9.25, which is high risk for MSDs. The main reasons for the MSD problems were found to be lack of knowledge about workplace safety, working postures and the settings of the workplace. Application of National Institute for Occupational Safety and Health (NIOSH) lifting and manual handing technique of work materials as well as ergonomic training of saw millers were therefore recommended, while suggestion for the arrangement of Occupational Safety and Health Administration (OSHA) ergonomic design of work table and workplace were also made.

Also, findings obtained in a descriptive study conducted by Elechi &and Warmate (2019) on occupational health hazards associated with 414 sawmill workers in Port Harcourt Metropolis River State, revealed ergonomic hazards of 88.4% repetitive work and movement, 77.5% of awkward body position, 68.6% of persistent fatigue due to work activity and 51.0% of long working hours. These high percentage risk factors showed that saw millers are at increased risk of developing musculoskeletal disorders. Recommendation was then made for prioritization of improved workplace safety regulations, adequate personal protective equipment, and increased awareness on the importance of occupational health and safety.

2.3.1.6 Occurrence of Arterial (Blood) Pressure Health Challenges Among Artisans

In a study conducted by Alexander et al. (2016) on occupational safety measures and morbidity among welders in Vellore, Southern India, among other health issues (skin, eye and ear) reported in the result, hypertension was noted in 12.6% of the welders as compared to 0.7%

among the non-welders. None of the welders used appropriate PPE. Low educational attainment was associated with an increased risk of eye injury ($P < 0.05$, OR = 18.18). Majority of welders 73.3% were married. All worked without formal training and were unaware of safe working guidelines that existed but are not implemented for the welders in India.

In another cross-sectional study performed by Ayogu et al. (2021) on prevalence and predictors of different patterns of hypertension among adults aged 20 - 60 years in rural communities of southeast Nigeria, isolated systolic hypertension (10.6%), diastolic hypertension (18.2%), combined systolic and diastolic hypertension (37.8%) were reported among the participants. According to the results, increase in age and low education level were some of the significant predictors detected in the study.

In a study by Adeloye et al. (2022), data culled from fifty-three (53) studies, covering almost 80,000 people across the six geopolitical zones of Nigeria, showed that age-adjusted prevalence of hypertension increased from 8.6% (representing 4.3 million of the total population) in 1995 to 32.5% (representing 27.5 million of the total population) in 2020.

2.3.2 Occupational Hazards Encountered Among Artisans

In a study conducted by Balogun et al. (2016) on the health problems, workplace hazards and health needs of 509 artisans (comprising of tailors, mechanics, hairdressers, welders and carpenters) in Ibadan, Nigeria, the report revealed physical hazards of noise (71.0%), chemical hazard of fumes (43.4%), mechanical hazards of sharp metals (85.9%), biological hazard of insect bites (91.0%) and psycho-social hazard of low income (68.9%). Respondents working for > 8 hours per day were found to be more likely to experience occupational injury compared to those working for ≤ 8 hours per day.

Odibo et al. (2018), in a descriptive study on assessment of occupational hazards of sawmills in Delta State, Nigeria, used 21 sawmill sites in three selected sawmill locations at Sapele, Warri and Udu. Employing purposive and simple random sampling techniques for the selection of three sawmill locations and participants for the study respectively, and using sound level meter standardized with 90dBA and structured questionnaire, the result detected noise generated from machinery used within the mills, saw dust generated and unguarded machines as the major physical, chemical and mechanical hazards of saw milling respectively . The findings also revealed that 56.6% of workers were at risk of hearing loss due to noise pollution level of 258%, 202% and 256% for Sapele, Warri and Udu respectively, found to be higher than the accepted limits by National Institute of Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), National Environmental Standards and Regulations Enforcement Agency (NESREA) with the equivalent noise levels of 101.2 dBA, 97.72 dBA and 100.91 dBA for Sapele, Warri and Udu sawmills respectively over a nine hours work duration. Safety education intervention, shift schedule, and proper kitting of workers with protective devices before being allowed to work were recommended.

Elechi and Warmate (2019) in a descriptive study conducted on Occupational Health Hazards associated with Sawmill Workers in Port Harcourt Metropolis River State, using a multistage random sampling technique to select 414 respondents. Results obtained revealed occupational hazards of noise from sawing machine (91.1%), wood dust from machines (88.9%), flying and falling sharp wood (75.6%), vibration from sawing machine (66.7%), fumes and gases from operating machine (62.6%) and smoke from burning dust and wood pieces (30.0%). Chemical hazards found were fumes and gases fro operating machines (62.6%), smoke from burning dust and wood pieces (30.0%). Biological hazards found include: exposure to airborne pathogens

(64.7%). Ergonomic hazards include: repetitive work or movement (88.4%), awkward body position (77.5%), heavy lifting and psycho-social hazards found out were: occupational stress (80.0%), persistent fatigue due to work activity (68.6%) and long working hours (51.0%). The tested hypotheses showed statistically significant relationship between exposure to occupational hazard and use of personal protective wears and unsafe behaviour among sawmill workers.

Also, report of another descriptive cross-sectional study conducted by Nwafor (2019) on occupational hazards and safety practices among 315 welders in Port Harcourt Metropolis, revealed chemical hazards of 74.2%, followed by physical hazards 66.0%, mechanical hazards 62.7%, biological hazard 33.5%, ergonomic hazards 32.1% and lastly psychological hazard 28.5%. The results also indicated that the majority of the welders fall between the ages of 30 years and above (50.8%) followed by those within the age of 20 - 29 years (35.2%).

Ebe *et al*. (2019) in a study on assessment of noise exposure among sawmill workers at Ogbosisi Naze and Mbieri Timber and Allied Market in Owerri, Imo State, detected noise as an unwanted sound, which reduces the quality of life and causes serious chronic or acute health problems. Using a digital sound level meter Lutron (Model SL-4030) and a global positioning system (GPS) –NAVA 300 W to measure the sound level at the two study locations, results were recorded in Decibel (dB) for morning and afternoon working periods for six (6) days respectively. From the findings, it was observed that all the locations sampled from station A to E were above the standard limits of noise (96.15 to 101.65 dB) for both morning and afternoon in Ogbosisi and similar levels were also observed at industrial Market Umuonyeali Mbieri (93.19 to 94.96). Thus all workers within these areas were found to be exposed to noise hazards which affect their health and hearing ability.

Richard et al. (2017), in a study on the assessment of occupational safety and health status of Saw Milling Industries in Nakuru County, Kenya showed that saw mill workers are occupationally exposed to noise (78.0%) among other hazards.

Ukaegbu and Anyanwu (2020), in a study reported that 85% of artisans in Imo State were exposed to harmful chemicals, with the majority of cases being attributed to the lack of protective equipment and poor ventilation in the workplace.

Hazards originating from inadequate safety and health standards for instance, poor housekeeping, are particularly evident among artisans in Nigeria due to inadequate supervision and lack of occupational health services (Afolabi, 2021). Non-compliance and non-usage of personal protective devices (Elenwo, 2018; Balogun et al., 2016). Unsafe work-practices such as touching hot surfaces, sucking petrol with one's mouth and washing hands with fuel, treating injuries with hydraulic (Adeyemi et al., 2016; Ojo et al., 2017) are also factors that have been reported to have caused health problems among artisans in Nigeria.

2.3.3 Awareness of Occupation-Related Health Challenges Among Artisans

In a cross sectional study conducted by Diwe et al. (2016) on Occupational Hazards, Safety and Hygienic Practices among timber workers in a south eastern state in Nigeria. The finding revealed that the majority of the respondents were aware of the hazardous nature of wood dust (96%), and their main source of awareness was from personal experiences (55%).

Also, in another cross sectional descriptive study carried out by Hassan et al. (2018) in Lahore, Pakistan to assess the level of awareness of occupational health hazards among 70 welders, it was discovered that 45.7% of respondents regarded welding as a profession with no major health risk. On the contrary, though similar studies on awareness of occupational hazards

among welders by Joseph, Venkatesh and Shoney, (2017) in India and Lideta Sub-city Ethiopia by Tadesse et al. (2015), revealed much higher levels of awareness of 62.6% and 85.5% respectively.

Marahatta et al. (2018), in a descriptive cross-sectional study conducted on 400 automobile repair artisans from Kathamandu Metropolitan City, Nepal. Using simple random sampling method for the recruitment of participants, the findings indicated that awareness on occupational hazard (56%) and use of PPE (44.3%) was low. Being educated, having job duration of greater than or equal to 6 years and having pre-service training for work were significantly associated with the awareness of occupational hazards. Notably, those who were aware of occupational hazards (OR= 3.01, 95% CI: 1.98 - 4.57), were found to be three times more likely to use the safety measures when compared to those who were unaware. Recommendation was made for intervention on awareness raising areas like provision of pre-service training, promotion of safety, advocacy and enforcement of appropriate regulation for work place.

Oboh and Ofagbor, (2019) in a study on predominant ocular challenges and protective eyewear compliance among welders in mechanic and steel villages, in Port Harcourt, Rivers State, reported in their findings that 88.3% of the 103 respondents used for the study, were aware that welding could cause harm to their eyes which could be prevented by the use of protective eyewear, 7.8% disagreed, while 3.9% had no idea. With the use of protective eyewear, only 5.8% of welders complied regularly, 60.2% complied occasionally, 28.2% complied sparingly while 5.8% never used protective eyewear before. All (100%) of the welders who have never complied fall within the youngest age group (16 – 25 years). There was no statistically

significant association between the age of welders and compliance to protective eyewear ($p < 0.05$).

In a cross-sectional analytical study conducted by Agbana et al. (2021) on the assessment of knowledge of occupational hazards among sawmill workers in Kwara State. A multistage sampling technique was utilized to recruit 196 workers who had been in continuous employment for a minimum of 6 months. Using a 5 point scale, results obtained revealed that knowledge of occupational hazards was low among these artisans. 61.7% of the respondents had poor knowledge, while 15.8% had good knowledge that exposure to hazards could be reduced by limiting their work hours to a maximum of 8 hours per day.

Also, the study conducted by Adeniyi and Isah (2023) on assessment of workplace hazards awareness, work related health complaints and safety measures among welders in Benin City, Nigeria, showed that a high proportion of welders had good knowledge for their workplace hazards and personal protective equipment (PPE).

From the studies above, level of awareness and knowledge of health hazards have great influence on the attitude of artisans towards occupational health protection. Awareness gap regarding hazards and their control is a major factor contributing to high rate of injuries and illnesses among welders. Therefore, there is a need for improved education and training on occupational health and safety in order to increase this level of awareness and knowledge of health hazards among artisans. Employers should also provide regular training on the proper use of safety equipment and the importance of occupational health and safety. Additionally, public awareness campaigns can be conducted to promote the importance of workplace safety among artisans.

2.3.4 Occupational Safety and Health Protection Practices Among Artisans

Bamu-Chipunza (2018) argued that poverty and income insecurity make it often impossible for artisans to invest in personal protective equipment and other safety devices that are relevant to their work.

Umeokafor et al. (2014) in a literature review focused on the construction industry, argued, based on Diugwu et al., (2012); Idubor and Oisamoje (2013), that there is a general lack of awareness of occupational health and safety which affects all workers in Nigeria.

Olsen et al. (2010) also revealed that poor knowledge of the long-term effects of chemical agents at the workplace and a belief that such agents are not dangerous, negatively affects prevention of the use of such agents.

Diwe et al. (2016), in a cross sectional study on occupational hazards, safety and hygienic practices among timber workers in south eastern, Nigeria, discovered that though majority of respondents (96%) were aware of hazardous nature of wood dust, which they acquired through personal experience (55%) yet they had very low attitude towards adherence to protective measures. In the report, while only 13% use PPE, 38% attributed their non-usage of PPE to forgetfulness, Also, poor hygiene and sanitation were poorly practiced, with all the respondents (100%) disposing waste wood indiscriminately and about one-third (33%) refuse to take their bath after each day's work.

Itiakorit et al. (2021) in a cross sectional study on the prevalence and determinants of occupational injuries among welders in small scale metal workshops in Wakiso District, Uganda, reported lack of adequate training and long working hours (which fall short of the standard for occupational health and safety) as the cause of high prevalence of occupational

injuries 287 (87.7%) among these workers, with cuts/burns 242 (84.3%) and eye injuries 180 (62.7%) as the most sustained injuries.

There is therefore need for proper health education/awareness creation on the occupational hazards among artisans as well as regulatory enforcement on occupational health and safety standards especially consistency on the usage of PPE on the part of government of Nigeria. Also, since different artisan groups are likely to face specific health challenges, it will be relevant to explore the views of specific groups of artisans on how to prevent or reduce these hazards.

2.3.5 Personal Hygiene and Sanitation Practices Among Artisans

A cross -sectional study conducted by Diwe et al. (2016) on Occupational Hazards, Safety and Hygienic Practices among Timber Workers in a South Eastern State in Nigeria, showed that proper hygiene and sanitation was poorly practiced, as all respondents (100%) indiscriminately disposed their wastes. Also, about one third of the workers (33%) failed to bath after day's work. This showed that timber workers in Nigeria are faced with increased risk of diseases and challenges of health protection and safety. There is therefore, need for proper education on hygiene, sanitation practices and safety among artisans in Nigeria.

2.3.6 Attitude Towards Occupation-Related Health Protection Among Artisans

Chukwuonye et al. (2016), in a study on prevalence and pattern of musculoskeletal disorders among artisans in Nnewi, found that many artisans had negative attitude towards workplace safety. From the findings, some artisans believed that workplace injuries were inevitable and that they had to accept them as part of their job. The study also revealed that artisans had low level of awareness of occupational health hazards.

Additionally, a study by Ogbuagu et al. (2019), found that many artisans had a complacent attitude towards occupational hazards. The study revealed that some artisans do not use safety equipment, even when it is provided to them and this has of led to increased risk of exposure to harmful chemicals and physical injuries.

Also a study carried out by Oboh and Ofagbor, 2019 in their study on predominant ocular challenges and protective eyewear compliance among welders in mechanic and steel villages in Port Harcourt, Rivers State, reported that attitude of welders towards compliance with use of protective eyewear was low. Of 103 respondents used for the study, only 5.8% of welders complied regularly with use of protective eyewear, 60.2% complied occasionally, 28.2% complied sparingly while 5.8% never used protective eyewear before. 100% of welders who never complied, fall within the youngest age group (16 – 25 years). And there was no statistically significant association between the age of welders and compliance to protective eyewear($p< 0.05$).

Another study by Ukaegbu and Anyanwu (2020), found out that artisans who perceived themselves at higher risk of workplace injuries are more likely to take preventive measures to protect themselves.There is therefore, need for increased education and training on workplace safety in order to improve the attitude of artisans towards occupational hazards. Employers should also provide regular training on the proper use of safety equipment and the importance of occupational health and safety. Additionally, public awareness campaigns can be conducted to promote the importance of workplace safety among artisans.

2.3.7 Factors Influencing Occupation-Related Health Challenges Among Artisans

In a study conducted by Oranusi et al. 2014 on assessment of Occupational Diseases among Artisans and Factory Workers in Ifo, Nigeria. Result of distribution of the respondents by age, showed that majority (52) of the respondents (34.62%) were young, between 30-39 years of age.

Also, the study of Ibeneme et al. (2015), supported that of Oranusi et al. 2014 by stating that younger artisans are more likely to sustain work-related injuries than older artisans. That is because, based on his study, younger artisans are more likely to engage in risky behaviour and are less likely to use protective equipment.

A study by Ezinne et al. (2021) on occupational ocular injuries and utilization of eye protective devices among sawmill workers in Ojo local government of Lagos State, Nigeria, revealed that majority of sawmill workers are male (93.7%). This may be due to the fact that most artisanal activities are male dorminated, since male engage in physically demanding work than females.

In the study conducted by Oranusi et al. 2014 on assessment of Occupational Diseases among Artisans and Factory Workers in Ifo, Nigeria. Findings of distribution of the respondents by sex indicated that majority of all the workers were males while minority were females.

Educational level is also an important factor that can influence the risk of health challenges among artisans. Ibeneme et al. (2015), in his study revealed that artisans with higher level of education are more likely to use protective equipment and less likely to engage in risky behavior. This suggests that education can play a crucial role in promoting safety among artisans.

Ogbuagu et al. (2019) in his study, found out that artisans with lower income levels are more likely to experience work-related injuries than those with higher income levels. This may be due to the fact that artisans with lower income levels may not have access to the same level of safety equipment and training as those with higher income levels.

In the development of strategies to promote workplace safety and mitigate the risk of health challenges among artisans, it is important to consider these socio-demographic factors as they play vital roles in influencing the risk of hazards at work

2.3.8 Preventive Strategies for Occupational hazards and Health Challenges Among Artisans

Previous studies have shown that most work-related accidents and diseases are preventable if exposure to work-related hazards is reduced or eliminated (Hui-Nee, 2014). Prevention could be realized by implementing sector-specific work-related safety guidelines such as those developed by the ILO (e.g., ILO, 2000; Health and Safety Executive, 2009). Work-related safety guidelines include usage of safety devices or equipment, providing adequate barriers that separate workers from hazards, discarding outdated equipment, providing adequate protection against falls and chemical exposures, and encouraging the use of personal protective equipment (PPE) by workers. However, these recommended preventive measures, and the work-related health and safety laws, are targeted mostly at formal organizations where the employers have corporate responsibility for the health and safety of their employees (Lund et al., 2016).

In Nigeria, there are no laws that regulate occupational health and safety for artisans especially in informal sector (Afolabi, 2021). Hence, incorporating work-related health and safety measures in their workplaces is not a legal necessity for these workers (WHO, 2017). Besides

the absence of adequate government regulation and surveillance, previous research has identified a number of other barriers to work-related health and safety for artisans in Africa. There is therefore need for proper health education/awareness creation on the occupational hazards among artisans as well as regulatory enforcement on occupational health and safety standards especially consistency on the usage of PPE on the part of government of Nigeria. Also, since different artisan groups are likely to face specific health challenges, it will be relevant to explore the views of specific groups of artisans on how to prevent or reduce these hazards.

CHAPTER THREE

MATERIALS AND METHODS

This chapter deals with study area, study design, population for the study, sample and sampling methods, instrument for data collection, validity of the instrument, reliability of the instrument, method of data collection, data analysis and ethical clearance/informed consent.

3.1 Study Area

The study area is Imo State, located in the South Eastern Igbo speaking part of Nigeria and one of the thirty-six (36) states in the Federal Republic of Nigeria. Imo State lies between latitude 4'45^{0}N to 7'15^{0}N and longitude 6'5^{0}E to 7'25^{0}E, with areas of around 5,100sqkm. Popularly referred to as Eastern Heartland, with Owerri city as its capital, Imo State is bounded on the east by Abia State, on the west by River Niger and Delta State, on the north by Anambra State and on the south by River State. It has a population of 4,927,563 inhabitants according to National Census of 2006 and a projected population of 5,408,800 in 2016 with 2,748,621 males and 2,660,179 females (National Bureau of Statistics). It was created in 1976 from the old east central state by the then Head of State, General Murtala Mohammed. There are twenty-seven (27) Local Government Areas and three (3) Senatorial Zones (Orlu, Owerri and Okigwe) in Imo State. Orlu zone referred to as Imo West Senatorial District has twelve (12) Local Government Areas with 2,269,100 inhabitants, while Owerri zone popularly called Imo East District has nine (9) with 2,041,900 inhabitants. Okigwe Zone also referred to as Imo North Senatorial District has six (6) Local Government Areas with 1,098,100 inhabitants. Inhabitants in these zones are mostly civil servants, business men and women, farmers and great number of artisans.

The lifestyle in Imo State is characterized by their traditional practices, agriculture and entrepreneurship. And because of rapid development in Imo State, different kinds of workers including various artisans such as automobile repair artisans, welding artisans and small-scale and medium-sized wood enterprises are evident in it.

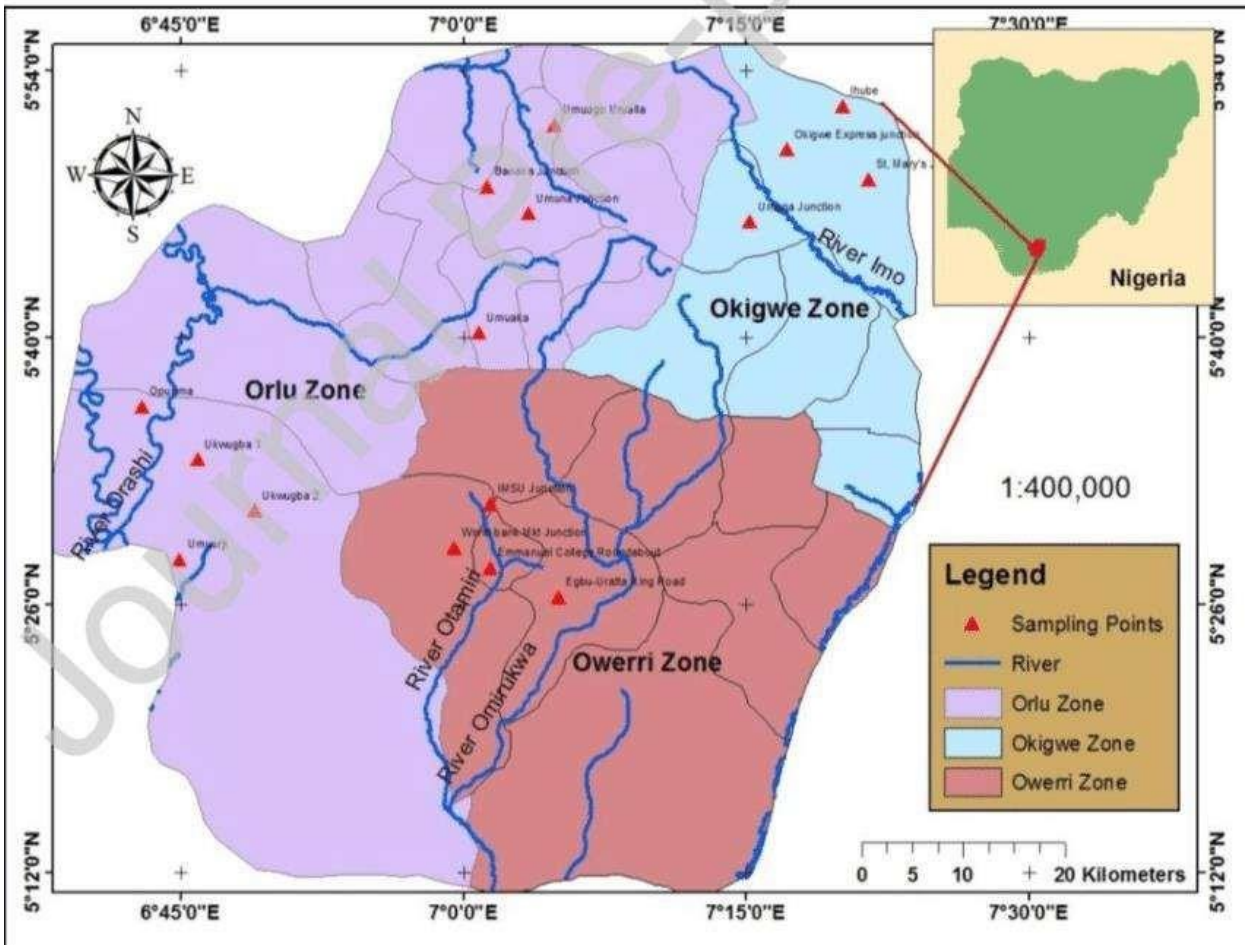

Fig 3.1: Map of Imo State, Nigeria showing the three senatorial zones

Source: Ibe et al., 2019

3.2 Study Design

Descriptive cross-sectional design was used for this study because it generates answers to research questions in a statistical form, making it possible for researchers to perform simple statistical analysis for interpretation of data. Elechi et al. (2019) used it to assess occupational health hazards associated with sawmill workers in Port Harcourt Metropolis Rivers State. Marahatta et al. (2018), also utilised cross-sectional design to conduct a study on automobile repair artisans from Kathamandu Metropolitan City, Nepal. The study lasted for six (6) months.

3.3 Population for the Study

The study population consisted of welders and wood work artisans of both sexes, aged 18years and above, who had lived in Imo state for not less than two years and had been actively involved in their respective work activities for these years. This comprised of the two (2) selected categories of welders (arc and auto welders) and wood work artisans (saw millers, wood carvers and carpenters/furniture makers) in Orlu, Owerri zone and Okigwe zones of Imo State.

3.3.1 Inclusion Criteria

Consenting artisans of the two (2) selected categories of both sexes, aged 18 years and above who have lived in any of the three (Orlu, Owerri and Okigwe) zones of Imo State for not less than two years and have been actively involved in their respective occupations.

3.3.2 Exclusion Criteria

Artisans of the two (2) selected categories of both sexes, aged 18 years and above who have lived less than two years in any of the three (Orlu, Owerri and Okigwe) zones of Imo State and have been partially involved in their respective artisanal occupations.

3.4 Sample and Sampling Methods

3.4.1 Sample Technique

A sampling frame was drawn from Imo State using Multistage Stratified Random Sampling Technique.

Stage One: Placement of the three Senatorial Zones in Strata

First, proportionate stratified random sampling technique was employed, to place the three senatorial zones (Orlu, Owerri and Okigwe) in strata.

Stage Two: Selection of Local Government Areas

Using a sampling fraction of $\frac{1}{3}$, the researcher randomly and proportionately drew 4, 3 and 2 from 12, 9 and 6 L.G.As in Orlu, Owerri and Okigwe zones respectively (see table 3.1 below).

Table 3.1: Selection of Local Government Areas from Three (3) Zones of Imo State

SENATORIAL ZONES	LOCAL GOVERNMENT AREAS	SELECTED LOCAL GOVERNMENT AREAS
Orlu (Imo West Senatorial Zone)	12	4
Owerri (Imo East Senatorial Zone)	9	3
Okigwe (Imo North Senatorial Zone)	6	2
TOTAL	**27**	**9**

From the three zones, 4, 3 and 2 L.G.As were randomly selected from 12 L.G.As in Orlu, 9 L.G.As in Owerri and 6 L.G.As in Okigwe zones respectively. Orlu zone got Orlu, Njaba,

Ideato-North and Nwangele L.G.As, Owerri zone got Owerri North, Owerri West and Mbaitoli L.G.As and Okigwe zone got Okigwe & Onuimo L.G.As as the selected local government areas.

Stage Three: Selection of communities

At each of the nine local government areas randomly selected (from the three zones), the researcher also randomly selected two communities by balloting (one urban, one rural).

From the four (4) L.G.As (Orlu, Njaba, Ideato-North & Nwangele) selected in Orlu zone, Amaifeke and Umuowa communities were randomly selected for Orlu L.G.A, Umuaka and Amucha were randomly selected for Njaba L.G.A, Akokwa & Umuobom were randomly selected for Ideato-North L.G.A, while Amaigbo & Dim-na-Nume were randomly selected for Nwangele L.G.A.

From the three (3) L.G.As (Owerri-North, Owerri-West & Mbaitoli) selected in Owerri zone, Egbu and Naze communities were randomly selected for Owerre-North L.G.A, Avu and Umuguma were randomly selected for Owerre-west, while Mbieri and Ubommiri were selected for Mbaitoli L.G.A.

From each of the two (2) L.G.As (Okigwe and Onuimo) selected in Okigwe zone, Umuokpara & Umulolo were communities randomly selected from Okigwe L.G.A, while Okwelle and Okwe were randomly selected from Onuimo L.G.A.

In all, eighteen (18) communities were randomly selected from the three senatorial zones (Orlu (8), Owerri (6), Okigwe (4) of Imo State.

Stage Four: Selection of Target Artisans

At each of these eighteen (18) communities in Imo State, wood markets and welding workshops were randomly selected. At each cluster of these markets and workshops, the list of registered members of welders and wood workers were collected from their union executives after advocacy visit and in-depth discussions. Subjects were selected by systematic sampling technique, using the sampling interval obtained by dividing the population with the required sample size.

As some workshops had more than one worker, only the senior worker or the representative was selected in each shop visited.

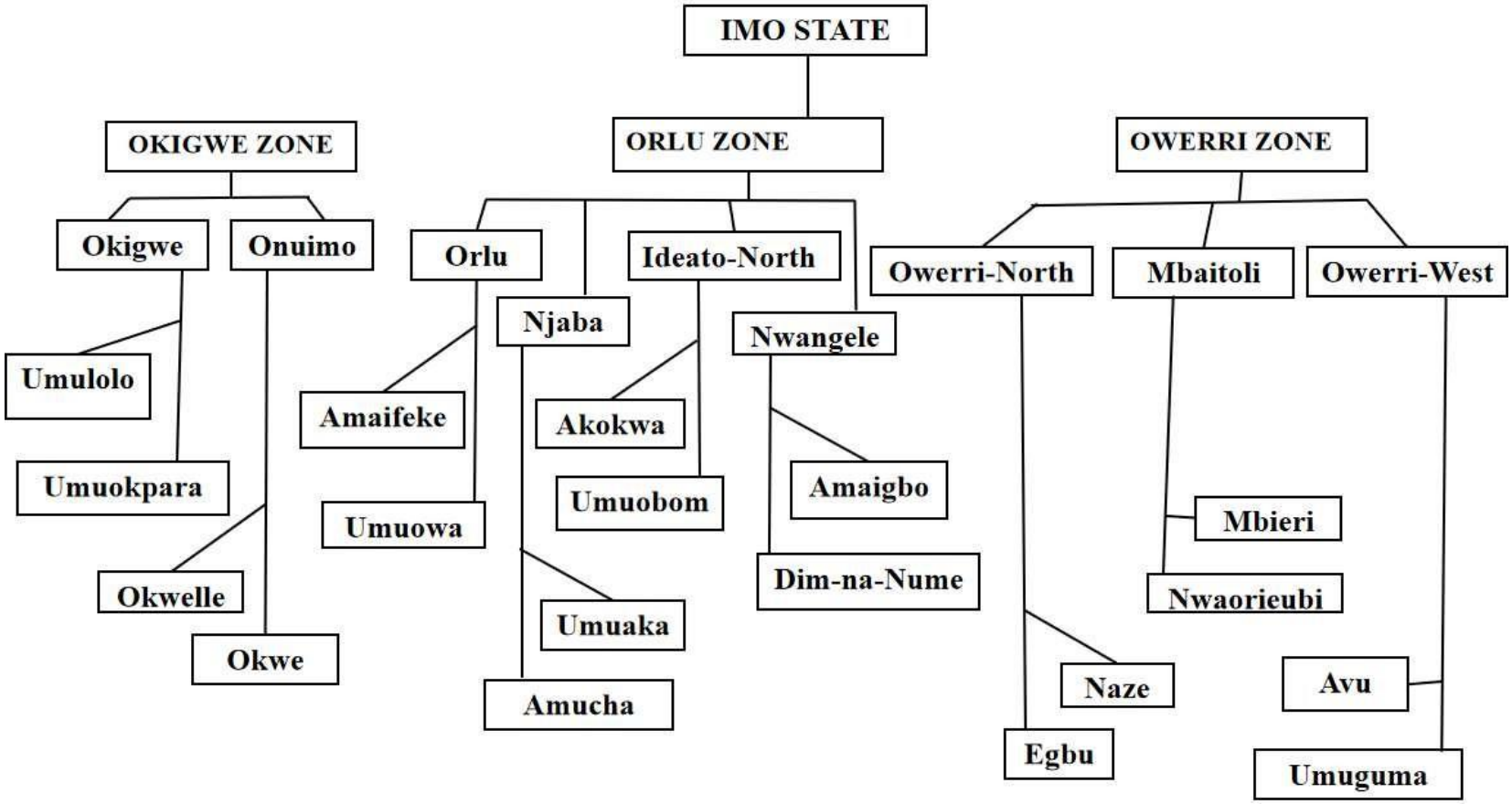

Fig 3.2: SCHEMATIC SAMPLING FLOW CHART FOR SELECTION OF LOCAL GOVERNMENT AREAS AND COMMUNITIES FROM THREE (3) ZONES OF IMO STATE

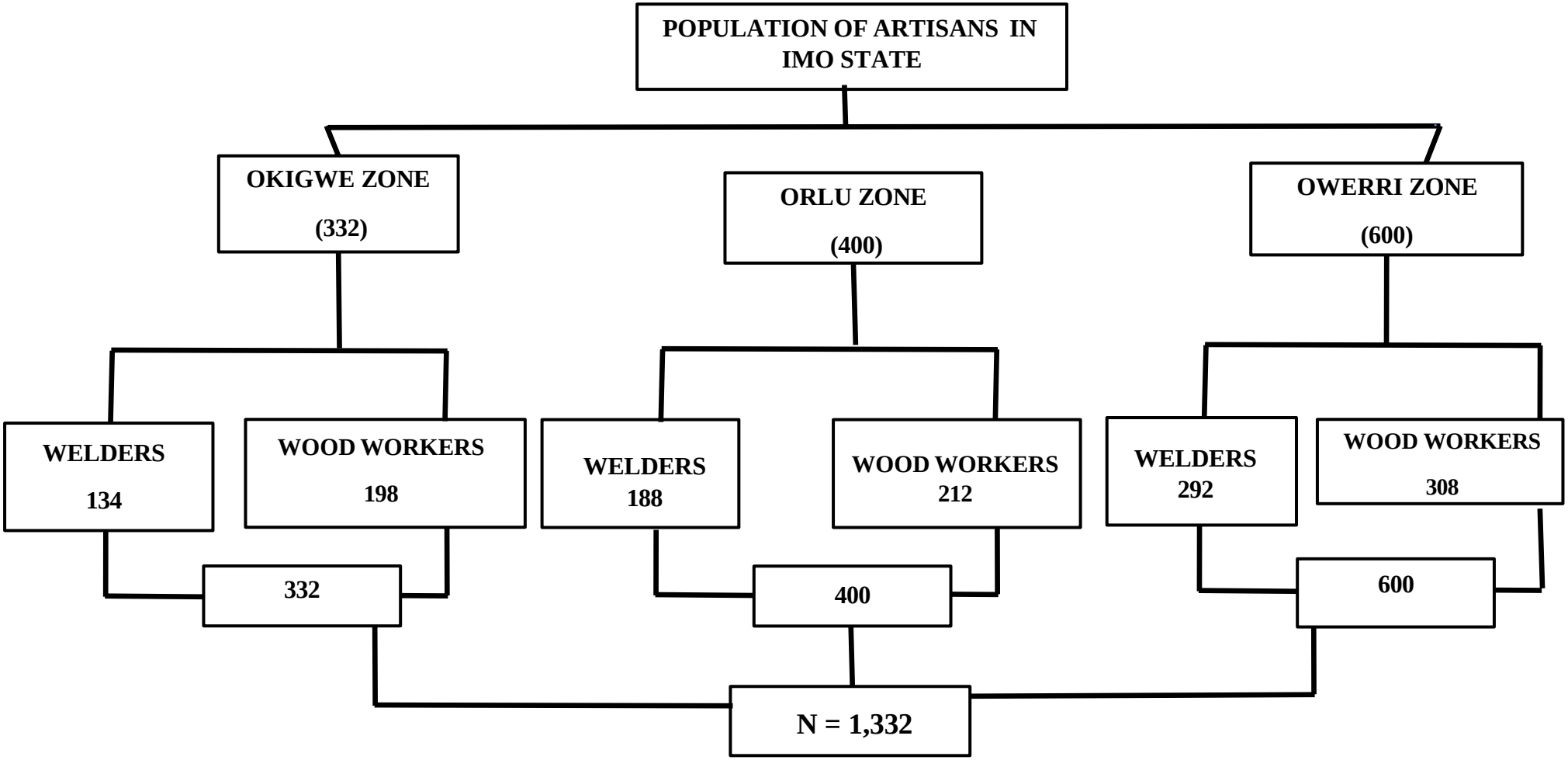

Fig 3.3: SCHEMATIC FLOW CHART OF POPULATION OF ARTISANS IN IMO STATE

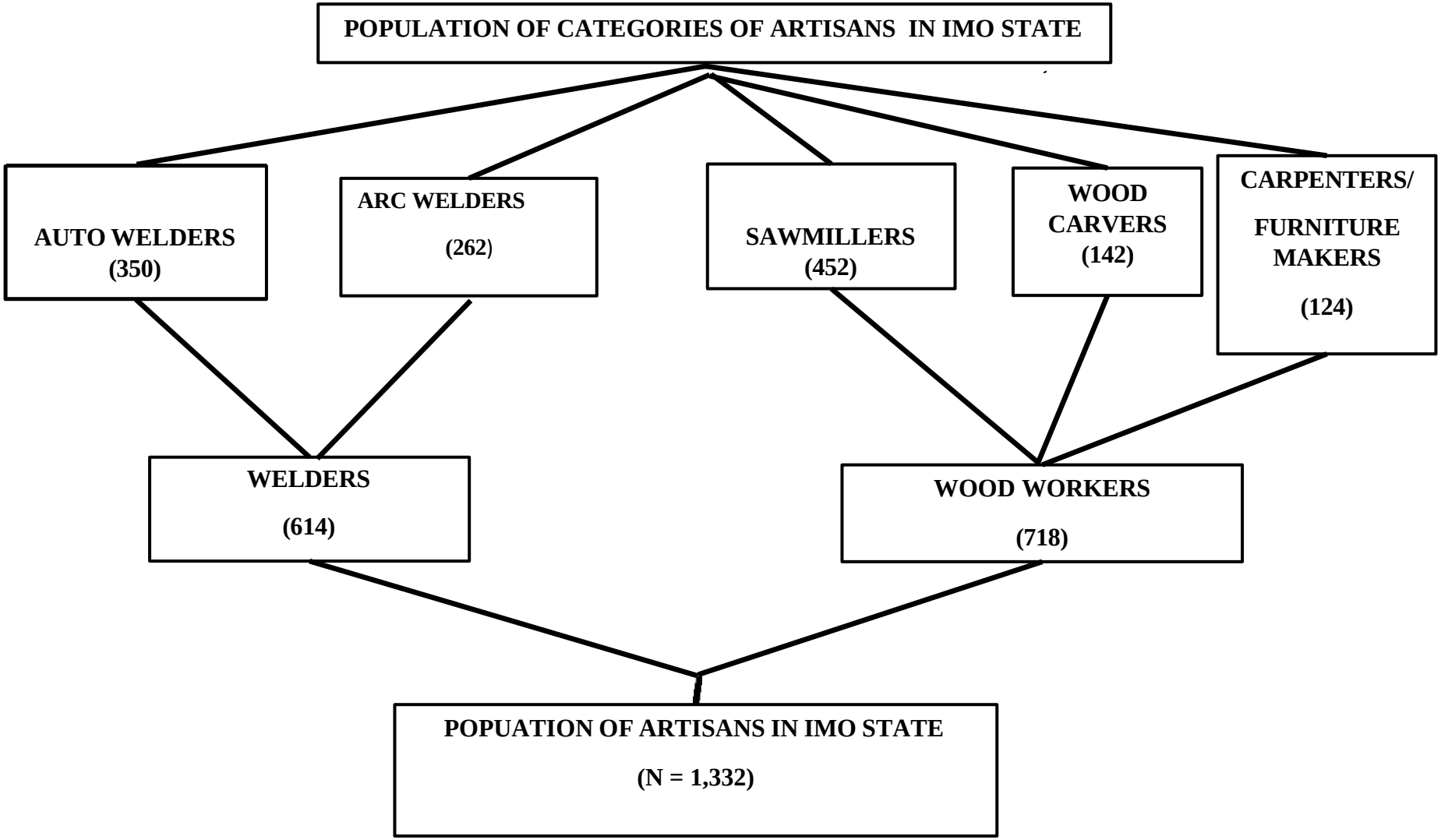

Fig 3.4: SCHEMATIC FLOW CHART OF POPULATIONS OF ARTISAN CATEGORIES IN IMO STATE

3.4.2 Sample Size

The sample size of 400 was made use of. Taro Yamane formula for sample size calculation for a given population was utilisesd. The mathematical illustration of the Taro Yamane formula is given thus: $n = N/1 + N(e)^2$

where n is the sample size,

N is the population under study and,

e is the marginal error.

The population under study was 1,332 being the 30% of the total population of the two (2) selected artisan categories of welders and wood artisans, aged 18years and above who had lived either in Orlu, Owerri and Okigwe zones of Imo state for not less than two years and had been actively involved in their respective work activities for these years (see table 3.3 above).

Therefore, sample size for the study (n) using the formula, $n = N/1 + N(e)^2$ and substituting for the figures appropriately,

$n = 1332 \div (1+1332(0.05)^2)$

$n = 1332 \div (1333 \times 0.0025)$

$n = 1332 \div (3.3325)$

$n = 399.69$

$n \approx 400$

The sample size for each group of welders (automobile & arc welders) and wood workers (sawmillers, wood carvers & furniture makers/carpenters) was calculated, using 30% of total population of each of the artisan groups in the three zones of Imo State. Orlu, Owerri and Okigwe zones got a total of 120, 180 and 100 artisans respectively (see table 3.4 below).

At each zone, the sample size for each of the artisans was proportionately distributed in relation to 30% of total population of the group. For instance, sample size for auto welders in Orlu zone was $\frac{104}{400} \times 120 = 31$, while arc welders, had $\frac{84}{400} \times 120 = 25$

The computation continued for other artisan groups in all the zones for their respective sample size.

Table 3.2: Sample size drawn from populations of each of the two selected artisan groups in Imo State

(Using 30% of respective artisan population)

ARTISANS	ORLU ZONE	OWERRI ZONE	OKIGWE ZONE	SAMPLE SIZE (n)
Auto welders	31	52	22	105
Arc welders	25	36	18	79
Total Welders	**56**	**88**	**40**	**184**
Saw millers	49	54	33	136
Wood carvers	5	22	15	42
Furniture makers/Carpenters	10	16	12	38
Total Wood work Artisans	**64**	**92**	**60**	**216**
30% population of Artisans in each zone	**120**	**180**	**100**	**400**

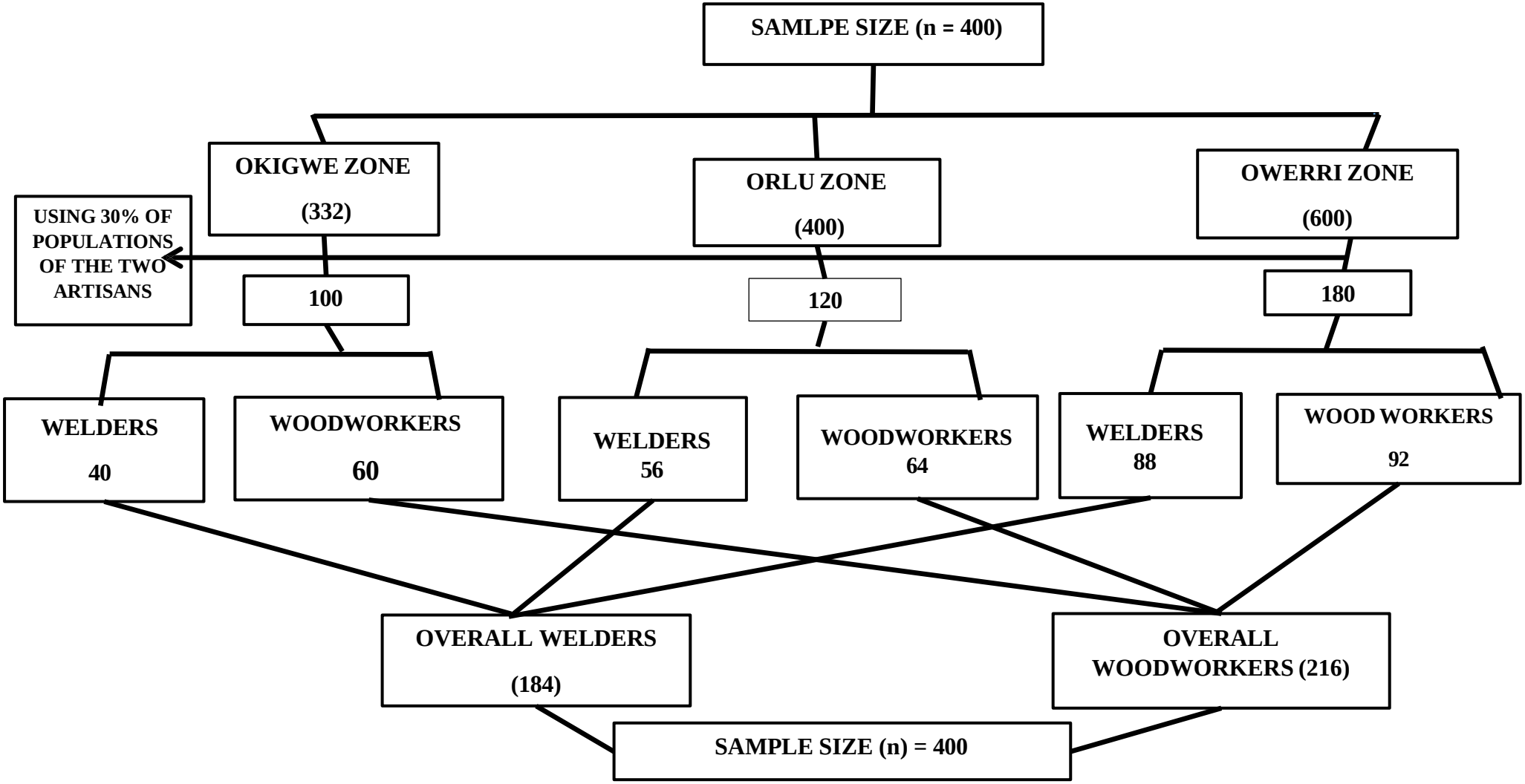

Fig 3.5: SCHEMATIC FLOW CHART OF SAMPLE SIZE OF ARTISANS IN IMO STATE

3.5 Instruments for Data Collection

The instruments used for this study were:

A) Questionnaire

A pretested semi-structured interviewer-administered questionnaire divided into four (4) sections, A, B, C, and D was used (see Appendix A).

Section A, made up five (5) items elicited information on respondents' socio-demographic characteristics of age, gender, marital status, educational level, religion.

Section B, consisted of sixteen (16) items gave details on respondents' occupational information including occupational history as regards work type and its sections, daily income earned, years at work (duration of work) and work schedule, health problems before the present work, feelings about work and smoking/non-smoking status; occupational exposure to hazards; and awareness towards health challenges with details on hazard type(s) encountered at work, source(s) of awareness of health challenge(s).

Section C, comprised of twenty four (24) items elicited information on adherence towards safety and health standard as concern medical checks, safety training and sources of the training, use of personal protective equipment and types. Information on personal hygiene and sanitation practices was also collected under section C, with details on accommodation status, hand washing before eating, bathing after daily work, work habit(s), availability of urinals and toilets facilities, toilet type, functionality and its cleaning methods, sources of water supply, refuse collection and disposal method among respondents.

Section D consisted of six (6) items, furnished information on ocular (eye), respiratory, auditory (ear), dermatological (skin), musculoskeletal disorders and blood pressure health conditions of respondents. Frequency of occurrence of these health problems, number of days-off due to health problems, treatment type and source were elicited. Information on other health conditions (not classified) of respondents such as crushing wound, fracture and dislocation were also collected under section E with six (6) items which provided same information as above. Respondents ocular examination, skin examination, blood pressure & pulse rate, lung function (peak expiratory flow rates) were also collected under section E.

B) Physical Health Assessment Tools

i) Visual Acuity (Literate and Illiterate Snellen) Charts

ii) Pen torch

iii) Ophthalmoscope (Heine - Beta 200, Germany)

iv) Sphygmomanometer (Omron M2 Eco (Hem 7120 Af))

v) Peak Flow Meter (Praxis-Service BoehringerIngelheim, England).

C) Work Environment Air Quality Monitoring Tools

i) Portable Particulate Matter Monitor (BTMETER BT-5800S, Vietnam)

ii) Portable Multi Gas Monitor (WINTACT WT8811, China)

iii) Portable Sound Meter (AudioMeter) (SV 973, Poland)

D) Paper and pen (writing materials)

3.6 Validity of the Instrument

Validity, the extent to which a test measures what it claims to measure was ascertained. Thus, the study questionnaire was carefully prepared by the researcher and given to the supervisor and two others lectures in Public Health Department for vetting in relevance to the content coverage, objectives and hypotheses as well as clarity of language usage. Their observations and input were noted and corrections were subsequently effected by the researcher, before the final copy was produced.

3.7 Reliability of the Instrument

The instruments reliability was ascertained by calculating a Conbach's alpha reliability coefficient after pre-testing the data collection instrument on twenty (20) subjects from similar setting. The instrument was found to be reliable at coefficient of 0.7 based on standardized items.

3.8 Methods for Data Collection

A. Questionnaire

The questionnaire were administered to the respondents by the researcher and trained research assistants after informed consent was obtained. The researcher and research assistants helped to clarify questions not well understood. Literate respondents were allowed to fill the questionnaire themselves with the guidance of the researcher and research assistants while the non-literate respondents, had the questionnaire translated in Igbo language. The questions were read out for them by the research assistants and their answers ticked appropriately by the research assistants. Data collection involved face-to-face interviews with respondents. Average of fifteen (15) minutes was used to answer a questionnaire.

B. Physical Health Assessment of Respondents

This involved physical examination and some investigative tests such as eye examination, blood pressure, pulmonary function of the respondents who met the criteria for participation in the study. Physical examinations were performed by health care professionals including medical doctors, optometrists, certified nurses and environmental officers recruited by the researcher. Health assessment examination included:

i) Ocular (Eye) Examination

Detailed eye examination was performed by Optometrists (recruited by the researcher) on respondents who met the criteria for participation in the study, using visual acuity chart, pen torch and ophthalmoscope.

Literate and illiterate snellen charts were used based on the ability of respondents to read out letters or symbols on the chart. Literate respondents were instructed to either sit or stand at a specified distance away from the chart and to call out alphabets or symbols seen with one eye at a time. He/she called out alphabets or symbols seen row by row with open eye while the other eye is closed. The process is repeated on the other eye thereafter. Illiterate respondents as well, were instructed to identify the direction letter E was facing. While either sitting or standing up, he/she was instructed by the examiner to look at the chart with one eye open and the other closed, and to point at the direction letter E was facing: up, down, left, or right. The procedure was repeated on the other eye and the visual acuity results recorded for the both eyes (right and left). Also while respondents were seated upright with their eyes widely opened, the examiner looked at the external features of respondents' eyes and their adnexia with the help of pen torch. The pen touch was shone from the sides to the centers of the respondents' eyes, to check features such as colour of the eyes, eyelashes, eyelids, size, shape and equality of pupils

to each other, pupillary reaction to light and accommodation, shape and size of cornea, and conjunctiva. The eyes were examined one after the other and abnormalities detected were recorded. The examiner once again looked at the internal features of the eyes such as the crystalline lens, the retina (optic cup and disc, optic nerve head, macula, positions of retinal blood vessels and entire fundal background) with the help of an ophthalmoscope. Both eyes were examined individually, and abnormalities detected were recorded.

ii) Sphygmomanometry (Blood Pressure/Pulse Rate Test)

Sphygmomanometry (Blood Pressure/Pulse Rate Test) was performed by medical doctors and certified nurses recruited by the researcher. Respondents who met the criteria for participation in the study were instructed to sit upright on a balanced chair while placing their left hand on a table. Pulling up the shirt sleeve (if any) of their left arm to the shoulder, the examiner (registered nurses, recruited by the researcher) applied the Sphygomanometer on the upper arm of respondents' left hand, two (2) inches from the elbow. Readings of the systolic and diastolic pressure as well as the pulse rate of respondents were recorded accordingly. The procedure was repeated three times and the average taken for all the respondents.

iii) Lung Function Test

Lung function test was performed by public health officers (recruited by the researcher) on respondents who had symptoms of respiratory problems using a hand-held peak flow monitor. Respondents were instructed to stand upright, while the peak flow monitor mouth tip was cleaned with methylated spirit, to sterilize it. Then respondents were then instructed to take deep breath in and to forcefully breath out air through the mouth into the peak flow meter (Praxis-Service Boehringer Ingelheim, England) within 1 min, with the help of stop watch as

time keeper. The indicated reading on the peak flow meter was recorded. The procedure was repeated three times and the average recorded for all the respondents.

iii) Skin Examination

Skin examination was performed by medical doctors and certified nurses recruited by the researcher. Respondents who met the criteria for participation in the study were instructed to sit upright on a balanced chair. The skin of their hands and fingers were inspected by medical doctors (recruited by the researcher) for colour change, texture, swellings and eruptions, burns, bruises, cuts, lacerations, and moles or lumps. Findings were recorded appropriately.

C. Workplace Environment Air quality Assessment of Respondents

Environment Air quality Assessment was performed by environmental health officers recruited by the researcher. Air quality assessment tools used included:

i) Portable Particulate Matter Monitor

This was used to monitor the dust particles obtainable at the workplace environment of the target respondents. The particulate matter monitor was set and and kept at a close distance to target respondents during their work activities. The readings reflected on the screen of the monitor was recorded for particulate matter 1.0, 2.5 and 10 as indicated. The procedure was repeated three times by environmental health officer (recruited by the researcher) and the average recorded for all the respondents.

ii) Portable Multi Gas Monitor

This was used to monitor gases, fumes and smoke released during work activities of target respondents. The gas detector was set and and kept at a close distance to target respondents

during their work activities. The readings reflected on the screen of the gas monitor was recorded. The procedure was repeated three times by environmental health officer (recruited by the researcher) and the average recorded for all the respondents.

iii) Portable Sound Meter (AudioMeter)

This was used to monitor the level of noise obtainable at the workplace environment of the target respondents. The sound meter was set and held by the examiner at a short distance, close to target respondents during their work activities. The readings indicated on the sound meter was recorded. The procedure was repeated three times by environmental health officer (recruited by the researcher) and the average recorded for all the respondents.

D. Paper and pen (writing materials)

Important information collected from respondents were recorded on a paper with pen. Interviews where necessary, were transcribed by identifiers such as; location, position, and the type of work. The interviews were first transcribed in the English language and then translated into Igbo to ensure completeness. Results for their physical observations were recorded.

3.9 Method of Data Analysis

Data collected was captured using Statistical Package of Social Sciences (SPSS) Program, version 25 (SPSS Inc. Chicago Illinois, USA). Descriptive technique such as frequencies, percentages and mean were used to describe the data variables, hence summarized using mean and standard deviations (SD) while qualitative variables were presented on tables of frequencies and were all expressed as the percentage of the distribution. Bar charts were utilized to visualize the variables. Data collected on attitude towards occupational health protection was analyzed using mean statistics. Inferential analysis was done using chi-square

test statistics to test the relationship between categorical variables under consideration and P values <0.05 were considered statistically significant. Logistic regression was used to test for relationships between variables through Wald test and the odds ratio computed was used to estimate the effect size.

The World Health Organization (WHO) Permissible Exposure Levels (PEL) for Particulate Matters, Gases, fumes and Noise were used as the standard value to compare the analysis of data for the pollution level of air in the selected artisans' workplace environments (see Appendix C). The analysis comparison was performed using statistical t-test procedure. All statistical test were performed at 5% significant level and the probability values (P) was used to interpret significance. Hence P less than 0.05 were considered significant.

3.10 Ethical Considerations and Informed Consent

Ethical clearance was obtained from the Ethical Clearance Committee of Public Health Department, School of Health Technology, Federal University of Technology, Owerri and Ministry of Health, Imo State, before the research was conducted (see Appendix D).

An informed written consent was obtained from the respondents to fill out the questionnaire, and the "no-risk" implication of voluntary participation and the guarantee of anonymity were clarified. The confidentiality of information they provided was also maintained (see Appendix D).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 RESULTS

A total of four hundred (400) questionnaire were distributed through face-to-face direct contact with the respondents and all were retrieved for the study. They were properly crosschecked for correctness and were used for the purpose of the analysis.

4.1.1 Prevalence of Occupation-Related Health Challenges Encountered Among Welders and Wood work Artisans in Imo State

The result of the prevalence of occupation-related health challenges encountered among welders and wood work artisans in Imo State included ocular 72.5% (290/400); respiratory 49.8% (292/400); hearing 57.3% (228/400); skin 79.5% (318/400); musculoskeletal 86.8% (347/400)and arterial (blood) pressure 40.2% (161/400) as shown in table 4.1.1

Table 4.1.1: Prevalence of Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State

Occupation-Related Health Challenges	Welders (n = 184)		Wood Artisans (n= 216)		Overall (n = 400)	
	Freq	%	Freq	%	Freq	%
Ocular Health Challenge (Yes)	141	76.6%	149	69.0%	290	72.5%
No	43	23.4%	67	31.0%	110	27.5%
Total	184	100.0%	216	100.0%	400	100.0%
Respiratory Health Challenge (Yes)	89	48.4%	110	50.9%	199	49.8.%
No	95	51.6%	106	49.1%	201	50.2%
Total	184	100.0%	216	100.0%	400	100.0%
Hearing Health Challenge (Yes)	105	42.9%	123	56.9%	228	57.0%
No	79	57.1%	93	43.1%	172	43.0%
Total	184	100.0%	216	100.0%	400	100.0%
Skin Health Challenge (Yes)	151	82.1%	167	77.3%	318	79.5%
No	33	17.9%	49	22.7%	82	20.5%
Total	184	100.0%	216	100.0%	400	100.0%
Musculoskeletal Health Challenge (Yes)	157	85.3%	190	88.0%	347	86.8%
No	27	14.7%	26	12.0%	53	13.2%
Total	184	100.0%	216	100.0%	400	100.0%
Arterial (Blood) Health Challenge(Yes)	73	39.7%	88	40.7%	161	40.2%
No	111	60.3%	128	59.3%	239	59.8%
Total	184	100.0%	216	100.0%	400	100.0%

4.1.1.1 Prevalence of Occupation-Related Ocular Challenges Among Welders and Woodwork Artisans in Imo State

The result of the prevalence of occupation-related ocular challenges among welders and wood work artisans in Imo State showed that commonly reported ocular symptoms was 73.0% (292/400), while ocular problems occurrence was 72.5% (290/400) as shown in table 4.1.1.1.

Among the welders, the prevalence of commonly reported ocular symptoms was 74.5% (137/184), while the prevalence of ocular problem occurrence was 76.6% (141/184).

Among the wood workers, the prevalence of commonly reported ocular symptoms was 71.8% (155/400), while the prevalence of ocular problems occurrence was 69.0% (149/216).

The commonly reported ocular symptoms included itching 18.7% (75/400), tearing 14.2.% (57/400), gritty sensation 13.5% (55/400), blurry vision 10.8% (43/400), pain 8.8% (35/400) and redness 7.0% (28/400). Among the welders, tearing was the commonest ocular symptom (19.6%; 36/184), while the commonest among wood workers was itching (29.2%: 63/216). Pain (14.7%) and eye redness (11.9%) and blurry vision (12.0%) were also reported more by welders, while gritty sensation was reported more among wood workers (16.7%).

Greater proportion of welders and wood work artisans had ocular problems (72.5%: 290/400). Conjunctivitis was the commonest ocular problem 34.8% (139/400), being the most detected among the welders and wood workers.

Conjunctivitis was found in great proportion of the wood workers (50.5%: 109/216) and in small proportion of welders (16.3%: 30/184). However, the prevalence of arc eye occurrence was 32.6% (60/184) among welders, while no arc eye was found among the wood workers (0.0:0/216). Occurrence of lens opacity (10.9%: 20/184) and pterygium (8.1%: 15/184)

were more among welders, while pinguencula (12.0%: 12/216) was more among wood workers. Corneal opacity and pinguencula were also found among welders (though on a low prevalence). Wood workers also showed lens opacity, corneal opacity, and pterygium (though on a lower scale).

Result on the visual acuity showed that great proportion of welders and wood work artisans (83.0%: 332/400) had normal visual acuity, while small proportion had moderate (11.0%: 44/400) and severe (6.0%: 24/400) visual impairment. No artisan was found with blindness (0.0%: 0/400). However, more wood respondents had moderate (12.0%:26/216) and severe visual impairment (8.4%: 16/216) as against welders with moderate (9.8%: 18/184) and severe (4.3%: 8/184) visual impairment.

Significant difference was found between welders and wood artisans in their respective ocular status (P=0.0001, χ^2= 160.3).

Table 4.1.1:1 Prevalence of Occupation-Related Ocular Health Challenges Among Welders and Woodwork Artisans in Imo State

Ocular Health Challenges	Welders (n = 184) Freq	%	Wood Artisans (n= 216) Freq	%	Overall(n = 400) Freq	%	P value
Common Reported Ocular Symptoms (Yes)	**137**	**74.5%**	**155**	**71.8%**	**292**	**73.0%**	
Itching	12	6.5%	63	29.2%	75	18.7%	
Tearing	36	19.6%	21	9.7%	57	14.2%	
Redness	22	11.9%	6	2.8%	28	7.0%	
Pain	27	14.7%	8	3.7%	35	8.8%	
Gritty sensation	18	9.8%	36	16.7%	54	13.5%	
Blurry vision	22	12.0%	21	9.7%	43	10.8%	
No	**47**	**25.5%**	**61**	**28.2%**	**108**	**27.0%**	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Occurrence of Ocular Problems (Yes)	**141**	**76.6%**	**149**	**69.0%**	**290**	**72.5%**	
Arc eye	60	32.6%	0	0.0%	60	15.0%	
Conjunctivitis	30	16.3 %	109	50.5%	139	34.8%	
Corneal opacity	12	6.5%	4	1.9%	16	4.0%	
Pinguencula	4	2.2%	26	12.0%	30	7.5%	
Pterygium	15	8.1%	2	0.9%	17	4.2%	
Lens opacity	20	10.9%	8	3.7%	28	7.0%	
No	**43**	**23.4%**	**67**	**31.0%**	**110**	**27.5%**	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Visual Acuity							
Normal	158	85.9%	174	80.6%	332	83.0%	
Moderate Visual Impairment	18	9.8%	26	12.0%	44	11.0%	
Severe Visual Impairment	8	4.3%	16	7.4%	24	6.0%	
Blindness	0	0.0%	0	0.0%	0	0.0%	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Statistical test	**160.33 [LR]**						**0.0001**

4.1.1.2 Prevalence of Occupation-Related Respiratory Challenges Among Welders and Woodwork Artisans in Imo State

The result of the prevalence of occupation-related respiratory challenges among the welders and wood work artisans in Imo State showed that commonly reported respiratory symptoms was 64.2% (257/400), while respiratory problem occurrence was 49.8% (199/400) as shown in table 4.1.1.2. Among the welders, the prevalence of commonly reported respiratory symptoms was 57.0% (105/184), while the prevalence of respiratory problem occurrence was 48.4% (89/184). Among the wood workers, the prevalence of commonly reported respiratory symptoms was 70.4% (152/216), while the prevalence of respiratory problems occurrence was 50.9% (110/216).

The commonly reported respiratory symptoms included cough (16.5%: 66/400), chest pain (15.2%; 61/400) and tightness of chest (13.2%: 53/400), wheezing (11.5%; 46/400) and phelgm production (7.8%: 31/400). Greater proportion of studied artisans had respiratory symptoms (64.2%: 257/400). Among the welders, the prevalence of chest pain (20.6%: 38/184) was the commonest symptom, while the commonest among wood workers was cough (20.4%: 44/216).

Given a normal peak expiratory flow rate (PEFR), ranging from 400 - 600 l/min (as normal reading), there were 89 welders (48.2%) that showed low peak expiratory flow rate. Among the wood workers, 110 (50.9%) of them showed low PEFR. The mean peak expiratory flow rate was found to be 396.2± 47.3l/min among the welders and 385.1± 52.4l/min among the wood artisans, indicating decline in the lung functions for both welders and wood workers. The wood workers had greater disadvantage (the mean was slightly lower for the wood artisans) as against the welding counterparts.

Significant difference was found between welders and wood work artisans in their respective mean peak expiratory flow rate ($P = 0.027$, $t = 2.224$).

Table 4.1.1.2: Prevalence of Occupation-Related Respiratory Challenges Among Welders and Wood Work Artisans in Imo State

Respiratory Health Challenges	Welders (n = 184) Freq %	Wood Artisans (n = 216) Freq %	Overall (n = 400)	P value
Common Reported Respiratory Symptoms (Yes)	**105 57.1%**	**152 70.4%**	**257 64.2%**	
Cough	22 12.0%	44 20.4%	66 16.5%	
Phelgm production	10 5.4%	21 9.7%	31 7.8%	
Wheezing	24 13.0%	22 10.2%	46 11.5%	
Chest pain	38 20.6%	23 10.6%	61 15.2%	
Tightness of chest	11 6.0%	42 19.4%	53 13.2%	
No	**79 42.9%**	**64 29.6%**	**143 35.8%**	
Total	**184 100.0%**	**216 100.0%**	**400 100.0%**	
Occurrences of Respiratory Problem				
Normal Peak Expiratory Flow Rate (400 - 600 l/min)	95 51.6%	106 49.1%	201 50.2%	
Low Peak Exiratory Flow Rate	89 48.4%	110 50.9%	199 49.8%	
Mean (±std. dev)	396.2± 47.3	385.1±52.4	**390.6**±50.2	
Total	**184 100.0%**	**216 100.0%**	**400 100.0%**	
Statistical test	**t = 2.224**			**0.027**

4.1.1.3 Prevalence of Occupation-Related Hearing Challenges Among Welders and Wood Work Artisans in Imo State

The result of the prevalence of occupation-related hearing problem among the welders and wood work artisans in Imo State showed that commonly reported hearing symptoms was 48.5% (194/400), while hearing problem occurrence was 57.0% (228/400) as shown in table 4.1.1.3. Among the welders, the prevalence of commonly reported hearing symptoms was 46.2% (85/184), while the prevalence of hearing problem occurrence was 42.5% (105/184). Among the wood workers, the prevalence of commonly reported hearing symptoms was 50.5% (109/216), while the prevalence of hearing problems occurrence was 56.9% (123/216).

The commonly reported symptoms included humming sensation (16%: 64/400), heaviness of ear (13%: 52/400), ringing sensation (9.8%: 39/400) and tuning-up of phone volume (9.8%: 39/400). Among the welders, the commonest symptom was heaviness of the ear with prevalence of 15.8% (29/184 , while that of wood artisans was humming sensation with prevalence of 20.4% (44/216). Ringing sensation and tuning-up of phone volume had equal prevalence (9.8%) among welders and wood work artisans.

Great proportion of welders and wood work artisans (57%: (228/400) had hearing problems. Among the welders, 57.1% (105/184) showed hearing problems. Similarly, among the wood artisans 56.9% (123/216) showed hearing problems.

No significant difference was found between the welders and wood work artisans studied in their respective hearing issues (P =0.981, $\square^2$=0.006).

Table 4.1.1.3: Prevalence of Occupation-Related Hearing Health Challenges Among Welders and Wood Work Artisans in Imo State

Hearing Health Challenges	Welders (n = 184) Freq	%	Wood Artisans (n = 216) Freq	%	Overall(n= 400)		P value
Common Reported Hearing Symptoms							
(Yes)	**85**	**46.2%**	**109**	**50.5%**	**194**	**48.5%**	
Ringing sensation	18	9.8%	21	9.7%	39	9.8%	
Humming sensation	20	10.9%	44	20.4%	64	16.0%	
Heaviness of ear	29	15.8%	23	10.6%	52	13.0%	
Tuning-up of phone volume	18	9.8%	21	9.7%	39	9.8%	
No	**99**	**53.8%**	**107**	**49.5%**	**206**	**51.5%**	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Occurrence of Hearing Problem							
Abnormal	105	42.9%	123	56.9%	228	57.0%	
Normal	79	57.1%	93	43.1%	172	43.0%	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Statistical test	$\chi^2 = 0.006$						**0.981**

4.1.1.4 Prevalence of Occupation-Related Skin Challenges Among Welders and Wood Work Artisans in Imo State

The result of the prevalence of occupation-related skin challenges among welders and wood work artisans in Imo State showed that skin symptoms was 66.5% (266/400),while skin problem occurrence was 79.5% (318/400) as shown in table 4.1.1.4. Among the welders, the prevalence of commonly reported skin symptoms was 57.6% (106/184), while the prevalence of skin problem occurrence was 82.1% (151/184). Among the wood workers, the prevalence of commonly reported skin symptoms was 74.0% (160/216), while the prevalence of skin problems occurrence was 77.3% (167/216).

The commonly reported skin symptoms included irritation (23.0%: 92/400), itching (15.0%: 60/400), blisters (12.3%: 49/400), dryness (9.7%: 39/400) and redness (6.5%:26/400). Among the welders, symptom of skin irritation had the highest prevalence (29.3%: 54/184), while symptom of itching had the highest prevalence (24.5%: 53/216) among wood respondents.

Greater proportion of both the wood work artisans (77.3%; 167/216) and welders (82.1%; 151/184) were found with skin problems. Prevalence of coarse palm was 32.6% (60/184) among the welders, and 19.0% (41/216) among the wood work artisans. Also, prevalence of scaly palms and cuts were found to be 29.2% (50/216) and 20.4% (44/216) respectively among wood artisans, and 20.7% (38/184) and 5.4% (10/184) respectively among the welders.

Significant difference was found between the welders and the wood artisans in their respective skin problem occurrences (P=0.0001, $\square^2$= 169.23).

Table 4.1.1.4: Prevalence of Occupation-Related Skin Challenges Among Welders and Wood Work Artisans in Imo State

Skin Health Challenges	Welders (n = 184)		Wood Artisans (n = 216)		Overall (n= 400)		P value
	Freq	%	Freq	%	Freq	%	
Common Reported Skin Symptoms (Yes)	**106**	**57.6%**	**160**	**74.0%**	**266**	**66.5%**	
Irritation	54	29.3%	38	17.6%	92	23.0%	
Dryness	23	12.5%	16	7.4%	39	9.7%	
Redness	13	7.1%	13	6.0%	26	6.5%	
Blisters	9	4.9%	40	18.5%	49	12.3%	
Itching	7	3.8%	53	24.5%	60	15.0%	
No	**78**	**42.4%**	**56**	**26.0%**	**134**	**33.5%**	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Occurrences of Skin Problem (Yes)	**151**	**82.1%**	**167**	**77.3%**	**318**	**79.5%**	
Coarse palms	60	32.6%	41	19.0%	101	25.3%	
Cuts	10	5.4%	44	20.4%	54	13.5%	
Bruises	15	8.2%	21	9.7%	36	9.0%	
Scaly palms	38	20.7%	50	29.2%	88	22.0%	
Burns	20	9.8%	8	3.7%	28	7.0%	
Laceration	8	4.3%	3	1.4%	11	2.7%	
No	**33**	**17.9%**	**49**	**22.7%**	**82**	**20.5%**	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Statistical test	$\chi^2 = 169.230$						**0.001**

4.1.1.5 Prevalence of Occupation-Related Musculoskeletal Challenges Among Welders and Wood Work Artisans in Imo State

The result of the prevalence of occupation-related musculoskeletal challenges among welders and wood work artisans in Imo State showed that commonly reported musculoskeletal symptoms was 87.5% (350/400), while musculoskeletal problem occurrence was 86.8% (347/400) as shown in table 4.1.1.5. Among the welders, the prevalence of commonly reported musculoskeletal symptoms was 85.6% (157/184), while the prevalence of musculoskeletal problem occurrence was also 85.3% (157/184). Among the wood workers, the prevalence of commonly reported musculoskeletal symptoms was 89.4% (193/216), while the prevalence of musculoskeletal problems occurrence was also 88.0% (190/216).

The commonly reported musculoskeletal symptoms included waist pain (34.2%: 137/400), low back pain (13.2%: 53/400), fatigue (12.5%: 50/400), and joint pain (11.0%: 44/400). Among the welders, the commonest symptom was waist pain with prevalence of 27.7% (51/184). This was followed by joint pain 18.5% (34/184) and low back pain 16.8% (31/184). Among the wood respondents, the commonest symptom was waist pain with prevalence of 39.8% (86/216). This was followed by fatigue 15.3% (33/216) and low back pain 10.2% (22/216).

Greater proportion of both the welders and wood work artisans showed musculoskeletal issues (87.5%: 350/400). Among the welders, 85.3% (157/184) had musculoskeletal issues, and 88.0% (190/216) had musculoskeletal problems among the wood artisans.

No significant difference was found between the welders and wood work artisans in their respective musculoskeletal problems (P =0.438, $\square^2$=0.601).

Table 4.1.1.5 Prevalence of Occupation-Related Musculoskeletal Health Challenges Among Welders and Wood Work Artisans in Imo State

Musculoskeletal Health Challenges	Welders (n = 184) Freq	%	Wood Artisans (n = 216) Freq	%	Overall (n= 400) Freq	%	P value
Common Reported Musculoskeletal Symptoms (Yes)	**157**	**85.3%**	**193**	**89.4%**	**350**	**87.5%**	
Joint pain	34	18.5%	10	4.6%	44	11.0%	
Waist pain	51	27.7%	86	39.8%	137	34.2%	
Low back pain	31	16.8%	22	10.2%	53	13.2%	
Stiffness of muscles	8	4.3%	21	9.7%	29	7.2%	
Numbness	12	6.5%	10	4.6%	22	5.5%	
Fatigue	17	9.2%	33	15.3%	50	12.5%	
Tenderness	4	2.2%	11	5.1%	15	3.8%	
No	**27**	**14.7%**	**23**	**10.6%**	**50**	**12.5%**	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Occurrences of Musculoskeletal Problem							
Yes	157	85.3%	190	88.0%	347	86.8%	
No	27	14.7%	26	12.0%	53	13.2%	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Statistical test	**χ^2 = 0.601**						**0.438**

4.1.1.6 Prevalence of Occupation-Related Arterial (Blood) Pressure Challenges Among Welders and Wood Work Artisans in Imo State

The result of the prevalence of occupation-related arterial (blood) pressure challenges among welders and wood work artisans in Imo State showed that commonly reported arterial pressure symptoms was 40.2% (161/400), while blood pressure occurrence was 40.2% (161/400) as shown in table 4.1.1.6.

The commonly reported arterial (blood) pressure symptoms included headache 18.8% (75/400),dizziness 5.5%(22/400),insomnia 4.0% (16/400),palpitation 3.7% ((15/400), fainting and shortness of breath 3.2% (13/400) respectively. Among the welders, prevalence of headache and dizziness were 17.9% (33/184) and 5.4% (10/184) respectively, while among wood workers, prevalence of headache and dizziness were 19.4% (42/216) and 5.6% (12/216).

A substantial proportion of welders and wood work artisans were hypertensive 40.3% (161/400). Among the welders, occurrence of hypertension was 39.7% (73/184)), while among wood workers hypertension occurrence was 40.7% (88/216). The prevalence of hypertension was slightly higher among the wood artisans than the welders.

No significant difference was found between the welders and wood work artisans in their respective arterial (blood) pressure condition (P =0.828, $\square^2$=0.042).

Table 4.1.1.6: Prevalence of Occupation-Related Arterial Health Challenges Among Welders and Wood Work Artisans in Imo State

Work-Related Health Challenges	Welders (n = 184)		Wood Artisans (n = 216)		Overall (n= 400)		P value
	Freq	%	Freq	%	Freq	%	
Common Reported Arterial (Blood) Pressure Symptoms (Yes)	**73**	**39.7%**	**88**	**40.2%**	**161**	**40.2%**	
Headache	33	17.9%	42	19.4%	75	18.8%	
Palpitation	7	3.8%	8	3.7%	15	3.7%	
Insomnia	5	2.7%	11	5.1%	16	4.0%	
Dizziness	10	5.4%	12	5.6%	22	5.5%	
Fainting	6	3.3%	7	3.3%	13	3.2%	
Shortness of breath	8	4.3%	5	2.3%	13	3.2%	
Nausea	4	2.2%	3	1.4%	7	1.8%	
No	**111**	**60.3%**	**128**	**59.8%**	**239**	**59.8%**	
Total	**184**	**100.0%**	**184**	**100.0%**	**400**	**100.0%**	
Occurrence of Blood Pressure Problems							
Hypertensive	73	39.7%	88	40.7%	161	40.2%	
Non-hypertensive	111	60.3%	128	59.3%	239	59.8%	
Total	**184**	**100.0%**	**216**	**100.0%**	**400**	**100.0%**	
Statistical test	$\chi^2 = 0.042$						**0.828**

4.1.1.7 Prevalence of Other Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State

The result of the prevalence of other occupation-related health challenges (unclassified in the present study) among the welders and wood work artisans in Imo State showed crushing wound (51.5%: 85/165), electric shock (27.3%: 45/165)and fracture (21.2%: 35/165) as shown in the table 4.1.1.7. Crushing wound was the most prevalent problem among both artisans.

Among the welders, electric shock (47.3%: 35/74) occurred more, while among the wood workers, crushing wound (62.6%: 85/91)occurred more. Up to 22.4% (37/165)of the studied artisans, reported that they had the problems every time, leading to 46.1%; 76/165) stay off from work among them. Among artisans that had other occupation-related health problems, welders had 21.6% (16/74) of the problems every time with 41.9%; 31/74)stay off from work among them. Similarly among the wood work artisans, 23.1% (16/91) encountered the problem every time, with 49.5% (45/91) stay off from work among them.

47.9% (79/165) of both artisans, including 47.3% (35/74) of welders, and 48.4% (44/91) of wood work artisans indicated that they stayed off work for 3 - 4 days as a result of the problem. Greater proportion of both artisans (66.1%: 109/165), including 68.9% (51/74) welders and 63.7% (58/91) wood work artisans, treated the health issue at chemist/pharmacy shop.

Table 4.1.1.7: Prevalence of Other Occupation-Related Health Challenges Among Study Artisans in Imo State

	Welders		Wood work Artisans		Overall	
Other Health Issues	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Other health problem experienced						
Crushing wound	28	37.8	57	62.6	85	51.5
Fracture	11	14.9	24	26.4	35	21.2
Electric shock	35	47.3	10	11.0	45	27.3
Total	74	100.0	91	100.0	165	100.0
Frequency of having the problem						
Every time	16	21.6	21	23.1	37	22.4
Sometimes	43	58.1	58	63.7	101	61.2
Once in a while	15	20.3	12	13.2	27	16.4
Total	74	100.0	91	100.0	165	100.0
Having stayed off work						
Yes	31	41.9	45	49.5	76	46.1
No	43	58.1	46	50.5	89	53.9
Total	74	100.0	91	100.0	165	100.0
Number of off work days						
1-2 days	33	44.6	42	46.2	75	45.5
3-4 days	35	47.3	44	48.4	79	47.9
5 days and above	7	9.5	5	5.5	12	7.3
Total	74	100.0	91	100.0	165	100.0
How the health problem was treated						
Hospital/ clinic	11	14.9	23	25.3	34	20.6
Chemist/ Pharmacy	51	68.9	58	63.7	109	66.1
Other (eg: herbal)	12	16.2	10	11.0	22	13.3
Total	74	100.0	91	100.0	165	100.0

4.1.2 Occupational Hazards Encountered Among Welders and Wood Work Artisans in Imo State

The result of occupational hazards encountered among welders and wood work artisans in Imo State showed that physical, chemical, ergonomic, biological and psychosocial hazards were encountered among artisans in their respective occupations as shown in figures 4.1 - 4.5

4.1.2.1 Physical Hazard Encountered Among Welders and Wood Work Artisans in Imo State

The result of the physical hazards encountered among welders and wood work artisans in Imo State showed that greater proportion of welders encountered physical hazards of noise (181: 98.4%), heat (178: 96.7%), vibration (132: 71.7%), radiation (123: 66.8%), metal particles (121: 65.8%), electric fault (106: 57.6%) and explosion (99: 53.8%), while greater proportion of wood workers encountered physical hazards of noise (155: 71.8%), heat (132: 61.6%) and wood particles (203: 93.4%) in their workplaces as shown in figure 4.1.

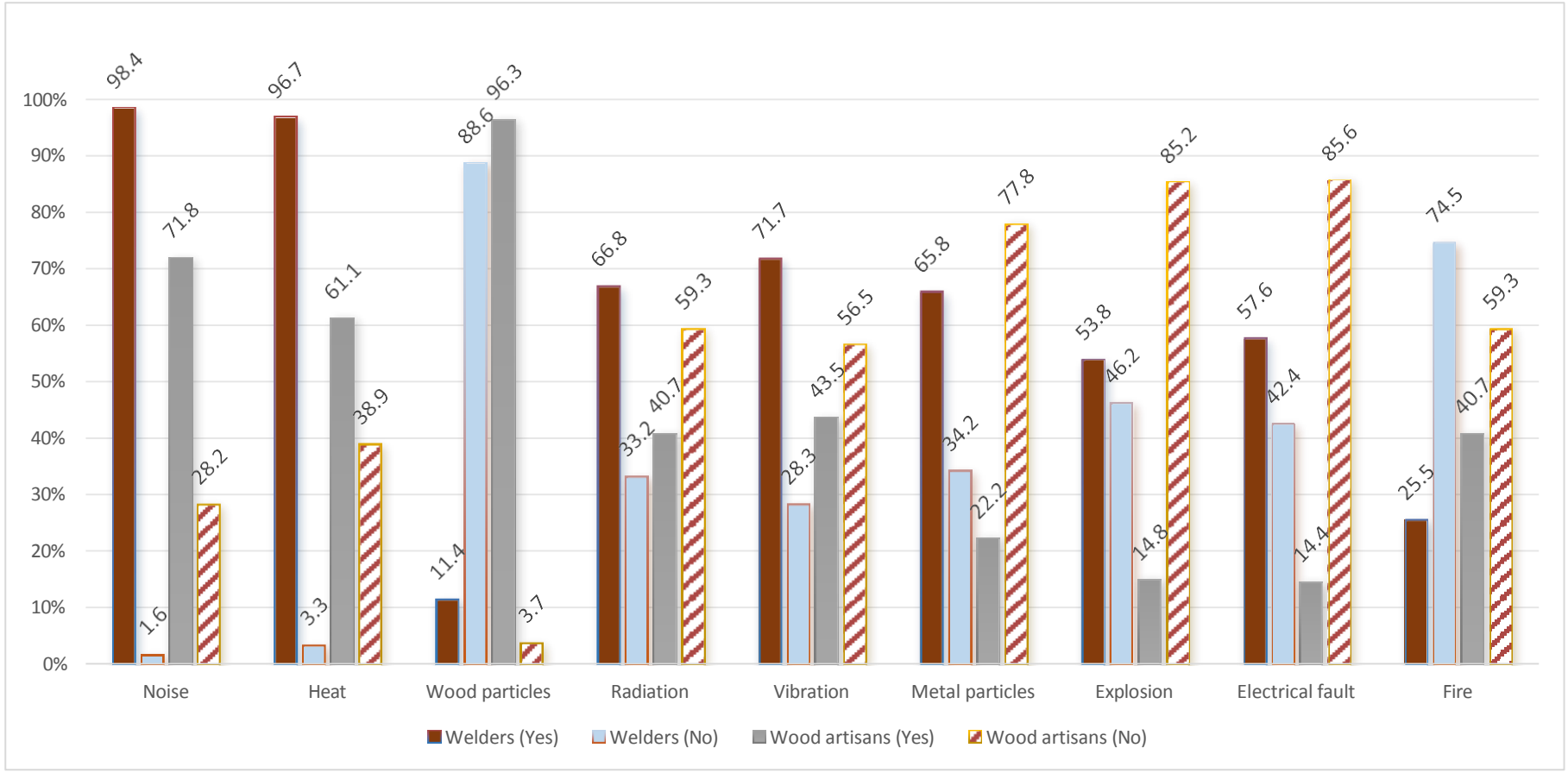

Fig 4.1.2.1: Physical Hazards Encountered Among Welders and Wood Work Artisans in Imo State

4.1.2.2 Chemical Hazard Exposures Among Welders and Wood Work Artisans in Imo State

The result of chemical hazards encountered among welders and wood work artisans revealed that greater number of welders encountered metal fumes (119: 64.7%) and smoke (97: 52.7%), while greater proportion of wood workers encountered wood dusts (198: 91.7%) and organic fumes (63.9%) as shown in figure 4.2.

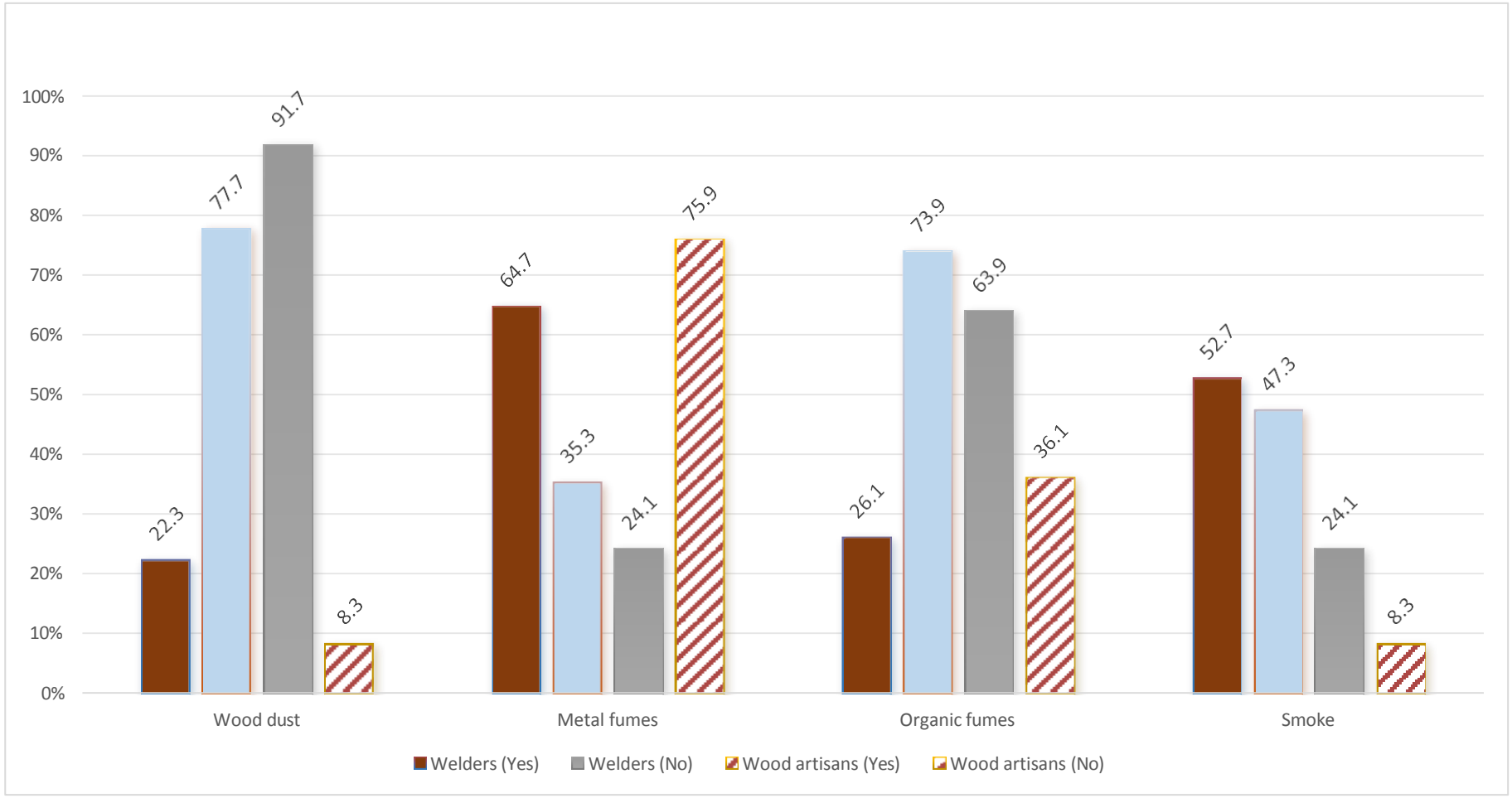

Fig 4.2: Chemical Hazards Encountered Among Welders and Wood Work Artisans in Imo State

4.1.2.3 Ergonomic Hazards Encountered Among Welders and Wood Work Artisans in Imo State

The result of ergonomic hazards encountered among welders and wood work artisans in Imo State showed that greater number of welders encountered hazards of manual lifting of heavy work materials (144: 78.3%) and awkward postures (101: 54.9%), while greater percentage of wood workers also encountered manual lifting of heavy work materials (130: 60.2%) and awkward postures (128: 59.3%), as well as repetitive work activities (117: 54.2%) and fixed (116: 53.7%) as revealed in figure 4.3.

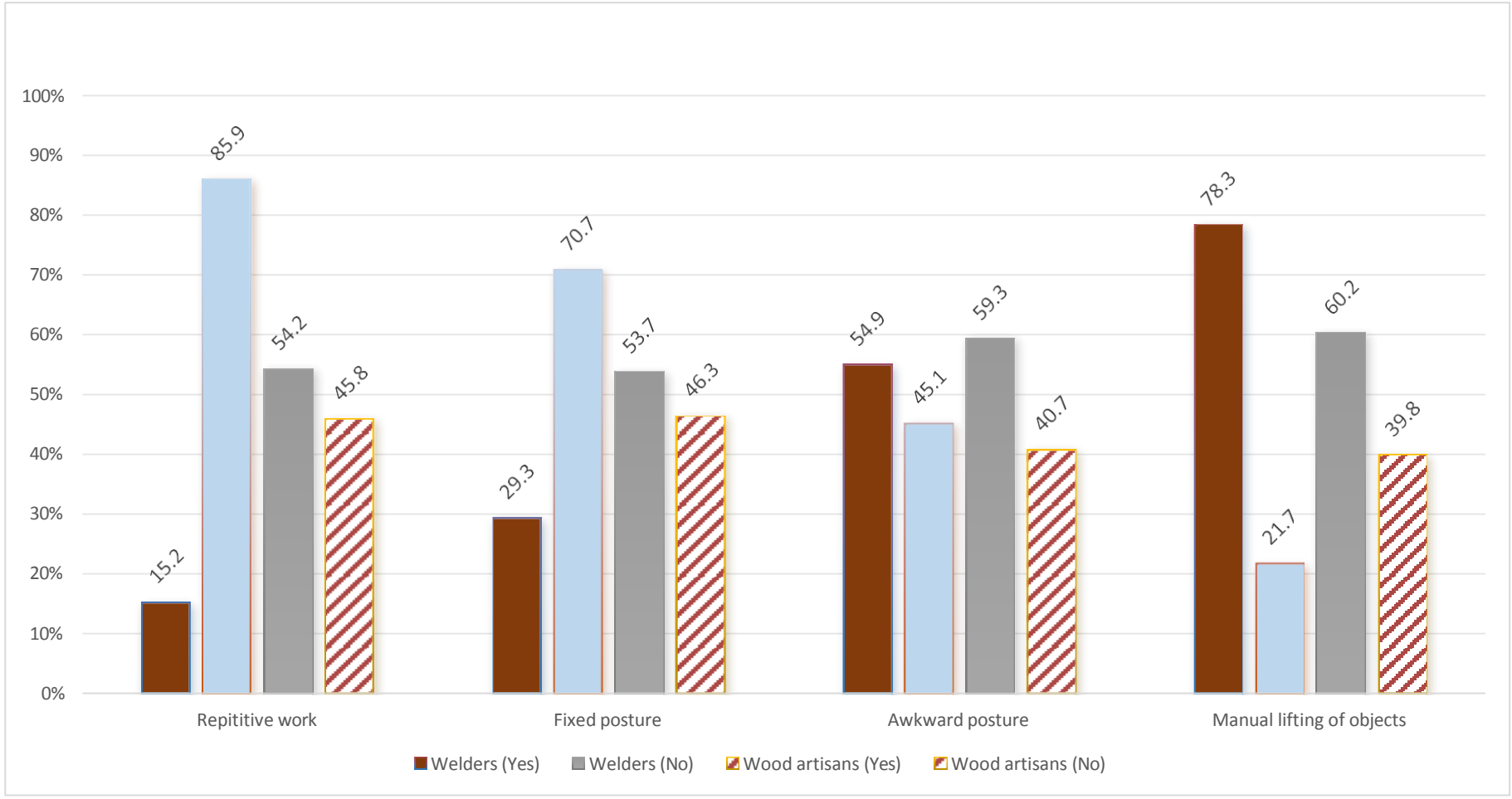

Fig 4.3: Ergonomic Hazards Encountered Among Welders and Wood Work Artisans in Imo State

4.1.2.4 Biological Hazard Encountered Among Welders and Wood Work Artisans in Imo State

The result of biological hazards encountered among welders and wood work artisans in Imo State revealed that majority of welders (102: 55.4%) and wood work artisans (132: 61.1%) encountered hazard of insect bite as shown in figure 4.4.

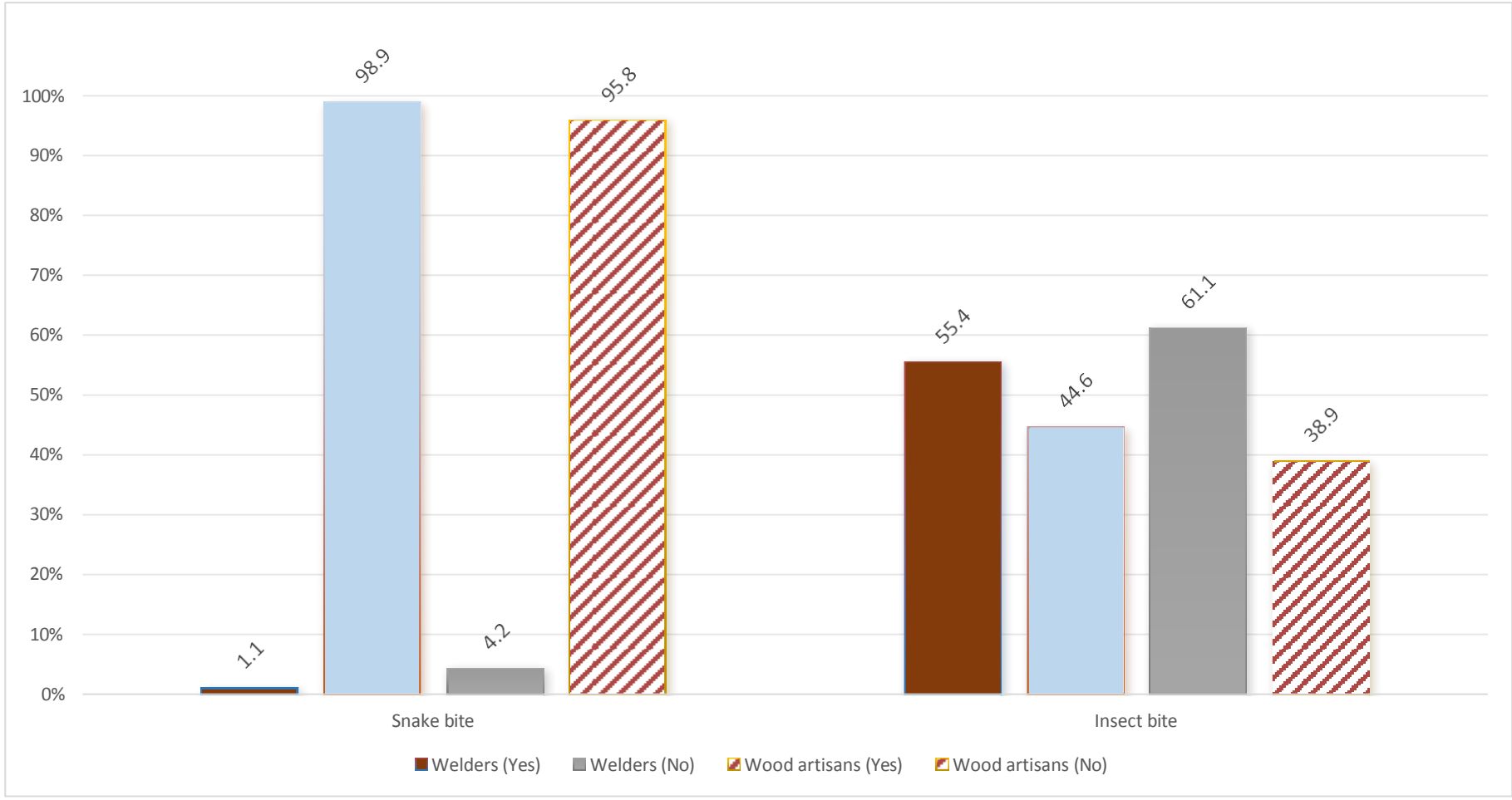

Fig 4.4: Biological Hazard Encountered Among Welders and Wood Work Artisans in Imo State

4.1.2.5 Pyscho-Social Hazard Encountered Among Welders and Wood Work Artisans in Imo State

The result of psycho-social hazards encountered among welders and wood work artisans in Imo State revealed that greater number of welders encountered stress (144: 78.3%) and fatigue welders (100: 54.3%). Similarly, the wood work artisans also encountered stress (132: 60.2%) and fatigue (127: 58.8%) as shown in figure 4.5.

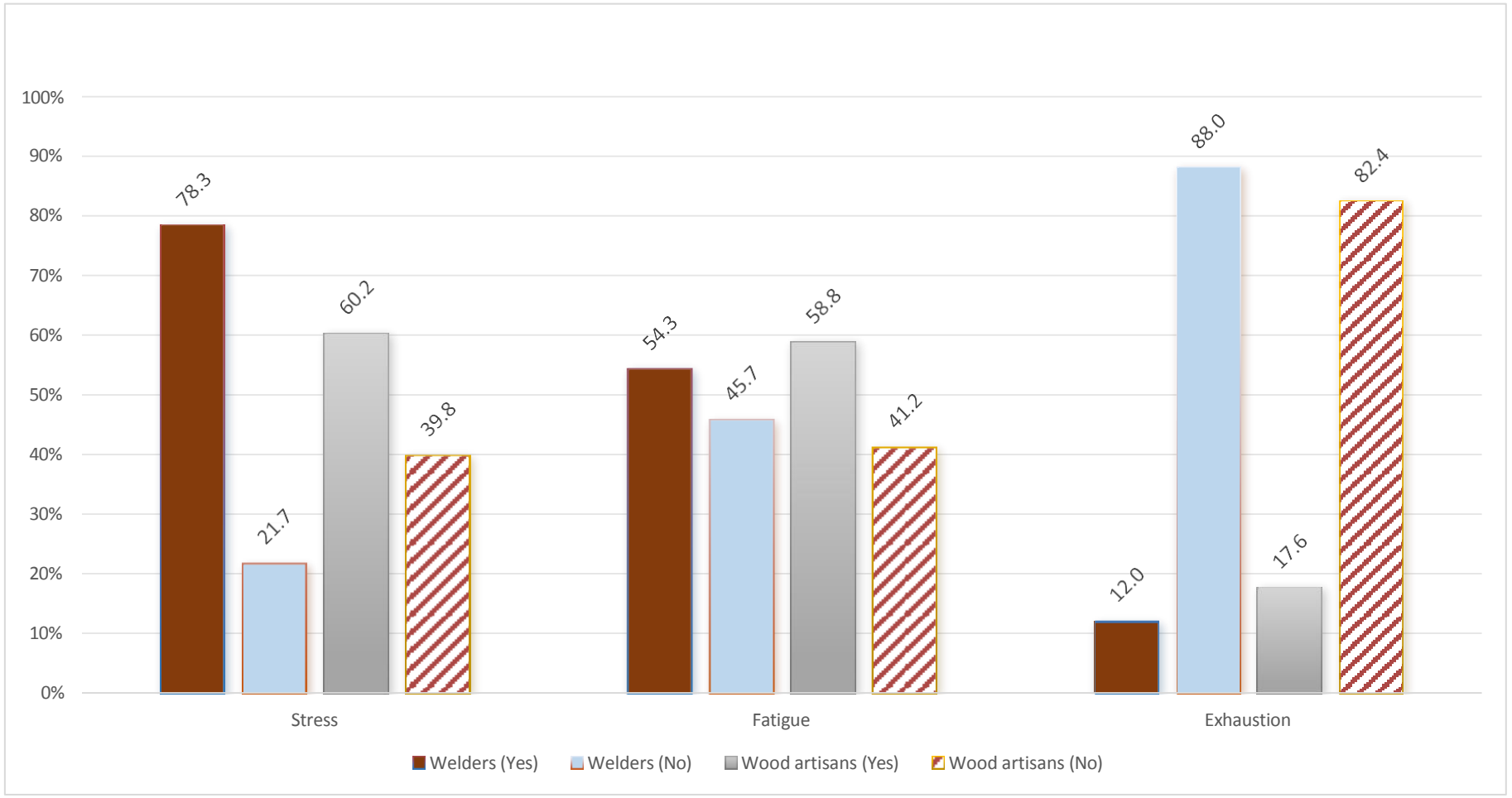

Fig 4.5 Psycho-social Hazard Exposure Among Welders and Wood Work Artisans in Imo State

4.1.3 Workplace Environment Air Pollution Among Welders and Wood Work Artisans in Imo State

The result of assessed workplace environment air pollution among artisans in Imo State showed that in the work locations of welders and wood workers, the estimated mean for the observed air quality parameters exceeded the World Health Organization (WHO) permissible (as shown in table 4.1.3).

The mean value for noise level was 114.42db at welders environment and 104db at wood work environment, and both were far above 85db WHO permissible limit for noise. Other parameters also showed mean values which exceeded the WHO tolerable limits.

Among the welders, the mean parameters for air quality showed significant difference with the WHO permissible limit on Noise (P =0.0001, t=8.618), $Pm_{2.5}$ (P =0.0001, t=3.406), $Pm_{1.0}$ (P =0.021, t=2.866), Pm_{10} (P=0.021, t=3.493) , NO (P =0.005, t=3.894), CO (P =0.008, t=3.518), CO_2 (P =0.005, t=3.876) and SO (P =0.011, t=3.269).

Similar significant difference were also found among the wood workers environment, which included Noise (P =0.0001, t=10.76), $Pm_{2.5}$ (P =0.0001, t=17.047), $Pm_{1.0}$ (P =0.0001, t=8.142), PM_{10} (P=0.029, t=3.029) , NO (P =0.004, t=5.140), CO (P =0.002, t=5.852), CO_2 (P =0.007, t=4.445), and SO (P =0.001, t=6.450).

The results indicated that both the welders and wood work artisans in Imo State were at the risk of environmental pollution in their respective workplace environments.

Table 4.1.3: Workplace Environment Air Pollution Assessment Among Welders and Wood Work Artisans in Imo State

Parameter	NOISE (db)	$PM_{2.5}$	$PM_{1.0}$	PM_{10}	NO	CO	CO_2	SO
WHO Permissible Limit	85	25 mg/m3	50 mg/m3	50 mg/m3	5ppm	10 mg/m3	50mg/m3	5ppm
Welders								
Mean	114.42	33.78	67.67	80.22	6.533	21.47	66.88	10.79
St.dev	11.28	11.26	18.69	25.96	1.19	9.89	13.07	5.31
t - test	8.618	3.406	2.866	3.493	3.894	3.518	3.876	3.269
P-value	0.0001	0.0001	0.021	0.021	0.005	0.008	0.005	0.011
Wood Work Artisans								
Mean	104.00	35.5	78.33	75.00	15.40	21.0	66.17	15.50
St.dev	12.52	13.00	8.525	20.21	4.96	4.60	8.91	3.987
t - test	10.759	17.047	8.142	3.029	5.140	5.852	4.445	6.450
P-value	0.0001	0.0001	0.0001	0.029	0.004	0.002	0.007	0.001

4.1.4 Awareness of Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State

The result of awareness of occupation-related health challenges among welders and wood work artisans in Imo State, showed that more than half of the total artisans (57.0%: $228/400$) were aware of various health challenges in their respective work place as shown in table 4.1.4. The awareness level was (54.3%: $100/184$) among welders, and (59.3%: $128/216$) among wood workers. Awareness level was slightly higher among the wood workers than among the welders. In terms of zonal distribution, the awareness level did not vary so widely across orlu and okigwe zones of Imo state (Orlu zone: 51.7%; Okigwe zone: 51.0%), Variation in level of awareness was seen only in Owerri zone (63.9%).

Concerning the sources of awareness, work experience was found to be the largest source among both welders (27.8%: $49/184$) and wood work artisans (37.2%: $74/216$). Up to 44% of the total artisans in Okigwe zone indicated that their awareness were from work experience. Next to experience were radio and TV media (overall: 21.1%, welders: 26.7%, wood artisans: 16.1%) and work safety books and leaflets (overall: 16.5%, welders: 18.2%, wood artisans: 15.1%). The information from friends and work colleagues was 16% in all (welders: 14.2%, wood artisans: 17.6%). Awareness based on different social media information source was quite low (13.1%).

Table 4.1.4: Awareness of Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State

Awareness	Welders (n=184)		Wood Artisans (n=216)		ORLU ZONE (n=120)		OWERRI ZONE (n=180)		OKIGWE ZONE (n=100)		Overall (n=400)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Are you aware that as a worker that you are exposed to various health challenge(s) in your work place?												
Yes	100	54.3	128	59.3	62	51.7	115	63.9	51	51.0	228	57.0
No	84	45.7	88	40.7	58	48.3	65	36.1	49	49.0	172	43.0
Total	184	100	216	100	120	100	180	100	100	100	400	100
Awareness source												
Work safety books	32	18.2	30	15.1	20	17.7	30	17.5	12	13.2	62	16.5
Radio/ TV media	47	26.7	32	16.1	23	20.4	49	28.7	7	7.7	79	21.1
Colleagues/friends	25	14.2	35	17.6	21	18.6	16	9.4	23	25.3	60	16.0
Social media	21	11.9	28	14.1	14	12.4	28	16.4	7	7.7	49	13.1
Experience	49	27.8	74	37.2	35	31.0	48	28.1	40	44.0	123	32.8
Total	176	100	199	100	113	100	171	100	91	100	375	100

4.1.4.1: Influence of Awareness on Occurrence of Occupational Health Problems Among Welders and Wood Work Artisans in Imo State

The result of awareness of occupation-related health challenges among welders and wood work artisans in Imo State showed significant influence on health problems occurrences as revealed in table 4.1.4.1 Significant results were obtained on ocular problem ($P < 0.0001$, 95% conf. Inter = 0.135 to 0.403), respiratory ($P < 0.004$, 95% conf. Inter = 0.276 to 0.781), hearing ($P < 0.0001$, 95% conf. Inter = 0.146 to 0.546), skin ($P < 0.0001$, 95% conf. Inter = 0.216 to 0. 623), and musculoskeletal ($P = 0.011$, 95% conf. Inter = 1.81 to 18.13.

Awareness showed negative coefficient with most of the heath problems indicating that increased awareness is likely to lead to reduction in health issues among the artisans.

The odd for having ocular issues was found to be 76.6% (i.e 1 - 0.234)% significantly lower among the artisans that showed awareness compared to those who are not aware (OR= 0.234). Those who were not aware of occupational health problems, were 13.3 times more likely to have musculoskeletal issues compared to those who are aware. Also, the odd of having blood pressure was found to be more than 2 times for artisans who are not aware of occupational-related challenges than those who are aware. Having skin problem was also associated with poor awareness and the odds was found to be 64% (i.e 1- 0.367) lower compared to not aware group.

Table 4.1.4.1: Influence of Awareness on Occurrence of Occupational Health Challenges Among Welders and Wood Work Artisans in Imo State

Health Problems	coefficient	Std. error	df	P value	Odds Ratio (OR)	95% C.I. for OR)	
						Lower	Upper
Awareness							
Musculoskeletal problem	-2.590	1.018	1	0.011	13.333	1.812	18.134
Blood Pressure problem	-.760	0.265	1	0.004	2.138	1.272	3.594
Skin problem	-1.002	0.270	1	0.000	0.367	0.216	0.623
Respiratory problem	-0.768	0.265	1	0.004	0.464	0.276	0.781
Hearing problem	-1.264	0.336	1	0.000	0.283	0.146	0.546
Ocular problem	-1.454	0.278	1	0.000	0.234	0.135	0.403

4.1.5. Adherence Towards Safety and Health Protection Practices Among Welders and Wood Work Artisans in Imo State

The result of adherence towards safety and health protection practices among welders and wood work artisans in Imo State showed that greater proportion (326: 81.5%) of them had no medical check-up after commencement of their jobs as shown in table 4.1.5.1

Among the welders, 145 of them (78.8%) had no medical check-up, and among the wood workers 181 (83.8%) had no medical check-up. Just 21 (5.3%) and 46 (11.5%) had medical check-up on quarterly and yearly basis respectively. None attended on monthly basis. In the zones, all the artisans from Okigwe zone (100%) had never attended medical check-up, while 110 (91.7%) and 116 (64.4%) had never attended in Orlu and Owerri zones respectively.

The result on safety and health training among welders and wood work artisans in Imo State showed that only 105 (26.3%) of them had no safety and health training. The situation was poor among the Orlu zone and the Okigwe zone groups with only (17:16.7%) and (20:17.0%) respectively found to have attended safety and health training for both groups. Among the welders, a total of 49 (26.6%) attended health and safety training, while 56 (35.9%) also attended among the wood artisans.

Adherence to medical check-up attendance showed slight significant association with non-occurrence of health challenges (Chi sq= 8.248, p=0.041). The proportion with no health problems was lowest among the adherence negligent artisans (5.5%). On the other hand, adherence to safety training attendance showed strong significant association with non-occurrence of health challenges (Chi sq= 27.39, p<0.0001). Among those that attended safety training, 18.1% had no health issues against 3.1% on those who never attended.

Adherence towards the use of personal protective equipment (PPE) among welders and wood workers was found to be low.From the result, only 132 (33.0%) of both artisans used PPE. Among the welders, 78 of them (42.4%) used PPE, while among the wood workers 54 of them (25.0%) used PPE. The situation was poor among the Orlu zone and the Okigwe zone artisan groups, with only (30: 25.0%) and (28: 28.0%) respectively found to have been using personal protective equipment (PPE).

The frequency of usage of PPE among welders and wood workers in Imo State, revealed that greater proportion of them (158: 39.5%) never used PPE. Only 56 of both artisans (14.0 %) used them every time, 78: 19.5% used PPE sometimes, while 51: 12.7% used once in a while and 57: 14.3% rarely used PPE.

Significant association was found between adherence to the use of PPE and the occurrence of health issues (P =0.000, chi sq = 14.8). While 13.6% of those that used PPE had none of the assessed health issues, just 3.4% among those who did not use PPE were free from them. Also, frequency of PPE usage showed significant association with occurrence of health challenges among welders and wood workers (P =0.000, Chi sq = 30.03). Those that used PPE all time had the highest proportion of no health issues occurrence (23.2%).

Table 4.1.5.1: Adherence Towards Safety and Health Practices Among Welders and Wood Work Artisans in Imo State

Adherence Towards Safety & Health Practices	Welders (n=184)		Wood Artisans (n=216)		ORLU ZONE (n=120)		OWERRI ZONE (n=180)		OKIGWE ZONE (n=100)		Occurrence of Health issues		Chi test	P value
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	No Freq (%)	Yes Freq (%)		
Attending Medical check up														
Monthly	0	0	0	0	0	0.0	0	0.0	0	0.0	0	0.0		
Bimonthly	1	0.5	6	2.8	3	2.5	4	2.2	0	0.0	2 (28.6)	5 (71.4)		
Quarterly	11	6	10	4.6	0	0.0	21	11.7	0	0.0	3 (14.3)	18 (85.7)		
Yearly	27	14.7	19	8.8	7	5.8	39	21.7	0	0.0	4 (8.7)	42 (91.3)		
Not at all	145	78.8	181	83.8	110	91.7	116	64.4	100	100	18 (5.5)	308 (94.5)		
Total	184	100.0	216	100.0	120	1	180	100.0	100	100	27 (6.8)	373 (93.3)	8.248	0.041
Safety & Health Training														
Yes	49	26.6	56	25.9	20	16.7	68	37.8	17	17.0	19 (18.1)	86 (81.9)		
No	135	73.4	160	74.1	100	83.3	112	62.2	83	83.0	9 (3.1)	286 (96.9)		
Total	184	100	216	100.	120	100	180	100	100	100	27 (6.8)	373 (93.3)	27.39	0.000
Usage of PPE														
Yes	78	42.4	54	25.0	30	25.0	74	41.1	28	28.0	18 (13.6)	114 (86.4)		
No	106	57.6	162	75.0	90	75.0	106	58.9	72	72.0	9 (3.4)	259 (96.6)		
Total	184	100.0	216	100.0	120	100	180	100.0	100	100.0	400	100.0	14.8	0.000
Frequency of Usage of PPE														
Every time	50	27.2	6	2.8	18	12.5	28	15.6	10	10.0	13 (23.2)	43 (76.8)		
Sometimes	68	36.9	10	4.6	22	18.3	38	31.7	18	18.0	6 (7.7)	72 (92.3)		
Once in a while	43	23.4	8	3.7	17	14.2	21	11.7	13	13.0	2 (3.9)	49 (96.1)		
Rarely	15	8.2	42	19.4	19	15.8	27	15.0	11	11.0	2 (3.5)	55 (96.5)		
Never	8	4.3	150	69.4	47	39.2	63	48.3	48	48.0	4 (2.5)	154 (97.5)		
Total	184	100.0	216	100.0	120	100	180	100	100	100	400	100.0	30.3	0.000

4.1.5.2 Types of Personal Protective Equipment Used Among Welders and Wood Work Artisans in Imo State

Table 4.1.5.2 contained the types of personal protective equipment used among studied respondents. Only 145 (36.3%) respondents use face mask (welders = 33.7%, wood artisans = 38.4%). Those that use nose mask were 131 (32.8%) in all (welders = 26.6%, wood artisans = 38.0%), while only 117 (29.3%) use ear muffs protective equipment (welding artisan = 29.3%, wood artisan = 29.2%).

The use of protective boots and hand gloves were both poor among the artisans. The use of protective boots recorded 31.8% in all (welders = 25.5%, wood artisans = 37.0%) while the use of hand glove was 30.8% (welding artisan = 22.3%, wood artisan = 38.0%). The use of goggle was found to be 64.7% among the welders and just 11.1% among the wood artisans (overall = 35.8%). The use of head protective helmet was also poor among the artisans at 23% (welders = 28.3%, wood artisan = 18.5%). It was found lowest among Okigwe zone artisans at 11%. Those that use coverall clothing were 99 (24.8%) comprising of 52 (28.3%) among welders and 47 (21.8%) among wood artisans.

Non-occurrence of health challenges were found to be significantly higher among artisans that use PPE than on those who do not use them. In each case of the analysis relating different personal protective equipment with health challenge occurrence, the association was found to be highly significant ($p < 0.0001$).

Table 4.1.5.2: Types of Personal Protective Equipment (PPE) Used Among Welders and Wood Work Artisans in Imo State

Types of PPE Used	Welders (n=184)		Wood Workers (n=216)		ORLU ZONE (n=120)		OWERRI ZONE (n=180)		OKIGWE ZONE (n=100)		Occurrence of Health Challenges		Statistical test	
	Freq	%	Freq	%	Freq	No	No	Freq	%	Freq	No	Yes	Chi sq	P
Use of Face mask													21.60	0.000
Yes	62	33.7	83	38.4	47	39.2	60	33.3	38	38.0	21 (14.5)	124 (85.5)		
No	122	66.3	133	61.6	73	60.8	120	66.7	62	62.0	6 (2.4)	249 (97.6)		
Use of Nose mask													15.12	0.000
Yes	49	26.6	82	38.0	42	35.0	57	31.7	32	32.0	18 (13.7)	113 (86.3)		
No	135	73.4	134	62.0	78	65.0	123	68.3	68	68.0	9 (3.3)	260 (96.7)		
Use of Ear muffs													10.15	0.000
Yes	54	29.3	63	29.2	34	28.3	47	26.1	36	36.0	16 (13.7)	101 (86.3)		
No	132	71.7	153	70.8	86	71.7	133	73.9	66	66.0	13 (4.6)	272 (95.4)		
Use of Boots													16.29	0.000
Yes	47	25.5	80	37.0	41	34.2	57	31.7	29	29.0	18 (14.2)	109 (85.8)		
No	137	74.5	136	63.0	79	65.8	123	68.3	71	71.0	9 (3.3)	264 (96.7)		
Use of Hand gloves													17.54	0.000
Yes	41	22.3	82	38.0	37	30.8	55	30.6	31	31.0	18 (14.6)	105 (85.4)		
No	143	77.7	134	62.0	83	69.2	125	69.4	69	69.0	9 (3.2)	268 (96.8)		
Eye Goggle													15.11	0.000
Yes	119	64.7	24	11.1	36	30.0	85	47.2	22	22.0	19 (13.3)	124 (86.7)		
No	65	35.3	192	88.9	84	70.0	95	52.8	78	78.0	8 (3.1)	249 (96.9)		
Helmet													17.33	0.000
Yes	52	28.3	40	18.5	32	26.7	49	27.2	11	11.0	15 (16.3)	77 (83.7)		
No	132	71.7	176	81.5	88	73.3	131	72.8	89	89.0	12 (3.9)	296 (96.1)		
Coverall clothing													14.75	0.000
Yes	52	28.3	47	21.8	31	25.8	53	29.4	15	15.0	15 (15.2)	84 (84.8)		
No	132	71.7	169	78.2	89	74.2	127	70.6	85	85.0	12 (4.0)	289 (96.0)		

4.1.5.3 Personal Hygiene Practices/Habits Among Welders and Wood Work Artisans in Imo State

The Personal hygiene practices/habits among the respondents was represented on table 4.1.5.3. The findings showed that majority of respondents (340 or 81.5%) have separate accommodation apart from their workshops, while minority (60: 15%) do not have separate accommodation. Of this number, 34 or 18.5% were welders, while 26 or 12% were wood artisans. The largest number of artisans that do not have separate accommodation was found in Owerri zone (42 or 23.3%).

In terms of frequency of hand washing before eating, only 123 (30.7%) in all wash hands every time, while 243 (60.8%) wash hands only for sometimes and 34 (8.5%) wash hands once in a while. In Okigwe zone, 20 respondents (20%) washed hands at every time, which is the lowest for all the zones. Among the welding artisans, just 51 (27.7%) wash hands every time before eating.

Concerning bathing after work, some of the study group also responded that they do not always bath after work. The largest proportion of those that do not "always" bath after work (40.8%) was found in Orlu zone (i.e 40% = 25.9 +8.8+ 4.2+1.9). They included 52 (28.3%) among welders and 88 (40.1%) among wood artisans.

Those that have the habit of washing hands with chemical substances were 94 (23.5%), comprising of 32 (17.4%) welders and 62 (28.3%) wood workers. On the other hand, a total of 45 (11.3%) were of the habit of treating wound with chemical substances (welders = 11 or 6%, wood workers = 34 or 15.7%)

Table 4.1.5.3: Personal Hygiene Practices/Habits Among Welders and Wood Work Artisans in Imo State

Personal Hygiene Practices/Habits	Welding Artisans (n=184)		Wood Artisans (n=216)		ORLU ZONE (n=120)		OWERRI ZONE (n=180)		OKIGWE ZONE (n=100)		Overall (n=400)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Separate Accommodation apart from the workshop												
Yes	150	81.5	190	88.0	109	90.8	138	76.7	93	93.0	340	85.0
No	34	18.5	26	12.0	11	9.2	42	23.3	7	7.0	60	15.0
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100	400	100
Hand washing before eating												
Every time	51	27.7	72	33.3	34	28.3	69	38.3	20	20.0	123	30.7
Sometimes	122	66.3	121	56.0	70	58.3	102	56.7	71	71.0	243	60.8
Once in a while	11	6.0	23	10.6	16	13.3	9	5.0	9	9.0	34	8.5
Never	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100	400	100
Bath after work												
Every time	132	71.7	128	59.3	71	59.2	112	62.2	77	77	260	65
Sometimes	35	19.0	56	25.9	29	24.2	48	26.7	14	14	91	22.75
Once in a while	13	7.1	19	8.8	11	9.2	15	8.3	6	6	32	8
Rarely	4	2.2	9	4.2	7	5.8	4	2.2	2	2	13	3.25
Never	0	0.0	4	1.9	2	1.7	1	0.6	1	1	4	1
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100	400	100
Work habits practiced												
Washing of hands with chemical substances	32	17.4	62	28.7	34	28.3	37	20.6	23	23	94	23.5
Treating of wound with chemical substances	11	6.0	34	15.7	21	17.5	6	3.3	18	18	45	11.25
None	141	76.6	120	55.6	65	54.2	137	76.1	59	59	261	65.25
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100	400	

4.1.5.4 Sanitation Practices Among Welders and Wood Work Artisans in Imo State

On table 4.1.5.4, sanitation practices among respondents was presented. The findings showed that none of the wood respondents observed had hand washing facilities in their workshop. Approximately 33% or 60 (32.6%) hand washing facilities noticed among all the respondents, were at welders workshops. However, of all the hand washing facilities observed, very few were seen from among respondents in Okigwe zone.

In terms of presence of urinals in the respondents' workshops, welders had 48 or 26.1%, while wood artisans had 20 or 9.3%. Orlu zone contained 13 or 10.8%, Owerri zone had 48 or 26.7% and Okigwe zone had 7 or 7.0%.

The water supply access to the workshops showed that all the wood artisans had water supply access and 98% of the artisans also got water supplied to reachable distance of their workshops. The most commonly source of water to the workshops was borehole system (70.2%). For the welding artisans, 63.6% of their water sources was borehole, while that of wood artisans was 75.9%. The borehole system was only 44% of the water sources in Okigwe zone while it was 72.5% and 83.3% respectively in Orlu and Owerri zones.

A total of 186 (46.5%) workshops visited had access to toilet facilities (welders workshops = 97: 52.7%, wood workshop = 89: 41.2%), Among these workshops, 64 (53.3%) and 108 (60%) respectively in Orlu and Owerri zones had access to toilet facilities while just 14% had access to toilet facilities in Okigwe zone.

In Owerri zone, 77.9% of the toilet facilities were water closet while 76.4% in Orlu zone and 72.7% in Okigwe zone were flush pour types of toilet. More of the water closet types were found within reach for the welders and similarly 76.4% of the flush pour types were found

within reach for the wood workers. Only about half of the toilets in all were functional (62.9% for welders and 37.1% for wood workers).

In terms of toilet cleaning, only 86 (46.2%) of the toilets were being cleaned (59.8% at welders workshops, 31.5% at wood workshops). In Orlu and Okigwe zones, 60.7% and 63.6% of the toilets were not cleaned from time to time. However, only 9.1% of the toilets were cleaned daily, none (0%) in Okigwe zone and just 1 (1.8%) in Orlu zone received daily cleaning.

Table 4.1.5.4: Sanitation Practices Among Welders and Wood Work Artisans in Imo State

Sanitation Practices	Welders (n=184)		Wood Artisans (n=216)		ORLU ZONE (n=120)		OWERRI ZONE (n=180)		OKIGWE ZONE (n=100)		Overall (n=400)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Have hand washing												
Yes	60	32.6	0	0.0	10	8.3	45	25.0	5	5.0	60	15.0
No	124	67.4	216	100.0	110	91.7	135	75.0	95	95.0	340	85.0
Have Urinals												
Yes	48	26.1	20	9.3	13	10.8	48	26.7	7	7.0	68	17.0
No	136	73.9	196	90.7	107	89.2	132	73.3	93	93.0	332	83.0
Have Water Supply												
Yes	181	98.4	216	100.0	120	100.0	180	100.0	97	97	397	99.25
No	3	1.6	0	0.0	0	0.0	0	0.0	3	3	3	0.75
Water supply source												
Tap water	28	15.2	0	0.0	7	5.8	17	9.4	4	4	28	7
Tanks	39	21.2	52	24.1	26	21.7	13	7.2	52	52	91	22.75
Borehole	117	63.6	164	75.9	87	72.5	150	83.3	44	44	281	70.25
Have access to toilet facility at work place												
Yes	97	52.7	89	41.2	64	53.3	108	60.0	14	14	186	46.5
No	87	47.3	127	58.8	56	46.7	72	40.0	86	86	214	53.5
Toilet type available												
Water closet	76	78.4	21	23.6	21	37.5	67	77.9	9	20.5	97	52.2
Flush pour	16	16.5	68	76.4	33	58.9	19	22.1	32	72.7	84	45.2
Bucket toilet	5	5.2	0	0.0	2	3.6	0	0.0	3	6.8	5	2.7
Toilet functionality												
Yes	61	62.9	33	37.1	25	44.6	51	59.3	18	40.9	94	50.5
No	36	37.1	56	62.9	31	55.4	35	40.7	26	59.1	92	49.5
Toilet being cleaned from time to time												
Yes	58	59.8	28	31.5	22	39.3	48	55.8	16	36.4	86	46.2
No	39	40.2	61	68.5	34	60.7	38	44.2	28	63.6	100	53.8
Frequency of toilet cleaning												
Once daily	11	11.3	6	6.7	1	1.8	16	18.6	0	0.0	17	9.1
Weekly	32	33.0	16	18.0	16	28.6	21	24.4	11	25.0	48	25.8
Don’t know	15	15.5	6	6.7	5	8.9	11	12.8	5	11.4	21	11.3
None	39	40.2	61	68.5	34	60.7	38	44.2	28	63.6	100	53.8

4.1.5.5 Refuse Collection and Disposal Practices Among Welders and Wood Work Artisans in Imo State

On table 4.1.5.5, Refuse collection and disposal practices among respondents was presented. The findings showed no specific refuse collection practice among respondents.

On the container used for refuse collection among respondents, 192 (40.8%) responded for "any container", 81 (20.3%) responded for "without container" , 41 (10.2%) responded for wheel barrow and 86 (21.5%) of the responses were on bin bags.

About half of the wood artisans indicated that they use any container to pack refuse. Also at Owerri zone, more than half of the respondents (96: 53.3%) were using any container.

Trash bins were available only in 89 (22.3%) workshops, comprising of 69 (37.5%) among welders and just 20 (9.3%) among wood workers. Trash bins available in the workshops in Owerri zone were 39.9% of the studied group in the zone which happened to the largest observed in any zone.

Refuse disposal practices among the respondents included open dumping (33.8%) incineration (49.5%) river dumping (2.3%) and street or anywhere dumping (12.5%). Majority of the respondents (198 or 49.5%) practiced incineration method of waste disposal, while 135 (33.7%) respondents resorted to open dumping. However, open dumping was practiced more by the welders (49.5%), while incineration was being practiced mostly at the wood work (71.3%). Only very few respondents (17 or 4. 2%) dispose their wastes in the river, 50 (12.5%) dump theisr anywhere.

The responses on the frequency of waste removal indicated that majority (206 or 51.5%) of the respondents (76.1% of welders and 30.6% wood artisans) removed their refuse on daily basis. Up to 55% in each of Owerri zones responded that the refuse generated were removed every day, while 22.5% and 16.5% responses indicated refuse removal of weekly and forth nightly respectively.

Table 4.1.5.5: Refuse collection and Disposal Practices Among Welders and Wood Work Artisans in Imo State

Refuse Collection & Disposal Practices	Welders (n=184)		Wood Artisans (n=216)		ORLU ZONE (n=120)		OWERRI ZONE (n=180)		OKIGWE ZONE (n=100)		Overall (n=400)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
How refuse are collected												
Any Container	82	44.6	110	50.9	55	45.8	96	53.3	41	41	192	48.0
Without container	47	25.5	34	15.7	26	21.7	28	15.6	27	27	81	20.3
Wheel barrows	33	17.9	8	3.7	15	12.5	9	5.0	17	17	41	10.2
Bin bags	22	12.0	64	29.6	24	20.0	47	26.1	15	15	86	21.5
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100	400	100
Trash bin bag availability												
Yes	69	37.5	20	9.3	23	19.2	52	28.9	14	14.0	89	22.25
No	115	62.5	196	90.7	97	80.8	128	71.1	86	86.0	311	77.75
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100.0	400	100..0
Refuse disposal												
Open dumping	91	49.5	44	20.4	43	35.8	60	33.3	32	32.0	135	33.75
Incineration (burning)	44	23.9	154	71.3	57	47.5	96	53.3	45	45.0	198	49.5
Dumping in the river	7	3.8	10	4.6	7	5.8	4	2.2	6	6.0	17	4.25
Dumping anywhere	42	22.8	8	3.7	13	10.8	20	11.1	17	17.0	50	12.5
Refuse removal frequency												
Daily	140	76.1	66	30.6	66	55.0	99	55.0	41	41	206	51.5
Weekly	30	16.3	60	27.8	25	20.8	37	20.6	28	28	90	22.5
Forth nightly	6	3.3	60	27.8	19	15.8	28	15.6	19	19	66	16.5
Every three weeks	2	1.1	0	0.0	0	0.0	0	0.0	2	2	2	0.5
Monthly	7	3.8	30	13.9	10	8.3	16	8.9	11	11	37	9.25
Total	184	100.0	216	100.0	120	100.0	180	100.0	100	100	400	100

4.1.6 Relationship Between Socio-demographic Factors and Health Challenges Among Welders and Wood Work Artisans in Imo State

Relationship between socio-demographic factors and health challenges among welders and wod work artisans in Imo State showed that age was significantly associated with the health challenges among wood workers ($\square^2$ = 21.49, P=0.000), while daily income was significantly associated (though moderate) with health challenges among welders ($\square^2$= 7.918, P=0.048). Duration (years) at work was significantly (though slight) associated with health challenges among both welders ($\square^2$=10.912, p=0.012), and wood workers ($\square^2$ =8.646. p=0.034) as shown in table 4.1.6.

Factors which included sex (welders: $\square^2$ =0.076, P=0.782; wood workers: $\square^2$ =0.002, P=0.969), marital status (welders:$\square^2$ =3.432, P=0.064; wood workers: $\square^2$ =0.140, P=0.708) and educational level (welders:$\square^2$ =1.819, P=0.611, P=0.064; wood workers: $\square^2$ =1.853, P=0.396) were found not to be significantly associated with occupation-related health challenges of welders and wood work artisans in Imo State .

Table 4.1.6: Relationship Between Socio-Demographic Factors and Health Challenges Among Welders and Wood Work Artisans in Imo State

	Health Challenge of Welders					Health Challenge of Wood Artisans					Overall Health Challenges Among Artisans				
	Total	**None**	**%**	**Yes**	**%**	**Total**	**None**	**%**	**Yes**	**%**	**Total**	**None**	**%**	**Yes**	**%**
Sex															
Male	183	13	7.1	170	92.9	200	13	6.5	187	93.5	383	26	6.8	357	93.2
Female	1	0	0.0	1	100.0	16	1	6.3	15	93.8	17	1	5.9	16	94.1
Total	184	13	7.1	171	92.9	216	14	6.5	202	93.5	400	27	6.8	373	93.3
Statistical test		χ^2 =0.076, P=0.782					χ^2 =0.002, P=0.969					χ^2 =0.021, P=0.884			
Age															
20 - 29	51	6	11.8	45	88.2	26	7	26.9	19	73.1	77	13	16.9	64	83.1
30 – 39	67	5	7.5	62	92.5	70	4	5.7	66	94.3	137	9	6.6	128	93.4
40 – 49	10	1	10.0	9	90.0	55	2	3.6	53	96.4	65	3	4.6	62	95.4
50 -59	52	1	1.9	51	98.1	42	1	2.4	41	97.6	94	2	2.1	92	97.9
60 +	4	0	0.0	4	100.0	23	0	0.0	23	100.0	27	0	0.0	27	100.0
Total	184	13	7.1	171	92.9	216	14	6.5	202	93.5	400	27	6.8	373	93.3
Statistical test		χ^2 =4.261, P=0.372					χ^2 =21.49, P=0.000					χ^2 =18.18, P=0.000			
Marital status															
Married	149	8	5.4	141	94.6	214	14	6.5	200	93.5	363	22	6.1	341	93.9
Single	35	5	14.3	30	85.7	2	0	0.0	2	100.0	37	5	13.5	32	86.5
Total	184	13	7.1	171	92.9	216	14	6.5	202	93.5	400	27	6.8	373	93.3
Statistical test		χ^2 =3.432, P=0.064,					χ^2 =0.140, P=0.708					χ^2 =2.966, P=0.085			
Educational level															
Primary	28	1	3.6	27	96.4	21	0	0.0	21	100.0	49	1	2.0	48	98.0
Secondary	130	11	8.5	119	91.5	186	13	7.0	173	93.0	316	24	7.6	292	92.4

Table 4.1.6 Continued

Tertiary	12	0	0.0	12	100.0	0	0	0.0	0	0.0	12	0	0.0	12	100.0
Non-formal	14	1	7.1	13	92.9	9	1	11.1	8	88.9	23	2	8.7	21	91.3
Total	184	13	7.1	171	92.9	216	14	6.5	202	93.5	400	27	6.8	373	93.3
Statistical test		χ^2 =1.819, P=0.611					χ^2 =1.853, P=0.396						χ^2 =0.216, P=0.378		
Daily Income (Naira)															
< 2,000	12	0	0.0	12	100.0	0	0	0.0	0	0.0	12	0	0.0	12	100.0
2,000 - 3,000	52	0	0.0	52	100.0	32	1	3.1	31	96.9	84	1	1.2	83	98.8
4,000 - 5,000	38	5	13.2	33	86.8	30	1	3.3	29	96.7	68	6	8.8	62	91.2
Above 5,000	82	8	9.8	74	90.2	154	12	7.8	142	92.2	236	20	8.5	216	91.5
Total	184	13	7.1	171	92.9	216	14	6.5	202	93.5	400	27	6.8	373	93.3
Statistical test		χ^2 =7.918, P=0.048					χ^2 =1.522, p=0.467						χ^2 =6.573, P=0.087		
Work Duration (years)															
2 - 4 years	23	5	21.7	18	78.3	14	0	0.0	14	100.0	37	5	13.5	32	86.5
5 - 7 years	28	0	0.0	28	100.0	22	4	18.2	18	81.8	50	4	8.0	46	92.0
8 - 10 years	58	2	3.4	56	96.6	142	10	7.0	132	93.0	200	12	6.0	188	94.0
Above 10 years	75	6	8.0	69	92.0	38	0	0.0	38	100.0	113	6	5.3	107	94.7
Total	184	13	7.1	171	92.9	216	14	6.5	202	93.5	400	27	6.8	373	93.3
Statistical test		χ^2 =10.912, P=0.012					χ^2 =8.646. P=0.034						χ^2 =3.364, P=0.339		

4.1.7 Artisans At Increased Risk of Occupation-Related Ocular Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans at higher risk of occupation-related ocular health challenges among welders and wood workers in Imo State was shown in table 4.1.7. Of the commonly reported symptom of tearing with prevalence of 19.5% among welders, arc welder was the category at increased risk (25.3%), as against the auto welders with 15.3% prevalence. Commonly reported symptom of pain with prevalence of 14.7% among welders, had the arc welders as the category at increased risk (19.0%), Also, arc welders were the category at increased risk of blurry vision (13.9%) among welders with the symptom (12.0%).

Commonly reported symptom of itching with prevalence of 24.5% among wood workers, had the wood carvers as the category at increased risk (31.0%), while the saw millers was at increased risk of gritty sensation (24.1%) among wood workers with prevalence of 16.2% for the symptom.

Arc eye occurrence among welders with prevalence of 76.6%, showed arc welders as the category at increased risk (44.3%), while conjunctivitis occurrence with prevalence of 48.1%among wood workers, had wood carvers as the category at higher risk (73.8%).

Table 4.1.7.1: Artisans At Increased Risk of Occupation-Related Ocular Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans	Welders (n = 184)			Wood Artisans (n = 216)			
Category of Artisans	**Arc Welder(n = 79) Freq %**	**Auto Welder (n = 105) Freq %**	**Overall (n = 184) Freq %**	**Sawmiller (n = 136) Freq %**	**Wood carver (n = 42) Freq %**	**Carpenter (n = 38) Freq %**	**Overall (n = 216) Freq %**
Prevalence of Common Reported Ocular Symptoms							
Yes	**74 93.7%**	**63 60.0%**	**137 74.5%**	**95 69.9%**	**32 76.2%**	**28 73.7%**	**155 71.8%**
Itching	5 6.3%	7 6.6%	12 6.5%	30 16.9%	13 31.0%	10 26.3%	53 24.5%
Tearing	20 25.3%	16 15.3%	36 19.5%	15 6.6%	3 7.1%	3 7.9%	21 9.7%
Redness	13 16.5%	9 8.6%	22 12.0%	8 1.5%	2 4.8%	2 5.3%	12 5.6%
Pain	15 19.0%	12 11.4%	27 14.7%	9 2.2%	2 4.8%	3 7.9%	14 6.5%
Gritty sensation	10 12.7.0%	8 7.6%	18 9.8%	20 10.3%	9 21.4%	6 15.8%	35 16.2%
Blurry vision	11 13.9%	11 10.5%	22 12.0%	13 5.1%	3 7.1%	4 10.5%	20 9.3%
No	**5 6.3%**	**42 40.0%**	**47 25.5%**	**41 30.1%**	**10 23.8%**	**10 26.3%**	**61 28.2%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100%**	**216 100%**
Prevalence of Ocular Problem Occurrence							
Yes	**77 97.5%**	**64 61.0%**	**141 76.6%**	**73 53.7%**	**42 100.0%**	**34 89.5%**	**149 69.0%**
Arc eye	35 44.3%	25 23.8%	60 32.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Conjunctivitis	12 15.2%	18 17.2%	30 16.3%	52 38.3%	31 73.8%	21 55.4%	104 48.1%
Corneal opacity	8 10.1%	4 3.8%	12 6.5%	2 1.5%	1 2.4%	1 2.6%	4 1.9%
Pinguencula	3 3.8%	1 1.0%	4 2.2%	15 11.0%	9 21.4%	7 18.4%	31 14.4%
Pterygium	7 8.9%	8 7.6%	15 8.2%	1 0.7%	0 0.0%	1 2.6%	2 0.9%
Lens opacity	12 15.2%	8 7.6%	20 10.8%	3 2.2%	1 2.4%	4 10.5%	8 3.7%
No	**2 2.5%**	**41 39.0%**	**43 23.4%**	**63 46.3%**	**0 0.0%**	**4 10.5%**	**67 31.0%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Statistical test			**160.33 [LR]**	**P = 0.0001**			

4.1.7.2 Artisans At Increased Risk of Occupation-Related Respiratory Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans at increased risk of occupation-related respiratory health challenges among welders and wood work artisans in Imo State was shown in table 4.1.7.2. Of the commonly reported symptom of chest pain with prevalence of 20.7% among welders, arc welders was the category at increased risk (21.5%), as against the auto welders with 20.0% prevalence. Symptom of wheezing among welders with prevalence of 13.0%, had the arc welders as the category at higher risk (16.5%).

Among the wood respondents with cough as the commonly reported symptom with prevalence of 19.9%, wood carvers was the category at higher risk (28.6%), while wood carpenters was at higher risk of tightness of chest (26.3%), with the prevalence of 19.4% for the symptom among wood workers.

Occurrence of respiratory problem with mean peak expiratory flow rate (PEFR) of 396.2±47.3l/min among welders, showed arc welders as the category at increased risk (394.9±3.5l/min). Also, among the wood workers with mean peak expiratory flow rate (PEFR) of 385.1±47.3l/min, the wood carvers were the category at increased risk of respiratory problem (380.5±52.4l/min).

Table 4.1.7.2: Artisans At Increased Risk of Occupation-Related Respiratory Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans	Welders (n = 184)			Wood Artisans (n = 216)			
Category of Artisans	**Arc Welder(n =79) Freq %**	**Auto Welder (n = 105) Freq %**	**Overall (n = 184) Freq %**	**Sawmiller (n = 136) Freq %**	**Wood carver (n = 42) Freq %**	**Carpenter (n = 38) Freq %**	**Overall (n = 216) Freq %**
Common Reported Respiratory Symptoms							
Yes	**53 67.1%**	**52 49.5%**	**105 57.1%**	**77 56.6%**	**41 97.6%**	**34 89.5%**	**152 70.4%**
Cough	12 15.2%	10 9.5%	22 12.0%	21 15.4%	12 28.6%	10 26.3%	43 19.9%
Phlegm production	6 7.6%	4 3.8%	10 5.4%	11 8.1%	6 14.3%	4 10.5%	21 9.7%
Wheezing	13 16.5%	11 10.5%	24 13.0%	10 7.4%	5 11.9%	7 18.4%	22 10.3%
Chest pain	17 21.5%	21 20.0%	38 20.7%	14 10.3%	7 16.6%	3 8.0%	24 11.1%
Tightness of chest	5 6.3%	6 5.7%	11 6.0%	21 15.4%	11 26.2%	10 26.3%	42 19.4%
No	**26 32.9%**	**53 50.5%**	**79 42.9%**	**59 43.4%**	**1 2.4%**	**4 10.5%**	**64 29.6%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100%**
Prevalence of Respiratory Problem Occurrence							
Normal Peak Expiratory Flow Rate (400 - 600 l/min)	51	44	95	71	14	21	106
Low Peak Expiratory Flow Rate	28	61	89	65	28	17	110
Mean (±std. dev)	**394.9±3.5**	**397.5±3.2**	**396.2±47.3**	**386.6±2.7**	**380.5±2.7**	**388.2±2.6**	**385.1±52.4**
Statistical test			**t = 2.224**		**P = 0.027**		

4.1.7.3 Artisans At Increased Risk of Occupation-Related Hearing Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans at increased risk of occupation-related hearing health challenges among welders and wood work artisans was shown in table 4.1.7.3. The commonly reported symptom of heaviness of ear had prevalence of 15.7% among welders, with arc welders as the category at higher risk (16.5%), as against the auto welders with 15.2% prevalence.

Among the wood respondents with prevalence of 20.4% for humming sensation as the commonly reported symptom, wood carvers was the category at higher risk (35.7%).

Occurrence of hearing problem with prevalence of 57.1% among welders, had auto welders as the category at increased risk (57.1%) of noise-induced hearing loss. Also, among the wood workers with prevalence of 59.6% (for hearing problem), carpenters was the category at increased risk (73.3%) of noise-induced hearing loss.

Table 4.1.7.3: Artisan At Increased Risk of Occupation-Related Hearing Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans	Welders (n = 184)			Wood Artisans (n = 216)			
Category of Artisans	**Arc Welder(n = 79) Freq %**	**Auto Welder (n = 105) Freq %**	**Overall (n = 184) Freq %**	**Sawmiller (n = 136) Freq %**	**Wood carver (n = 42) Freq %**	**Carpenter (n = 38) Freq %**	**Overall (n = 216) Freq %**
Common Reported Hearing Symptoms							
Yes	**41 51.9%**	**44 41.9%**	**85 46.2%**	**47 34.6%**	**33 78.6%**	**29 76.3%**	**109 50.5%**
Ringing sensation	9 11.4%	9 8.6%	18 9.8%	9 6.6%	6 14.3%	6 15.8%	21 9.7%
Humming sensation	11 13.9%	9 8.6%	20 10.9%	17 12.5%	15 35.7%	12 31.6%	44 20.4%
Heaviness of ear	13 16.5%	16 15.2%	29 15.7%	11 8.1%	5 11.9%	7 18.4%	23 10.7%
Tuning-up of phone volume	8 10.1%	10 9.5%	18 9.8%	10 7.4%	7 16.7%	4 10.5%	21 9.7%
No							
Total	**38 48.1%**	**61 58.1%**	**99 53.8%**	**89 65.4%**	**9 21.4%**	**9 23.7%**	**107 49.5%**
	79 100.0%	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Prevalence of Hearing Problem Occurrence							
Abnormal	45 57.0%	60 57.1%	105 57.1%	72 52.9%	23 54.8%	28 73.7%	123 56.9%
Normal	34 43.0%	45 42.9%	79 42.9%	64 47.1%	19 45.2%	10 26.3%	93 43.1%
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Statistical test χ^2 **=006** **P = 0.981**							

4.1.7.4 Artisans At Increased Risk of Occupation-Related Skin Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans at increased risk of occupation-related skin health challenges among welders ans wood work artisans in Imo State was shown in table 4.1.7.4. The commonly reported symptom of irritation with prevalence of 29.3% among welders, had arc welders as the category at higher risk (30.4%), as against the arc welders with 28.6% prevalence.

Among the wood respondents with prevalence of 24.5% for itching as the commonly reported symptom, carpenters (26.3%) and wood carvers (26.2%) were the categories at higher risk .

Skin problem of coarse palms occurrence had prevalence of 32.6% among welders, with arc welders as the category at increased risk (35.4%). Also, among the wood workers with prevalence of 23.2% for scaly palms, wood carvers (23.8%) and saw millers (23.5%) were the categories at greatest risk.

Table 4.1.7.4: Artisans At Increased Risk of Occupation-Related Skin Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans	Welders (n = 184)			Wood Artisans (n = 216)			
Category of Artisans	**Arc Welder(n = 79) Freq %**	**Auto Welder (n = 105) Freq %**	**Overall (n = 184) Freq %**	**Sawmiller (n = 136) Freq %**	**Wood carver (n = 42) Freq %**	**Carpenter (n = 38) Freq %**	**Overall (n = 216) Freq %**
Common Reported Skin Symptoms							
Yes	**48 60.8%**	**58 55.2%**	**106 57.6%**	**107 78.7%**	**28 66.7%**	**25 65.8%**	**160 74.0%**
Irritation	24 30.4%	30 28.6%	54 29.3%	30 22.1%	4 9.5%	4 10.5%	38 17.6%
Dryness	10 12.7%	13 12.4%	23 12.5%	11 8.1%	2 4.8%	3 7.9%	16 7.4%
Redness	6 7.6%	7 6.6%	13 7.1%	7 5.1%	3 7.1%	3 7.9%	13 6.0%
Blisters	5 6.3%	4 3.8%	9 4.9%	27 19.9%	8 19.1%	5 13.2%	40 18.5%
Itching	3 3.8%	4 3.8%	7 3.8%	32 23.5%	11 26.2%	10 26.3%	53 24.5%
No	**31 39.2%**	**47 44.8%**	**78 42.4%**	**29 21.3%**	**14 33.3%**	**13 34.2%**	**56 26.0%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Prevalence of Skin Problem Occurrence							
Yes	**75 94.9%**	**76 72.4%**	**151 82.1%**	**100 73.5%**	**32 76.2%**	**35 92.1%**	**167 77.3%**
Coarse palms	28 35.4%	32 30.4%	60 32.6%	22 16.2%	9 21.5%	10 26.3%	41 19.0%
Cuts	5 6.3%	5 4.8%	10 5.4%	24 17.6%	7 16.7%	13 34.2%	44 20.4%
Bruises	6 7.6%	9 8.6%	15 8.2%	16 11.8%	3 7.1%	2 5.3%	21 9.7%
Scaly palms	21 26.6%	17 16.2%	38 20.7%	32 23.5%	10 23.8%	8 21.1%	50 29.2%
Burns	12 15.2%	8 7.6%	20 10.9%	4 2.9%	3 7.1%	1 2.6%	8 3.7%
Laceration	3 3.8%	5 4.8%	8 4.3%	2 1.5%	0 0.0%	1 2.6%	3 1.4%
No	**4 5.1%**	**29 27.6%**	**33 17.9%**	**36 26.5%**	**10 23.8%**	**3 7.9%**	**49 22.7%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Statistical test $\chi^2 = 169.230$ **P = 0.001**							

4.1.7.5 Artisans At Increased Risk of Occupation-Related Musculoskeletal Challenges Among Welders and Wood Work Artisans in Imo State

Artisans at increased risk of occupation-related musculoskeletal health challenges among welders and wood workers was shown in table 4.1.7.5. Of the commonly reported symptom of waist pain with prevalence of 27.7% among welders, arc welders was the category at increased risk (29.1%), as against the auto welders with 26.7% prevalence.

Also, with waist pain as the commonly reported symptom with prevalence of 28.2.4% among the wood workers, wood carvers was the category at increased risk (31.0%).

Musculoskeletal problems had prevalence of 85.3% among the greater proportion of welders, and arc welders was the category at higher risk (93.7%). Also, among the majority of wood workers with musculoskeletal problems (89.4%), saw millers was the category at greatest risk (94.1%).

Table 4.1.7.5: Artisans At Increased Risk of Occupation-Related Musculoskeletal Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans	Welders (n = 184)			Wood Artisans (n = 216)			
Category of Artisans	**Arc Welder(n = 79) Freq %**	**Auto Welder (n = 105) Freq %**	**Overall (n = 184) Freq %**	**Sawmiller (n = 136) Freq %**	**Wood carver (n = 42) Freq %**	**Carpenter (n = 38) Freq %**	**Overall (n = 216) Freq %**
Common Reported Musculoskeletal Symptoms							
Yes	**74 93.7%**	**83 79.0%**	**157 85.3%**	**128 94.1%**	**35 83.3%**	**30 78.9%**	**193 89.4%**
Joint pain	15 19.0%	19 18.1%	34 18.6%	13 9.6%	4 9.5%	3 7.9%	20 9.2%
Waist pain	23 29.1%	28 26.7%	51 27.7%	38 27.9%	13 31.0%	10 26.3%	61 28.2%
Low back pain	15 19.0%	16 15.2%	31 16.8%	18 13.2%	6 14.2%	5 13.2%	29 13.4%
Stiffness of muscles	4 5.1%	4 3.8%	8 4.3%	16 11.8%	4 9.5%	2 5.3%	22 10.2%
Numbness	7 8.9%	5 4.8%	12 6.5%	12 8.8%	1 2.4%	3 7.9%	16 7.4%
Fatigue	8 10.1%	9 8.6%	17 9.2%	22 16.2%	6 14.3%	6 15.7%	34 15.7%
Tenderness	2 2.5%	2 1.9%	4 2.2%	9 6.6%	1 2.4%	1 2.6%	11 5.1%
No	**5 6.3%**	**22 21.0%**	**27 14.7%**	**8 5.9%**	**7 16.7%**	**8 21.1%**	**23 10.6%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Prevalence of Musculoskeletal Problem Occurrence							
Yes	74 93.7%	83 79.0%	157 85.3%	128 94.1%	35 83.3%	30 78.9%	193 89.4%
No	5 6.3%	22 21.0%	27 14.7%	8 5.9%	7 16.7%	8 21.1%	23 10.6%
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Statistical test	**χ^2 = 0.601**		**P = 0.438**				

4.1.7.6 Artisans At Increased Risk of Occupation-Related Arterial (Blood) Pressure Challenges Among Welders and Wood Work Artisans in Imo State

Artisans at increased risk of occupation-related blood pressure health challenges among welders and wood work artisans in Imo State was shown in table 4.1.7.6. Of the commonly reported symptom of headache with prevalence of 17.9% among welders, auto welders was the category at increased risk (18.1%), as against the arc welders with prevalence of 17.7% for symptom of headache.

Also, with headache as the commonly reported symptom with prevalence of 19.4% among the wood workers, wood carvers (42.1.%) was the category at higher risk.

Of the hypertensive welders with prevalence of 38.7%, arc welders was the category at higher risk (43.0%). Also, among the hypertensive wood workers with prevalence of 40.7%, saw millers was the category at higher risk (47.8%).

Table 4.1.7.6: Artisans At Increased Risk of Occupation-Related Arterial Pressure Health Challenges Among Welders and Wood Work Artisans in Imo State

Artisans	Welders (n = 184)			Wood Artisans (n = 216)			
Category of Artisans	**Arc Welder(n = 79) Freq %**	**Auto Welder (n = 105) Freq %**	**Overall (n = 184) Freq %**	**Sawmiller (n = 136) Freq %**	**Wood carver (n = 42) Freq %**	**Carpenter (n = 38) Freq %**	**Overall (n = 216) Freq %**
Common Reported Blood Pressure Symptoms							
Yes	**32 40.5%**	**41 39.0%**	**73 39.7%**	**32 23.5%**	**25 59.5%**	**31 81.6%**	**88 40.7%**
Headache	14 17.7%	19 18.1%	33 17.9%	12 8.8%	14 33.3%	16 42.1%	42 19.4%
Palpitation	3 3.8%	4 3.8%	7 3.8%	3 2.2%	2 4.8%	3 7.9%	8 3.7%
Insomnia	2 2.5%	3 2.8%	5 2.7%	5 3.7%	3 7.1%	3 7.9%	11 5.1%
Dizziness	5 6.3%	5 4.8%	10 5.4%	4 2.9%	4 9.5%	4 10.5%	12 5.6%
Fainting	4 5.1%	2 1.9%	6 3.3%	3 2.2%	2 4.8%	2 5.3%	7 3.2%
Shortness of breath	3 3.8%	5 4.8%	8 4.4%	3 2.2%	0 0.0%	2 5.3%	5 2.3%
Nausea	1 1.3%	3 2.8%	4 2.2%	2 1.5%	0 0.0%	1 2.6%	3 1.4%
No	**47 59.5%**	**64 61.0%**	**111 60.3%**	**104 76.5%**	**17 40.5%**	**7 18.4%**	**128 59.3%**
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100%**	**38 100.0%**	**216 100.0%**
Prevalence of Blood Pressure Problem Occurrence							
Hypertensive	34 43.0%	39 37.1%	73 38.7%	65 47.8%	10 23.8%	13 34.2%	88 40.7%
Non-hypertensive	45 57.0%	66 62.9%	111 60.3%	71 52.2%	32 76.2%	25 65.8%	128 59.3%
Total	**79 100.0%**	**105 100.0%**	**184 100.0%**	**136 100.0%**	**42 100.0%**	**38 100.0%**	**216 100.0%**
Statistical test $\chi^2 = 0.042$ **P = 0.828**							

4.2 DISCUSSION

4.2.1 Prevalence of Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State

Occupation-related health challenges encountered among welders and wood work artisans in Imo State showed musculoskeletal occurrence as the most prevalent health problem. This was followed by skin, ocular, hearing, respiratory, and arterial (blood) pressure problems.

Findings on prevalence of ocular challenges among welders and wood work artisans showed tearing as the most prevalent among the welders, while itching was most prevalent among wood workers. Pain, eye redness and blurry vision were also reported more by welders, while gritty sensation was reported more by wood workers.

Occurrence of ocular problems showed that greater proportion of both artisans had ocular problems. Conjunctivitis was highly prevalent among the both artisans. It occurred in more than half of the wood workers and substantial number of welders. Arc eye occurred only among welders, while conjunctivitis was more prevalent among wood workers. Other eye issues found (though with low prevalence) included corneal opacity, eye redness and pinguencula. However, pinguencula occurred more among the wood workers, while lens opacity and pterygium were more prevalent among welders. Significant difference existed between the welders and wood artisans in their respective ocular health conditions (P=0.0001, χ^2= 160.3).

Greater proportion of both artisans had normal visual acuity, while few had moderate and severe visual impairment. No artisan was found with blindness. However, more wood workers had moderate and severe visual impairment than their welding counterpart.

Findings of this study on ocular health challenges detected may most likely be due to occupational hazards of metal and wood particles/dusts encountered by welders and wood workers during their work activities.

The commonly reported ocular symptoms (eye itching (18.7%), tearing (14.2.0%), gritty sensation (13.5%), blurry vision (10.8%), pain (8.8%%), and redness (7.0%%) were in agreement with a similar study by Oboh & Ofagbor, (2022) on predominant ocular challenges and protective eyewear compliance among welders in Port Harcourt Mechanic and Steel Villages in Rivers State, Nigeria, which showed the most frequent eye symptoms among respondents to be sandy sensation (30.1%), cloudy vision (22.3%), painful red eyes (18.5%), watery eyes (3.9%) and itchy eyes (2.9%). Another study by Megbele et al. (2012) among metal arc welders in Nigeria, which revealed self-reported symptoms of pain, tearing, sandy sensation and photophobia, found to be significantly higher among welders compared with controls (all $P <$ 0.001) also concurred with the present study.

The occurrence of ocular problems agreed with a similar study conducted by Ankamal-Lomotey et al. (2018) on ocular hazards among wood workers in Ashaiman timber market in Ghana, which showed that woodworkers had allergic conjunctivitis (120: 80%), ocular foreign bodies (115: 76.6%), pinguencula (8: 25.33%) and pterygia (71: 47.33%).

The findings also concurred with Adeoye et al. (2015) study among 100 sawmill workers(test group) and 100 matched vehicle mechanics (control group) in Osun State, Nigeria, where the findings on ocular health, indicated conjunctivitis (60%) to be significantly higher in sawmill workers than the controls at P less than 0.05 level.

Another study by Douglas & Koroye-Egbe, (2018) on the prevalence of ocular injuries among welders in Yenagoa, Bayelsa State, Nigeria, which detected ocular abnormalities of pinguenculae

(47.6%), conjunctiva discolouration (35.4%), pterygium (15.6%), also tallied with the present study.

Reports of study by Chukwuoha et al. (2018) on ocular injuries among welders in Nekede, Imo State, Nigeria, supported the findings of this present study by listing foreign bodies (30.7%), conjunctivitis (20.3%), pterygium (13.4%), arc-eye injury (12.6%), cataract (10.0%) as ocular problems found among welders.

Findings of this study also corroborated Oboh & Ofagbor (2022) study among welders in Port Harcourt Mechanic and Steel Villages in Rivers State, Nigeria, which reported pinguecula (31.1%), pterygium (21.4%) and corneal opacity (3.9%) among ocular surface abnormalities detected among respondents. There was a statistically significant association between age of welders and eye symptoms experienced and predominant ocular surface abnormalities. This also tallied with the present study.

Findings on visual acuity among the artisans agreed with that of Douglas & Koroye-Egbe, (2018) in Yenagoa, Bayelsa State, Nigeria, which reported that majority of the participants (95.6%) had mild visual impairment.

Findings on prevalence of respiratory challenges among welders and wood work artisans in Imo State showed commonly reported respiratory symptoms of cough and chest pain. Chest pain was more prevalent among welders, while cough was more prevalent among wood workers.

The respiratory problems occurrence among artisans revealed that substantial proportion of welders and great proportion half of wood workers showed declined lung functions, with mean peak expiratory flow rate among welders shown to be 396.2± 47.3l/min, and that of wood workers found to be 385.1± 52.4 l/min. However, the declined lung function was more among

the wood work artisan as seen in table 4.1.1.2. Significant difference was found between welders and wood workers in their mean peak expiratory flow rates (PEFR) (P =0.027, t = 2.224).

Findings on respiratory challenges may be due to chemical hazards of metal fumes, wood dusts, smoke encountered by artisans in their respective work activities as well as workplace environment air pollution in their work locations, whose parameters were found to be above the WHO permissible limits (as shown in table 4.1.3), hence the respiratory symptoms and declined lung functions as observed in the study.

The findings was in keeping with a similar study by Agu et al. (2016) on health problems and workplace risk assessment among sawmill workers in Abakaliki, which reported cough (47.5%) and chest pain (42.1%) as main respiratory issues. And concluded that respiratory symptoms and injuries were the most prevalent health problem among saw millers.

The findings also colloborated another study by Awoke et al. (2021) in medium-scale woodwork factories in Ethiopia, which revealed prevalence (69.8%) of chronic respiratory symptoms among wood workers, with cough (54.6%), phlegm (52.2%), wheezing (44.6%), breathlessness (42.1%) and chest pain (42.9%).

The findings was also in consonance with another similar study by Adeoye et al. (2015) in Osun State, Nigeria which revealed a mean peak expiratory flow rate, significantly (P>0.01) lower among saw millers (332.6±66.23l/min) than mechanics (488.7±60.23l/min) used as control.

Findings also agreed with yet another study by Mbegue, Sow, Houndjo et al. (2018) in Thies, Senegal, which detected alterations of respiratory function parameters of respondents. Among the seventy average aged (39 years) carpenters that were used, spirometry revealed obstructive respiratory disorder in 32.85% of cases with 17.14% mild; 7.14% moderate; 18.57% pure

restrictive and 7.14% of cases as mixed syndrome. Wood dust was implicated as the cause of respiratory disorders encountered by carpenters.

Findings also tallied with reports of Mgonja, (2017) study, which concluded that welders were at risk of respiratory dysfunctions, while Wanjari & Wankhede, (2020) concurred with the reports of Mgonja and the present study by revealing that welders have susceptibility to respiratory disorders due to their exposures to metal fumes, dusts and gases emanating from welding activities.

Findings on prevalence of hearing challenges among among welders and wood work artisans in Imo State showed heaviness of the ear and humming sensation as the commonly reported symptoms. Heaviness of the ear was more prevalent among welders, while humming sensation was more prevalent among wood workers.

The hearing problems occurrence was found in substantial proportion of both artisans. No significant difference was found between the welders and wood artisans in their respective hearing conditions (P =0.981, χ^2=0.006)3.

The findings on the hearing challenges among welders and wood work artisans may have been due to high noise levels encountered by welders (114.42db) and wood workers (104.00db) at their respective work environments (seen in table 4.1.3), the values of which exceeded the WHO 85db permissible limit, making both the welders and woodworkers at risk of noise-induced hearing problems.

The findings agreed with a similar study by Odibo et al. (2018) in Delta State, Nigeria. The aforementioned result, showed that 56.6% of workers were at risk of hearing loss due to noise pollution. Noise levels found included 101.2 dBA, 97.72 dBA and 100.91 dBA for Sapele, Warri and Udu sawmills respectively over a nine hours work duration), which were higher than the

accepted limits by National Institute of Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), National Environmental Standards and Regulations Enforcement Agency (NESREA).

Findings also corroborated another study by Ebe et al. (2019) at Ogbosisi Naze and Mbieri Timber and Allied Market in Owerri, Imo State, which observed that all the locations sampled (stations A to E), were above the standard limits both in Ogbosisi Naze (96.15 to 101.65 dB) and industrial Market Umuonyeali Mbieri (93.19 to 94.96) for both morning and afternoon. All the workers within these areas were reported to be at risk of noise-induced hearing problems.

Findings on prevalence of skin challenges among among welders and wood work artisans in Imo State, revealed commonly reported symptoms of irritation and itching. Irritation was more prevalent among the welders, while wood workers had itching as the prevalent symptom. Occurrence of skin issues**,** showed that greater proportion of both welders and wood workers had skin issues as shown in table 4.1.1.4. The prevalence of coarse palms was more among welders, while that of scaly palms was more among woodworkers. Also, prevalence of burns were more among welders, while cuts were more among wood workers. Significant difference was found between welders and wood woodworkers in their respective skin health conditions (P=0.0001, χ^2= 203.64).

The skin issues among welders and wood workers may have resulted from substances and materials used in the treatment/preservation of wood and their products as well as habits of washing hands with chemical substances (as revealed in table 4.1.5.2). Other reasons may have been mechanical hazards from implements, obsolete tools and machines of work (for instance unguarded moving belts and rotating wheels), whose pointed edges, high-powered force, may have exerted stress, and injured artisans exposed to them as posited by Amadi, (2011).

Findings of this study tallied with that of Sahkvidi et al. (2019) in Iran, where it was discovered that car repair workers had increased prevalence of hand dermatitis (19.0%) than office workers (7.9%) that were used as control. As reported in the mentioned study, the risk of developing occupational contact dermatitis was 2.74 in car repair workers than in control used.

Another study by Johnson & Bassey (2015) at Mechanic village in Uyo, Nigeria, which reported hand dermatitis (40.4%) among respondents due to habit of hand washing with fuel (90.1%), washing vehicle parts with fuel (90.1%) and treatment of bruises with hydraulic (37.8%) and fuel (8%) also corroborated with the present study.

The findings also supported the reports of a related study by Balogun et al. (2016), which also showed cuts (96.7%) as one of the health problems detected among respondents.

Other related studies by Johnson & Bassey (2017), which revealed cuts (84.1%) and Agu et al. (2019), which listed cuts (25.0%) among health problems found among sawmillers, tallied with the findings of this study.

Findings on prevalence of musculoskeletal challenges among welders and wood work artisans in Imo State showed commonly reported symptom of waist pain among both artisans. Greater proportion of both welders and wood work artisans had musculoskeletal problems. No significant difference existed between them in their respective musculoskeletal health conditions (P =0.438, $\square^2$=0.601) as shown in table 4.1.1.5

These musculoskeletal health issues may have resulted from ergonomic hazards of repetitive and excessive forced activities, manual and heavy lifting of objects and materials of work, adopted awkward or fixed work postures which these artisans encountered for long hours, on daily basis as reported by Adeyemi et al. (2017), in his study on job safety assessment of woodwork industry in the South Western Nigeria. These activities usually affect the muscles, tendons,

ligaments, and nerves leading musculoskeletal disorders ((Aiggan et al., 2020; Canadian Centre for Occupational Safety, 2015). They affect the neck, shoulders, forearms, elbows, lower back, waist, wrists, thigh and knees with diverse rate across the parts of the body (Hamid et al., 2017). The findings of this study concurred with a similar study by Balogun et al. (2016) in Ibadan, Nigeria, which revealed that all the respondents showed musculoskeletal health problems of joint pain (63.3%) and low back pain (54.7%).

The findings also corroborated a related study by Adeyemi et al. (2016), on job safety assessment of woodwork industry in the South Western Nigeria which implicated repetitive and excessive forced activities, manual and heavy lifting of objects and materials of work, adopted awkward or fixed work postures as factors that may have led to musculoskeletal disorders among respondents.

Findings of this study supported yet another study by Gbiri et al. (2012) in a Nigeria rural-urban center, where the result revealed high prevalence of work-related musculoskeletal disorders among welders. According to the said report, low-back pains followed by neck and shoulder pains were the most prevalent. 98% of the respondents had work-related musculoskeletal disorders, with low-back pain as the most common, occurring in 60.1% of the cases.

Also, Johnson and Bassey (2016) in their work on the habits and health problems of 151automobile technicians at Mechanic village Uyo, Nigeria, discovered low back pain among 78.1% of the respondents, which tallied with the present study.

Yet, another study conducted by Balogun et al. (2016) on the health problems, workplace hazards and health needs of 509 artisans (comprising of tailors, mechanics, hairdressers, welders and carpenters) in Ibadan, Nigeria, also found musculoskeletal disorders of joint pain (63.3%)

and low back pain (54.7%) as the health problems encountered by all the respondents. This also supported the present study.

Findings of a similar study by Rahman et al. (2019) on work-related musculoskeletal disorders: a case study of sawmill workers in Bangladesh was in tandem with the present study. As shown in the aforementioned study, sawmill workers were at increased risk of musculoskeletal disorders due to risk factors of musculoskeletal disorders including manual handling tasks of lifting, carrying, pushing and pulling of wood materials. The findings revealed 70.1% musculoskeletal disorders in at least one body part for at least one year among the respondents. Average Rapid Entire Body Assessment (REBA)score of four main tasks (pushing, pulling, lifting and carrying timber) was found to be 9.25, which is high risk for musculoskeletal disorders.

Also, findings obtained from Elechi & Warmate (2019) study in Port Harcourt Metropolis River State, supported this study by revealing ergonomic hazards of 88.4% repetitive work and movement, 77.5% of awkward body position, 68.6% of persistent fatigue due to work activity and 51.0% of long working hours as high percentage risk factors and showed that saw millers were at increased risk of developing musculoskeletal disorders.

Findings on prevalence of arterial (blood) pressure challenges among welders and wood work artisans showed headache as the most prevalent symptom. The prevalence was slightly higher among wood artisans. Blood pressure issue occurred in substantial proportion of both artisans. Of those with hypertension, the prevalence was slightly higher among the woodworkers. However, at 5% level of significance, the difference welders and wood workers was not significant ($P = 0.828$, $\chi^2 = 0.042$).

The blood pressure challenges may have resulted from artisans' encounter with psycho-social stressors of workplace including work demands, time pressure, decision latitude, reward and recognition, workloads, support from supervisors, job clarity, job design, job training, poor communication, shift work issues, fear of job loss and many more, often lead to psychological and behavioural health effects like emotional tension as well as psychosomatic ill health such as fatigue, headache, pain in different parts of the body; propensity to peptic ulcer, hypertension, heart disease and rapid aging as reported by Amadi, (2022).

The findings tallied with a similar study by Gupta et al. (2019), in Mohali district of Punjab India which revealed headache as one of the health problems faced by artisans used in the study.

The finding was also in consonance with a similar study by Alexander et al. (2016) in Vellore, Southern India, which showed occurrence of hypertension to be 12.6% among the welders. Though the rate was higher in the present study, which may be due to conditions of work here which may be more stressful.

The finding also corroborated a related study by Ayogu et al. (2021) in rural communities of southeast Nigeria, which detected isolated systolic hypertension (10.6%), diastolic hypertension (18.2%), combined systolic and diastolic hypertension (37.8%) among the participants. According to the study, increase in age and low education level were some of the significant predictors detected.

Findings on prevalence of other health challenges (unclassified in the present study) among welders and wood workers showed crushing wound, fracture and electric shocks as commonly reported symptoms. Crushing wound was most prevalent among wood workers, while electric shock was prevalent among welders. Crushing wound occurrence may most likely be from logs

of wood which occasionally slip off from wood workers who manually carry them, resulting in fracture and other injuries.

A substantial proportion of both artisans reported constant (every time) encounter with these health challenges, leading to almost half of them staying off from work. Among both welders and wood workers, greater proportion of both artisans stayed off work for 3 - 4 days, as a result of these problems. And great percentage of them treated the health challenges at chemist/pharmacy shop.

Findings corroborated study of Agu et al. (2016), which included injuries from log of wood (57.4%) as one of the health problems detected among saw milling respondents used in the study.

Summarily, the findings showed prevalence of occupation-related health challenges among welders and woodwork artisans in Imo State, thereby rejecting the null hypothesis one (H_1) which stated that there is no prevalence of occupation-related health challenges among welders and wood work artisans in Imo State.

4.2.2 Occupational Hazards Encountered Among Welders and Wood Work Artisans Imo State

Occupational hazards encountered among welders and wood work artisans in Imo State were physical, chemical, ergonomic, biological, and psychosocial hazards as shown in figures 4.1.2.1, 4.1.2.2, 4.1.2.3, 4.1.2.4 and 4.1.2.5.

Findings on physical hazards encountered among artisans revealed that greater proportion of both welders and wood work artisans were exposed to physical hazards of noise and heat. However, greater percentage of welders encountered more physical hazards of radiation,

vibration, metal particles and explosion, while greater percentage of wood workers encountered more physical hazards of wood particles in their occupations (as shown in figure 4.1.2.1).

Findings on chemical hazards encountered among artisans (fig. 4.1.2.2), showed that greater proportion of welders encountered more chemical hazards of metal fumes and smoke, while greater proportion of wood workers encountered more chemical hazard of wood dust.

Findings on ergonomic hazards encountered among artisans (fig. 4.1.2.3), showed that greater proportions of both welders and wood workers encountered awkward postures and manual lifting of heavy work materials. However, greater proportion of wood workers also encountered more repetitive work activities and fixed postures in their occupations.

Findings on biological hazards encountered among artisans (fig. 4.1.2.4), revealed that greater percentages of both welders and wood work artisans encountered insect bites.

Findings on psycho-social hazards encountered among artisans (fig. 4.1.2.5), showed the great proportion of wood workers encountered hazard of fatigue, while great proportion of welders encountered hazard of stress.

The findings of this study on physical hazards of noise (84.0%), heat (77.5%), radiation (52.8%) vibration (56.5%), wood particles (57.3%) and metal particles (42.3%); chemical hazards of fumes (42.8%＋46.5%, smoke (37.3%, wood dust (59.8%); ergonomic hazards of repetition (36.3%), fixed postures (42.5%), awkward postures (57.3%) and manual lifting (68.5%); biological hazards of insect bites (58.5%) and psycho-social hazards of stress (68.5%) and fatigue (56.8%) agreed with a similar study by Balogun et al. (2016) in Ibadan, Nigeria, which revealed physical hazards of noise (71.0%), chemical hazard of fumes (43.4%), biological hazard of insect bites (91.0%) and psycho-social hazard of low income (68.9%). The only variation is in

the psycho-social hazard was low income as against stress and fatigue as indicated in the present study.

Another related study by Amfo-otu & Agyemang (2016) in Sekyere, East District of Ghana, also tallied with Balogun et al. (2016) and the present study. According to the mentioned study, physical hazards of heat, chemical hazard of fumes, biological hazards of insect bites and psychological hazards of working under pressure were detected among respondents,.

Richard et al. (2017) study, which showed that sawmill workers encountered hazards of wood dust (81.0%) and noise (78.0%), also lend credence to the present study.

Again, results of Elechi & Warmate (2019) study corroborated the findings of this study by identifying physical hazards of noise (91.1%), flying and falling sharp wood (75.6%), vibration (66.7%); chemical hazards of wood dust (88.9%), fumes and gases (62.6%), smoke (30.0%); biological hazards of airborne pathogens (64.7%); ergonomic hazards of repetitive work (88.4%), awkward body position and heavy lifting (77.5%); psycho-social hazards of stress (80.0%), persistent fatigue (68.6%) and long working hours (51.0%).

Yet another study by Nwafor (2019), also supported the present study by revealing physical hazards (66.0%), chemical hazards (74.2%), biological hazard (33.5%), ergonomic hazards (32.1%) and psychological hazard (28.5%), as occupational hazards encountered by welders in the course of their occupation.

Summarily, occupational hazard encountered among welders and wood work artisans in Imo State, showed that these occupations encountered physical, chemical, ergonomic, biological and psycho-social hazards in their respective work activities. Most of these hazards were peculiar with individual occupation, while some occurred in both of them.

Therefore the null hypothesis two (H_2), that stated that there is no occupational hazards encountered among welders and wood work artisans in Imo State was rejected.

4.2.3 Workplace Environment Air pollution Among Welders and Wood Work Artisans in Imo State

Findings on workplace environment air pollution within the study area as contained in table 4.2.3, showed that in workplace environment of welders and wood workers, the estimated mean for the observed hazard parameters exceeded the WHO permissible limit required, making them at risk of occupation-related health challenges in their work environments.

The mean value for noise level at welders' (114.42db) and wood workers' environment (104.00db) far exceeded the WHO 85db permissible limit for noise, indicating risk of noise-induced hearing problems among both artisans.

At welders work locations, the mean parameters for air quality showed significant difference with the permissible limit on noise: (P =0.0001, t=8.618), $PM_{2.5}$ (P =0.0001, t=3.406), PM_1 (P =0.021, t=2.866), PM_{10} (P=0.021, t=3.493) , NO (P =0.005, t=3.894), CO (P =0.008, t=3.518), CO_2 (P =0.005, t=3.876) and SO (P =0.011, t=3.269).

Similar significant difference also existed in wood work environment. Significant parameters included noise: (P =0.0001, t=10.76), $Pm_{2.5}$ (P =0.0001, t=17.047), Pm_1 (P =0.0001, t=8.142), PM_{10} (P=0.029, t=3.029) , NO (P =0.004, t=5.140), CO (P =0.002, t=5.852), CO_2 (P =0.007, t=4.445), and SO (P =0.001, t=6.450).

The findings showed high pollution level of air quality in both welders and wood workers workplace environment.

The null hypothesis three (H_3) which stated that there is no significant workplace environment air pollution among welders and wood work artisans in Imo State was therefore rejected.

4.2.4 Awareness Towards Work-Related Health Challenges Among Respondents

Findings on level of awareness among the artisans, revealed high level of awareness among both artisans as shown in table 4.2.4. Greater proportions of both artisans were aware that they were exposed to health challenges in their work places. The awareness level was slightly higher among the wood workers. The sources of awareness, was mostly from work experience for the both artisans.

Findings on the influence of awareness on occurrence of occupational health challenges among welders and wood work artisans as shown in table 4.2.4.1, revealed significant results on ocular ($P < 0.0001$, 95% conf. Inter = 0.135 to 0.403), respiratory ($P < 0.004$, 95% conf. Inter = 0.276 to 0.781), hearing ($P < 0.0001$, 95% conf. Inter = 0146 to 0.546), skin ($P < 0.0001$, 95% conf. Inter = 0.216 to 0. 623), and musculoskeletal ($P = 0.011$, 95% conf. Inter = 1.81 to 18.13) problem occurrences.

Awareness showed negative coefficient with most of the heath problems indicating that increased awareness is likely to lead to reduction in health issues among the artisans.

The odd for ocular issues occurrence was found to be 76.6% (i.e 1 - 0.234)% significantly lower among the artisans that showed awareness compared to those who are not aware (OR= 0.234). Those who were not aware of occupational musculoskeletal problems, were 13.3 times more likely to have musculoskeletal issues compared to those who are aware. Also, the odd of blood pressure occurrence was found to be more than 2 times for artisans who are not aware, than those who are aware. Also occurrence of skin problem was also associated with not being aware.The

odds of skin problem occurrence was found to be 64% (i.e 1- 0.367) lower in those who are aware, compared to those who are not aware.

Findings of this study tallied with similar studies by Joseph et al., (2017) in India and Tadesse et al., (2015) in Lideta Sub-City Ethiopia, which revealed high levels of awareness of 62.6% and 85.5% respectively, though the practice of safety measures was found to be abysmally low compared to the awareness levels revealed from the aforementioned studies.

Findings of this study also concurred with a related study by Osagiede et al. (2020) in a semi-urban town in south-south Nigeria, which revealed high level of awareness on occupational hazards, with sub-optimal utilization of protective measures against hazards. According to the said study, 100% of the respondents showed awareness of at least one occupational hazard associated with welding activity. But the findings differed with that of Elenwo (2018) on occupational hazards and risks of automobile mechanic in Port Harcourt, which showed that 75.4% respondents used were not aware that their jobs was a hazardous one. As reported by the study also, 73.9% of the respondents were not aware that they are supposed to use personal protective equipment. The health issues reported included back pain (18.0%, burns (16.0%), headache (15.0%) and dizziness (13.0%) among others.

Summarily, awareness was moderately high among respondents, with source of awareness being mostly from work experience. There was significant association between awareness and occurrence of health challenges among welders and wood work artisans.Awareness also showed negative coefficient with most of the heath problems, indicating that increased awareness is likely to lead to reduction in occurrences of occupation-related health issues among the artisans.

Therefore the null hypothesis (H_4) which stated no significant influence of awareness on occurrence of occupation-related health challenges was rejected.

4.2.5 Adherence Towards Safety and Health Protection Practices Among Welders and Wood Work Artisans in Imo State

Findings on adherence towards safety and health protection practices among welders and wood work artisans in Imo State, showed that these practices including medical check-up after commencement of jobs, safety training attendance, personal protective equipment usage, personal hygiene and sanitation practices were low among both artisans. Significant association existed between adherence towards safety practices and occurrence of health challenges as shown in tables 4.1.5.1 - 4.1.5.5.

Findings on adherence towards safety practices as presented in table 4.1.5.1, showed that greater percentage of the artisans had no medical check-up after commencement of their jobs. Just very few among them had medical check-up on quarterly and yearly basis. None attended on monthly basis. Similarly, greater proportion of both welders and wood workers had no safety and health training.

Attendance to medical check-up showed slight significant association with non-occurrence of health challenges (chi sq= 8.248, p=0.041). The proportion with no health problems was lowest among medical check-up negligent artisans. On the other hand, safety training attendance showed strong significant association with non-occurrence of health challenges (Chi sq= 27.39, p<0.0001). Among those that attended safety training, greater number of them had no health issues against those who never attended.

The use of personal protective equipment (PPE) among artisans was quite low. Only few of them used PPE. Welders were in the majority of those that used PPE. The frequency of PPE use among both artisans, revealed that greater proportion of them never used PPE. Only few of both artisans used them every time.

Significant association was found between adherence to the use of PPE and the occurrence of health issues (P =0.000, chi sq = 14.8). Greater proportion of artisans who used PPE had none of the assessed health challenges, while just few among those who did not use PPE were free from health issues occurrence.

Frequency of PPE usage showed significant association with occurrence of health challenges among respondents (P =0.000, chi sq = 30.03). Those that used PPE all the time had the highest proportion of non-occurrence of health challenges.

Findings on the types of personal protective equipment used among artisans as shown in table 4.1.5.2, revealed that very few of the respondents use face mask. The proportion of wood respondents that use face and nose masks were more than that of welders, while usage of ear muffs protective equipment had almost same proportion for both artisan groups.

The use of protective boots and hand gloves were both low among the both artisans. The proportion of wood respondents that use of protective boots was higher that that of welders. The use of goggle was found to be high among the welders and very low among the wood respondents. The use of head protective helmet was also low among both artisans, with greater proportion among the welders.

Use of coverall clothing also was low among both artisans, with welders comprising the greater proportion of those that used it.

Non-occurrence of health challenges were found to be significantly higher among artisans that used PPE than on those who did not. A highly significant association was found between different personal protective equipment used among artisans and health challenge occurrence ($p < 0.0001$).

Findings concurred with a similar study by Tadesse et al., (2015) in Lideta Sub-City Ethiopia, which revealed abysmally low practice of safety measures compared to the reported knowledge of hazards among respondents used. Another study by Richard et al. (2017) in Nakuru County, Kenya, which reported that (80%) of the respondents used had no health and safety training, also agreed with the present study.

Yet another study by Ojo et al. (2020) in Ile–Ife, Nigeria, tallied with the findings of the present study by its report on the poor usage of personal protective equipment (PPE), which was found to be instrumental to self - reported health problems encountered by the respondents used.

Again, write-up of Afolabi (2021), concurred with the findings of this study, as it reported that most artisanal activities in Nigeria failed to meet decent work criteria as evident in the way they earned their livelihood under insecure and precarious working conditions.

Findings on personal hygiene practices/habits among artisans as shown in table 4.1.5.3, showed that the practices including frequency of hand washing before eating were low**.** Lower proportion of both welders and wood workers washed hands every time before eating. Only a little above one quarter of them, washed hands every time before eating, while slightly above half of the total artisans washed hands sometimes before eating and very few washed hands once in a while before eating. Substantial proportion of both welders and wood workers did not bath always after work. Greater percentage of both artisans washed hands and treated wounds

sustained during work activities with chemical substances, with wood workers having the largest number of those that practiced the habit.

There is therefore poor personal hygiene practices welders and wood work artisans in Imo State. The findings concurred with a related study by Ojo et al. (2020) on work habits and health problems of auto-artisans exposed to organic solvents in Ile–Ife, Nigeria, which showed poor habits of sucking petrol and treating of wounds with chemical substances (hydraulic).

Findings on sanitation practices among artisans as presented on table 4.1.5.4, showed that most of the hand washing facilities observed among both artisans, were at welders workshops. None of the wood workers' workshops observed, had hand washing facilities.

Similarly, greater proportion of both welders and wood workers in Imo State had no urinals in their workshops. Of those with urinals, the welders were in the majority.

Accessibility of water supply to artisans' workshops, showed that almost all the artisans had accessible and reachable water supply in their workshops.

Greater proportion of welders and wood workers had access to toilet facilities. Water closet type of toilet was found among welders, while the flush pour type was mostly seen among the wood workers. Greater number of the toilets found were not functional. Only few of the toilets were cleaned regularly, mostly among welders.

Findings on refuse collection and disposal practices among artisans as seen in table 4.1.5.5, showed no specific refuse collection practice among welders and wood workers in Imo State.

Greater proportion of both artisans used any container, while almost equal percentage of them collected their wastes "without container" and bin bags. The wood workers constituted about half of those that used any container to pack refuse.

The frequency of refuse removal, revealed that greater percentage of both artisans removed their refuse on daily basis. Only few them, removed refuse weekly and forth nightly. Trash bins were unavailable in the majority of both artisans workshops.

Refuse disposal practices among artisans in Imo State included open dumping, incineration, river dumping and street or anywhere dumping. Greater percentage of them practiced incineration method of refuse disposal, while the rest used open dumping. Open dumping was practiced more by welders, while incineration was practiced mostly by wood workers. Only very few of artisans disposed their refuse in the river, or dumped them anywhere.

Summarily, though artisans practiced different kinds of refuse collection and disposal, yet these practices fell short of the standard set for adequate safety and health protection. Welders practiced more personal hygiene and toilet sanitation than wood work artisans.

The findings tallied with a related study by Diwe et al. (2016) on occupational hazards, safety and hygienic practices among timber workers in a South Eastern State in Nigeria, which showed that proper hygiene and sanitation was poorly practiced as all respondents (100%) indiscriminately disposed their wastes. Also, about one third of the workers (33%) failed to bath after day's work.

Overall findings on adherence towards safety and health protection practices among welders and wood work artisans including medical checks, safety and health training, use of personal protective equipment, personal hygiene and sanitation practices as well as refuse collection and disposal practices were found to be poor. This answers the research question number four (4).

The findings concurred with several other studies conducted among artisans in Nigeria and other sub-Saharan African countries, which showed poor adherence to occupational and safety

standards with their resultant increase in health challenges. Similar studies by Akinwale et al. (2014), Diugwu et al. (2012) and Kalejaiye, (2013), all agreed with this study as they showed that most low and middle-income countries of the world (Nigeria inclusive) lack occupational health and safety regulation and enforcement.

A related study by Umeokafor et al. (2014), also supported this study by reporting that occupational health and safety (OHS) issues had not been accorded necessary and adequate attention by government and safety professionals of Nigeria. Umeokafor posited, that although Nigeria signed the 1981 ILO's Geneva Convention on Occupational Safety and Health (OSH), yet it was still struggling with the implementation and enforcement of OSH policies and regulations.

Similar studies by Adeoye et al. (2015) & Adeogun et al. (2013), also lend credence to the findings of this study. According to the said studies, ignorance of safety and health issues was listed as one of the causes of poor protection against occupational health among artisans.

Asakitikpi (2019), also pointed low level of awareness of national health insurance scheme as one of the relevant factors that was responsible for poor occupational health and safety practices among artisans in Nigeria. As opined by Asakitikpi, this has prevented artisans from benefiting from the programme. This was entirely true.

Summarily, adherence towards safety and health protection practices was low among welders and wood workers, no wonder the high prevalence of occupation-related challenges revealed among them. Significant association was found between adherence towards safety and health protection practices and occurrence of health challenges. Therefore, the null hypothesis five (H_5) was rejected.

4.2.6: Relationship Between Socio-demographic factors and Occurrence of Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State.

Findings on the relationship between socio-demographic factors and occurrence of occupation-related health challenges among welders and wood work artisans in Imo State, revealed significant association with age among wood workers (χ^2 = 21.49, p=0.000), daily income among welders (χ^2 = 7.918, P=0.048) and duration (years) at work among both welders (χ^2 =10.912, p=0.012), and wood workers (χ^2 =8.646. p=0.034). Sex, marital status and educational level of artisans were not found significant.

The findings concurred with a similar study by Nwala et al., 2018 in a rural community of Ekwulobia in Aguata Local government Area of Anambra State, Nigeria, which revealed that occurrences of ocular injuries increased with years at work, as workers with 1-2 years at work had 4.3% ocular issues, while those with 11 years and above had 39.3% ocular issues.

Another study by Ayogu et al. (2021) on prevalence and predictors of different patterns of hypertension among adults aged 20 - 60 years in rural communities of southeast Nigeria, also found increased age as one of the significant predictors of blood pressure problem (hypertension).

A related study by Awoke et al. (2021) among workers in medium-scale woodwork factories in Ethiopia, also detected increased years of work as one of the risk factors of chronic respiratory symptoms.

Yet another study by Oboh & Ofagbor (2022) among welders in Port Harcourt Mechanic and Steel Villages, Rivers State, Nigeria, revealed significant association between the age and eye

symptoms as well as predominant ocular surface abnormalities. These findings, also tallied with the present study.

Summarily, age, daily income and duration (years) at work were significant socio-demographic factors that were associated with occupation-related health challenges among welders and wood work artisans in Imo State. The null hypothesis six (H_6), which stated no significant relationship between socio-demographic factors and occurrence of occupation-related health challenges among welders and wood work artisans was therefore rejected.

4.2.7 : Artisans at Increased Risk of Occupation-Related Health Challenges Among Welders and Wood Work Artisans in Imo State.

Findings on artisans at increased risk of occupation-related ocular health challenges among welders and wood workers as shown in table 4.2.7.1 showed arc welders as the category at increased risk of commonly reported symptom of tearing among welders, while wood carvers and saw millers were the categories of wood workers at increased risk of commonly reported symptom of itching.

Arc eye occurrence among welders, showed arc welders as the category at increased risk, while conjunctivitis occurrence among wood workers, had wood carvers as the category at increased risk.

Findings on artisans at increased risk of work-related respiratory health challenges among welders and wood workers (table 4.7.2) revealed arc welders as the category at increased risk of commonly reported symptom of chest pain among welders, while wood carvers and carpenters were categories at increased risk of commonly reported symptom of cough among wood workers.

Arc welders was the category at increased risk of respiratory problem (declined lung function) among welders, while wood carvers was the category at increased risk of declined lung function (respiratory problem) among wood workers.

This may be due to inhalation of metal fumes among arc welders and wood dust among wood carvers. Also, welders and wood carvers perform their activities at very close range with their work materials. Metal fumes and wood dusts released at these close ranges, become inhaled thus, increasing their risk of respiratory problem.

Findings on artisans at increased risk of occupation-related hearing health challenges among welders and wood workers (table 4.7.3) showed arc welders as the category at increased risk of commonly reported symptom of heaviness of ear among welders, while wood carvers was the category at increased risk of commonly reported symptom of humming sensation among wood work artisans.

Auto welders was the category at increased risk of noise-induced hearing problem occurrence among welders, while carpenters was the category of wood workers at increased risk of noise-induced hearing problem.

These hearing challenges may have been due to noise emanated from beating of damaged/ accidental or worn-out vehicle parts during repairs among auto welders and constant cutting, joining and hitting of nails on wood parts during furniture making among carpenters.

Findings on artisans at increased risk of occupation-related skin health challenges among welders and wood workers (table 4.7.4) revealed that, of the commonly reported symptom of irritation among welders, arc welders was the category at higher risk, while carpenters and wood carvers were the categories of wood work artisans at increased risk of commonly reported symptom of itching.

Findings on artisans at increased risk of occupation-related skin health challenges among welders and wood workers (table 4.7.4) revealed arc welders as the category at increased risk of the commonly reported symptom of irritation among welders, while carpenters and wood carvers were the categories of wood work artisans at increased risk of commonly reported symptom of itching.

Arc welders was the category at increased risk of coarse palm occurrence among welders, showed, while wood carvers and saw millers were the categories of wood work artisans at increased risk of scaly palms.

These skin problems may have resulted from handling of work materials without personal protective equipment (hand gloves), which was revealed to be very low among welders and wood workers in the study. Friction, heat, chemical substance, poor hygiene of hand washing may also have been instrumental to the afore mentioned skin issues (coarse and scaly palms).

Findings on artisans at increased risk of work-related musculoskeletal health challenges among welders and wood workers (table 4.7.5) showed arc welders and wood carvers as the categories of artisans at increased risk of commonly reported symptom of waist pain among welders and wood workers. Greater proportion of both artisans had musculoskeletal problems.

Arc welders and saw millers were the categories of artisans at increased risk of musculoskeletal problem occurrence among welders and wood workers.

These musculoskeletal challenges may have been due to ergonomic hazards of manual lifting of work materials, fixed and awkward postures, repetitive work activities for long hours which these artisans were shown to have encountered in the findings of this study. This may have led to increased risk of musculoskeletal problems among them.

The findings agreed with a similar study by Elechi and Warmate (2019) in Port Harcourt Metropolis River State, which revealed ergonomic hazards of repetitive work and movement (88.4%), awkward body position (77.5%), persistent fatigue due to work activity (68.6%) and long working hours (51.0%), which showed that high percentage of these risk factors predispose sawmillers to increased risk of musculoskeletal disorders.

Findings on artisans at increased risk of occupation-related arterial (blood) pressure health challenges among welders and wood work artisans (table 4.1.27) revealed auto welders as the category at increased risk of commonly reported symptom of headache among welders. Among the wood artisans, wood carvers and carpenters were the categories at at increased risk of commonly reported symptom of headache.

Of the hypertensive welders, arc welders was the category at increased risk, while saw millers was the category at increased risk among hypertensive wood workers.

This blood pressure challenge may have resulted from stressful activities encountered in welding and wood work. Brain work needed to create intricate designs from metal and wood materials may have also led to blood pressure health challenges shown among them.

The null hypothesis seven (H_7), which stated that there was no artisan at increased risk of occupation-related health challenges among welders and wood work artisans in Imo State was therefore rejected, since different categories of artisans were found at increased risk of occupation-related health conditions assessed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Occupation health challenges among artisans is a public health issue, yet an under-exposed problem in Nigeria. There is an increased prevalence of musculoskeletal, skin, ocular, hearing, respiratory and blood pressure health problems among welders and wood work artisans in Imo State. These artisans encounter numerous work-related hazards including physical hazards of heat, noise, excessive lighting (radiation), vibration, wood particles, metal chips and fire; chemical hazards of metal fumes, organic fumes, wood dusts and smoke; biological hazards of insect bites; ergonomic hazards of repetitive work, fixed and awkward postures, and manual lifting of heavy objects; and psycho-social hazards of stress and fatigue for prolonged hours in their daily work activities. The air quality in their workplace environment is highly polluted. Awareness level towards occupation-related health challenges though slightly high among these artisans, yet their adherence towards safety and health protection practices, especially the use of personal protective equipment, medical check-up and safety training are abysmally low, thus making them at risk of occupation-related health challenges. Welders are at increased risk of arc eye and coarse palms, while wood workers are at increased risk of conjunctivitis and scaly palms. Most of both artisans have low mean expiratory flow rate (indicating declined lung function), hearing and musculoskeletal problems. Aged artisans with many years at work in Imo State have more occupation-related health challenges than the younger ones.

5.2 Recommendations

The study recommended the following:

i. Increased sensitization of artisans on the inherent work-related hazard exposures and resultant health challenges.

ii. Provision of functional occupational health and safety services which will involve proper safety training, education on workplace hazards, types and proper use of personal protective devices, for this economically viable group of workers in order to safeguard their health.

iii. Collaboration of Ministry of Labor and Productivity and Ministry of Health on the provision of occupational health care services and health care centers to cater for the health of artisans, as close as possible to where they live and work, in keeping with one of the principles of the primary health care program and Sustainable Development Goals 8 and 3 of decent work and economic growth, well-being promotion and good health to all.

iv. Sensitization of artisans who already have health issues for appropriate medicare/treatment, as well as occupational change for those with serious problems to prevent further aggravation of their health condition.

v. Incorporation of medical observations including pre-employment and periodic post medical check-ups among artisans. Since most of these workers are likely to remain asymptomatic till significant health challenges results, a regular medical check is therefore desirable.

vi. Environmental monitoring of artisans' work locations for maintenance of workplace air quality within World Health Organization permissible limit.

vii. Insistence on the use of appropriate personal protective equipment by artisans as well as formulation of policies and regulations towards adherence towards safety and health protection standards.

viii. Adequate and proper representation of various artisan unions to the appropriate tier of government, both at local, state and federal levels.

ix. Assessment of health conditions of other persons at same and/ or close locations to the selected artisans used in the study, since they are also exposed to same hazards. Also the study should be extended to other artisans who fall outside those selected in this study.

5.3 Contribution to Knowledge

Findings of this study has made immense contributions including:

i. Contributed in providing robust data for further researches in occupation-related health challenges of artisans.

ii. Contributed in identifying the health care needs and support system for artisans, which will eventually lead to provision of occupational health care services and intervention strategies by the government and other stakeholders of health.

iii. Contributed in updating the national health and safety databank, which hitherto has been scanty.

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APPENDICES

Appendix A

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF HEALTH TECHNOLOGY
DEPARTMENT OF PUBLIC HEALTH

Instrument for Data Collection (Questionnaire)

Dear Respondent,

I am a postgraduate student of Federal University of Technology, Owerri Imo State. I am undertaking a study on **"Occupation-Related Health Challenges of Welders and Wood Work Artisans in Imo State, Nigeria"** as part of the requirements for my programme.

In view of the above, you are kindly requested to truthfully respond to the questions below. Your response will be treated with utmost confidentiality and will be used only for the research purpose.

Your co-operation will be highly appreciated.

Yours faithfully,

….……

Agwah Eunice Ifeyinwa

OCCUPATION-RELATED HEATH CHALLENGES OF WELDERS AND WOOD WORK ARTISANS IN IMO STATE, NIGERIA

***Instruction*:** *please tick ☑ in the box that best represents your response to the following questions.*

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. What is your gender? (a) Male { } (b) Female { }

2. What is your age? (a) < 20 years { } (b) 20 – 29 years { } (c) 30 – 39 years { }

(d) 40 – 49 years { } (e) 40 – 49 years { } (f) 40 – 49 years { }

3. What is your Marital Status? (a) Married { } (b)Single { } (c) Seperated { }

(d) Divorced { } (e)Widowed { } (f) Others (Specify)……..

4. What is your Education level? (a) Primary { } (b) Secondary { } (c) Tertiary { }

(d) Non formal { }

5. What is your Religion? (a) Christianity { } (b) Muslim { } (c) Traditional { }

(d) Others (Specify) ……

SECTION B: OCCUPATIONAL INFORMATION

This section comprises of subsections A (occupational history), B (Occupational hazards exposure) & C (Awareness Towards Health Challenges)

A. Occupation History

1. What is your occupation?

(i) Wood work { }

In what section of wood work are you? (a) Saw milling { } (b) Wood carving { }

c) Carpentry/Furniture marking

(ii) Welding work { }

In what section of welding are you? (a) Automobile { } (b) Arc { }

(d) Others (specify)? …….

2. How long have you been in your occupation?

(a) < 2 years { } (b) 2 – 4 years { } (b) 5 – 7 years { } (c) 8 -10 years { } (d) Above 10 years { }

3. How long do you work daily?

(a) less than 2 hours { } (b) 2 - 4hours { } (c) 5 - 7 hours { } (d) 8 – 10 hours { } d)Above 10 hours { }

3. Do you work everyday of the week?

(a)Yes { } (b) No { }

If No, Specify…….

4. Do you work on shift

(a)Yes { } (b) No { }

5. What is your daily income?

a) < #1,000 { } (b) #2,000 - #3,000 { } (c) #4,000 – #5,000 { } (d) Above #5,000 { }

6. Does your daily income take care of daily needs?

(a) Very much { } (b) Somewhat { } c) Undecided { } d) Not Really { } e) Not at all { }

7. How do you feel about your work?

(a) Very happy □ (b) Happy □ c) Fairly happy □ d) Undecided □

e) Not happy □

8. Have you any of the following health problems before you started your present work?

(a) Eye problem { } (b) Respiratory problem { } (c) Musculoskeletal problem { }

(d) Skin problem { } (e) Hearing problem { } (f) Cardiovascular problem { }

(g) None { }

9. Do you smoke? (a) Yes { } (b) No { }

10. If yes, what brand of cigarette do you smoke? Specify ……..

11. For how long have you smoked?

(a) > 6 months { } (b) 7 months – 12 months { } (c) 13 months – 24 months { }

(d) 25 months – 36 months { } (e) Above 36 months { }

B. Occupational Hazard Encounter

1) Do you encounter any of the hazards listed below in your occupation?

Choose the best option by ticking ☑

Hazards	**Yes**	**No**
Physical		
a) Heat		
b) Noise		
c)Excessive light/Radiation		
d) Vibration		
e) Wood particles		
f) Metal chips/particles		
g) Fire		
Chemical		
h) Metal fumes		
i) Organic fumes		
j) Wood dust		
k) Smoke		
l) Explosives		
Ergonomic		
l) Repetitive work		
m) Fixed posture		
n) Awkward posture		
o) Manual lifting of heavy objects		
Biological		
p) Snake bite		
q) Insect/bee bite		
Psychological		
r) Stress		
s)Fatigue		

t) exhaustion		
u) unhappiness		

2. How often do you encounter these hazards at work?

(a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely { }

e) Never { }

C. Awareness Towards Health Challenges

- ❖ In this section, Multiple choices is allowed

1. Are you aware that as a worker that you are exposed to various health challenge(s) in your work place?

(a) Yes { } (b) No { }

2. If yes, what are the sources of your awareness of health (s) challenges?

(a) Reading books on work safety { } b) Television { } (c) Radio { } (d) Phone { }

(e) Social media { } (f) Experience from work { }

3. Are you aware that as a worker, you can develop health problems from constant exposure to these hazard(s)?

Hazards	Yes	No
a) Noise		
b) Heat		
c) Wood dust		
d) Wood particles		
e) Radiation		
f) vibration		
g) Metal fumes		
h) Organic fumes		
i) Metal particles		
j) Explosion		
k) Fire		
l) Smoke		
m) Electrical fault		
n) Repetitive work		

o) Fixed posture		
p) Awkward posture		
q) Manual lifting of heavy objects		
r) Snake bite		
s) Insect/bee bite		

4. Are you aware that hazard(s) can enter your body through the followings Routes?

Route	Yes	No
(a) Through the nose		
b) Through the skin		
c) Through the eyes		
d) Through the mouth		
e) Through the ear		

5. Are you aware that your health can be protected from hazard(s) by using the following personal protective equipment?

Route	Yes	No
a) Face mask		
b) Nose mask		
c) Ear muffs		
d) Boots		
e) Hand gloves		
f) Goggle		
g) Helmet		
h) Coverall clothing		

SECTION C: ADHERENCE TOWARDS SAFETY AND HEALTH PROTECTION PRACTICES

A. Safety and Health Practices

1. Have you had any medical - check since you started your present work?

(a)Yes { } (b) No { }

2. How often do you have medical - check since you started your present work?

(a) Monthly { } (b) Bimonthly { } (c) Quarterly { } (d) Yearly { }

(e) Not at all { }

3. Have you had any safety and health training on your occupation since you started work?

(a)Yes { } (b) No { }

(i) If yes, who trained you? (a) Government Organization { } (b) Non-Governmental Organization { } (c) Private Organization { }

(d) Others (Specify)…….

4. Do you use personal protective equipment (PPE) at work?

(a)Yes { } (b) No { }

5. Which of these personal protective equipment (PPE) do you use at work?

Choose the best option by ticking ☑

PPE	**Yes**	**No**
a) Goggles		
b) Ear Muffs		
c) Nose mask (Respirator)		
e) Face Shield		
f)Hand glooves		
g) Helmet		
h)Boots		
i) Coverall		

6. How often do you use the PPE at work?

(a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely □ { }

d) Never { }

B) Personal Hygiene & Sanitation Practices

1. Do you have separate accommodation apart from your workshop?

(a) Yes { } (b) No { }

2. Do you wash your hands before eating anything during/after work?

(a) Every time { } (b) Sometimes { } c) Once in a while □ { } d) Rarely { } e) Never { }

3. Do you bath after work?

(a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely □ { }

d) Never { }

4. Do you practice any of the following work habit(s)?

a) Sucking of fuel { } b) Washing hands with chemicals { } c) Treating of wounds with chemicals { }

5. Do you have toilet facilities in your workplace?

6. What type of toilet is available?

i. Water c loset ☐
ii. Flush pour ☐
iii. VIP latrine ☐
iv. Pit latrine ☐
v. Bucket toilet ☐
vi. None ☐

7. Are the toilets functional? Yes ☐ No ☐

8. Is the toilet cleaned regularly? Yes ☐ ☐

9. How often is the toilets cleaned with soap and disinfectants?

i. Twice daily
ii. Daily
iii. Weekly
iv. Don't know
v. None

10. Do you have facilities for hand washing? Yes ☐ No ☐

11. Do you have urinals? Yes ☐ ☐

12. Are there sources of water supply? Yes ☐ ☐

13. what are the sources of water supply? (Tick all that is applicable)

Tap water ☐ Well ☐ Tanks ☐ Borehole ☐ River/stream ☐

Others, Please specify…….……

14. How do you collect the refuse generated at your place of work?
    i. Standard container ☐
    ii. Any container ☐
    iii. Without container ☐
    iv. Wheelbarrows ☐
    Others (please specify)…….

15. How often do you remove your refuse?
    i. Daily ☐
    ii. Weekly ☐
    iii. Forth nightly ☐
    iv. Every three week ☐
    v. Monthly ☐
    vi. Quarterly ☐
    vii. Never ☐
    viii. Others (please specify)……

16. Are there adequate trash bins? Yes ☐ No ☐

17. What are the types of trash bins available?
    i. Closed standard ☐
    ii. Open standard ☐
    iii. None standard ☐
    iv. Others (please specify)…….

18. What method of refuse disposal is practiced in your work place?
    i. Open dumping ☐

ii. Incineration(burning) ☐

iii. Burying ☐

iv. Dumping into the river ☐

v. Dumping anywhere ☐

vi. Recycling (Use for biogas & animal feed) ☐

vii. Others (please specify)……..

SECTION D: WORK-RELATED HEALTH CHALLENGES

Instruction: In this section, Multiple choice is allowed

I. OCULAR HEALTH CHALLENGE

OCULAR (EYE) PROBLEM	Yes	No
1. What are the common eye problem(s) you are having now?		
a) Pain		
b) Itching		
c) Redness		
d) Tearing		
e) Gritty/sandy sensation		
f) Blurry vision		
g) Cloudy vision		
h) Sensitivity to light		
i) Discharges		
2. Were you having the problem(s) before your present work?		

3. How often do you have the problem(s)? (a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely { } d) Never { }

4. Do you stay - off work as a result of the problem(s)? (a) Yes { } (b) No { }

5. How long did you stay away from work due to the problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { } (d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 days { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { } (d) Above 10 days { }

6. How did you treat the problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Eye Examination……..

II. HEARING HEALTH CHALLENGE

HEARING (EAR) PROBLEM	Yes	No
1. What are the common ear problem(s) you are having now?		
a) Ringing sensation		
b) Humming sensation		
c) Heaviness of the ear		
d) Straining to hear others		
e) Tuning - up the volume of phone		

3. How often do you have problem(s)? (a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely { } d) Never { }

4. Do you stay - off work as a result of the problem(s)? (a) Yes { } (b) No { }

5. How long did you stay away from work due to the health problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { }

(d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 days { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 10 days { }

6. How did you treat the health problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Audiometry……

III. RESPIRATORY HEALTH CHALLENGE

RESPIRATORY PROBLEM	Yes	No
1. What are the common respiratory symptoms you are having now?		
a) Cough		
b) Phlegm production		
c) Wheezing		
d) Chest pain		
e) Tightness of chest		
f) Shortness of breath		
g) Fast breathing		
h) Sneezing		
2. Were you having the problem(s) before your present work?		

3. How often do you have the problem(s)? (a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely { } d) Never { }

4. Do you stay - off work as a result of the health problem(s)? (a) Yes { } (b) No { }

5. How long did you stay away from work due to the health problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { } (d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 days { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 10 days { }

6. How did you treat the health problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Spirometry……

IV. SKIN HEALTH CHALLENGE

SKIN PROBLEM	Yes	No
1. What are the common skin problems you are having now?		
a) Irritation		
b) Burning sensation		
c) Dryness		
d) Itching		
e) Redness		
f) Swelling		
g) Blisters		
h) Wheals		
i) Eruptions		
j) Dryness		
2. Were you having the problem(s) before your present work?		

3. How often do you have the problem(s)? (a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely { } d) Never { }

4. Do you stay - off work as a result of the health problem(s)? (a) Yes { } (b) No { }

5. How long did you stay away from work due to the health problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { } (d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 days { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 10 days { }

6. How did you treat the health problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Skin Examination……

V. MUSCULOSKELETAL HEALTH CHALLENGE

MUSCULOSKELETAL PROBLEM	Yes	No
1. What are the common musculoskeletal problems you are having now?		
a) Stiff joints		
b) Waist pain		
c) Low back pain		
d) Stiffness of muscles		
e) Sprain		
f) Numbness		
g) Difficulty in moving about		
h) Fatigue		
i) Burning sensation		
j) Redness & Swelling		
k) Tenderness		
2. Were you having the problem(s) before your present work?		

2. How often do you have the problem(s)? (a) Every time { } (b) Sometimes { }

c) Once in a while { } d) Rarely { } d) Never { }

4. Do you stay - off work as a result of the health problem(s)? (a) Yes { } (b) No { }

5. How long did you stay away from work due to the health problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { }

(d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 days { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 10 days { }

6. How did you treat the health problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Musculoskeletal Examination……..

VI. ARTERIAL PRESSURE HEALTH CHALLENGE

BLOOD PRESSURE PROBLEM	Yes	No
1. What are the common blood pressure problems you are having now?		
a) headache		
b) palpitation		
c) chest pain		
d) dizziness		
e) fainting		
f) shortness of breath		
g) nausea		

f) anxiety		
2. Were you having the problem(s) before your present work?		

3. How often do you have the problem(s)? (a) Every time { } (b) Sometimes { }

c) Once in a while { } d) Rarely { } d) Never { }

4. Do you stay - off work as a result of the health problem(s)? (a) Yes { } (b) No { }

5. How long did you stay away from work due to the health problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { } (d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 days { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 10 days { }

6. How did you treat the health problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Blood Pressure…… Pulse Rate……

VII. OTHER HEALTH CHALLENGE(S):

a) Crushing wound { } b) Fracture { } c) Electric shock { }

1. How often do you have above problem(s)? (a) Every time { } (b) Sometimes { } c) Once in a while { } d) Rarely { } d) Never { }

2. Do you stay - off work as a result of the problem(s)? (a) Yes { } (b) No { }

3. How long did you stay away from work due to the health problem(s)?

(i) In the last one month? (a) 1 - 2 days { } (b) 3 - 4days { } (c) 5 – 7 days { } (d) Above 7 days { }

(ii) In the last three month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 1 day { }

(iii) In the last six month? (a) 1 - 2 days { } (b) 3 - 4 days { } (c) 5 – 7 days { }

(d) Above 10 days { }

4. How did you treat the health problem(s)? (a) Clinic/hospital { } (b) Chemist { }

(c) Herbal/traditional { } d) None { }

Appendix B

Operational Definition of Terms

Occupation: Job activities engaged in by workers for gainful living or provision of needs.

Occupational Exposure: Condition of not creating barrier between workers and substances, materials and conditions prevailing in and around workplace which has tendency of causing negative health effects or challenges on workers.

Work Environment: Totality of prevailing conditions in and around workplace where work activities are performed which exert effects on heath of workers.

Artisans: Skilled craft-workers, servicemen, tradesmen and workmen who create objects and materials partly or entirely with hands making use of tools and machineries.

Welders: Craft-workers skilled in cutting and joining metals together or filling and repairing holes on metal constructions through the use of flame, electric arc or other sources of heat.

Arc Welders: Construction craft-men or tradesmen who employ fusion welding process, to create an arc which generates intense heat to melt and join metals, by the use of continuous supply of electricity.

Automobile Welders: Automobile, motor/car repairmen, servicemen or tradesmen skilled in the diagnosis, repair and maintenance of damaged vehicle bodies, making use of planishing and metalwork techniques, welding, use of putty fillers, and other skills. Often, they are referred to as panel beaters.

Wood Artisans: Craftsmen, workmen or tradesmen, skilled in making products from wood.

Saw-millers: Variously referred to as sawyers, lumber mill workers, wood machinists or wood processing workers, they are craft-workers, workmen or tradesmen in saw-milling section of mechanical wood industries, where wood are sawn, planed, curved and grooved with different machines.

Wood carvers: Skilled craftsmen who create intricate designs and sculptures from wood. They design wide range of items, including decorative sculptures, furniture, and even functional objects like utensils and bowls.

Carpenters: Skilled craftsmen who cut and join wood in order to construct, install, and repair various structures and objects. They also produce households and office furniture such as tables, chairs, cabinets, bookshelves, desks, counters, beds and many more. **Furniture makers:** Similar to carpenters are skilled craftsmen who specialize in creating/producing custom-made households and office furniture such as tables, chairs, cabinets, bookshelves, desks, counters, beds, upholstery and many more..

Occupational Health and Safety: Multi-disciplinary field concerned with workers welfare issues, safety or prevention of workers from disorders or deviations of health due to work activities.

Occupational Hazards: Substances, materials and conditions of workplace which have tendency of exposing workers to health risks and causing immediate or prolonged negative effects or challenges.

Occupational Injuries: Wounds or bodily damages sustained by workers in the course of their work activities.

Occupational Accidents: Unexpected and unplanned occurrences resulting from work activities.

Occupational illnesses: Disorders or deviations of health in workers resulting from exposure to substances, materials and conditions of work harmful to health.

Occupational Health Challenges: Deviations or disorders of normal body functions in workers due to exposure to hazards and risks of work activities.

Appendix C - Snapshots from Field Trip

Plate 1: An auto welder at work using eye google

Source: Field Trip at Avu Mechanic village, Owerri west (2023)

Plate 2 : An auto welder at work without personal protective wear

Source: Field Trip at Avu Mechanic village, Owerri west (2023)

Plate 3: Arc welders at work using sun glasses

Source: Field Trip at Egbu Road Welders Cluster, Owerri west (2023)

Plate 4: Dirty fingers and nails of an auto welder (poor personal Hygiene)

Source: Field Trip at Avu Mechanic Village, Owerri West (2023)

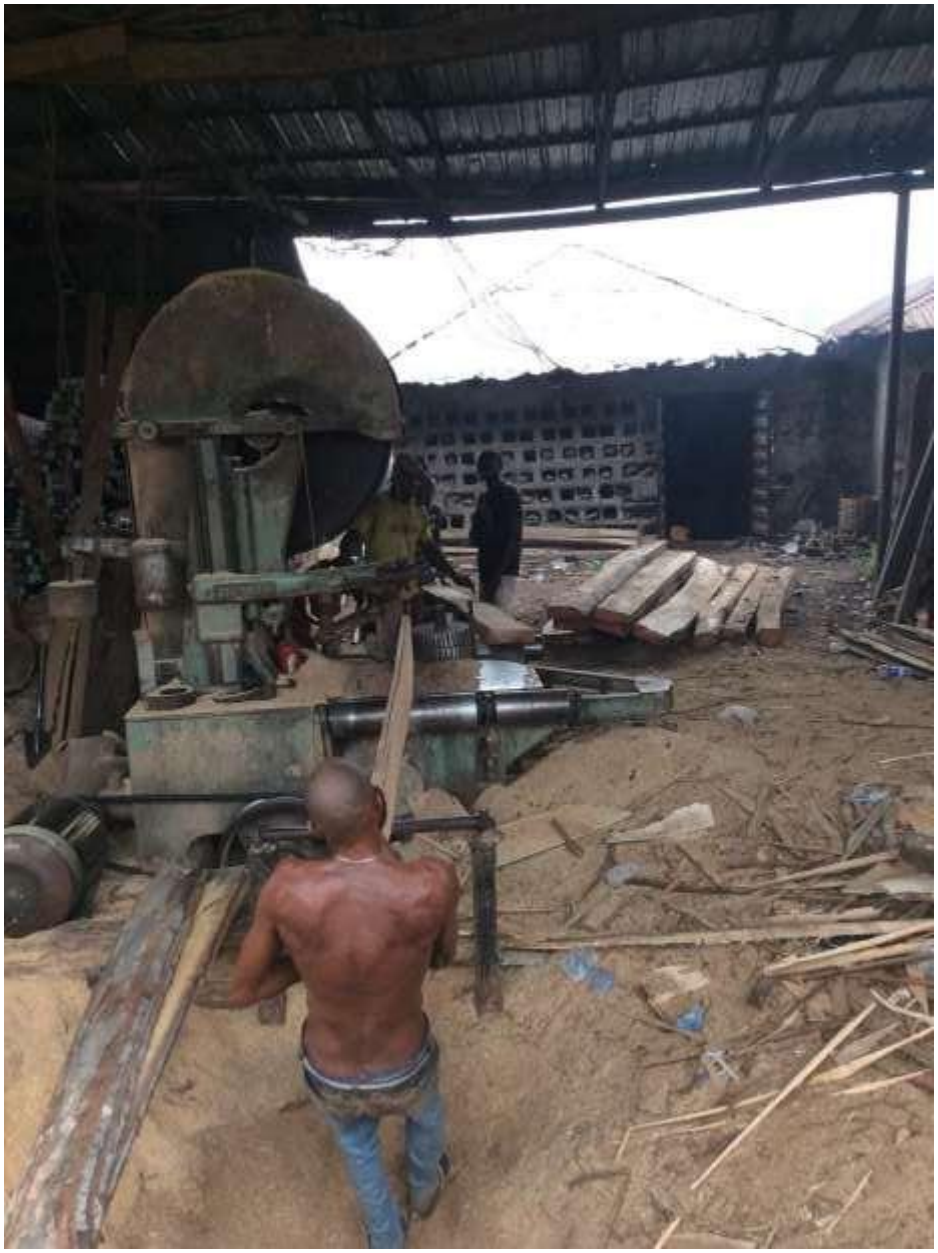

Plate 6: A circular sawmiller at work

Source: Field Trip at Ogbosisi, Naze, Owerri west (2023)

Plate 7: A wood carver at work

Source: Field Trip at Ogbosisi, Naze, Owerri West (2023)

Plate 8: A wood carver at work

Source: Field Trip at Ogbosisi, Naze, Owerri West (2023)

Plate 9: A carpenter at work

Source: Field Trip at Ogbosisi, Naze, Owerri West (2023)

Plate 10: Scaly palms of a wood worker at Ogbosisi, Naze Imo State

Source: Field Trip, 2023

Plate 11: A wood worker with cut & disfigured fingers (Back view)

Source: Field trip at Ogbosisi, Naze (2023)

Plate 12: A wood worker with cut & disfigured fingers (Front view)

Source: Field trip at Ogbosisi, Naze (2023)

Plate 13: Poor environmental sanitation at Ogbosisi, Naze,

Source: Field Trip at Ogbosisi, Naze, Owerri North (2023)

Indoor Air Quality Testing Standards:

The table below gives a gist of IAQ testing standards and the permissible limit for different indoor air pollutants and factors that affect indoor air quality.

Indoor Air Quality Parameters	Indoor Air Quality Standards			
	NBC 2016	ASHRAE	WHO	OSHA
CO	20 mg/m3	9 ppm (8 hours)	10 mg/m3	50 ppm (8 hours)
CO2	–	1000 ppm	–	5000 ppm
PM	60 µg/m3	–	–	–
PM 10	–		50 µg/m3	15 mg/m3
PM 2.5	–	–	25 µg/m3	5 mg/m3
SO2	80 µg/m3	–	20 µg/m3	5 ppm (8 hours)
NOX	20 µg/m3	–	–	–
NO2	–	–	40 µg/m3 (Annual)	5 ppm (8 hours)
HC	1800 µg/m3	–	–	–
Temperature	26±2 °C	22.8 to 26.1 °C	–	–
Humidity	40 % to 70 %	30 % to 65 %	–	–
Air velocity	1.2 m/s	–	–	–

Source: Indoor Pollutants. National Library of Medicine.

https://www.ncbi.nlm.nih.gov/books/NBK234057/

Appendix D - Consent Form

INFORM CONSENT FORM FOR THE RESPONDENTS

INTRODUCTION

I am a student in the Department of Public Health, School of Health Technology, Federal University of Technology Owerri, Imo State. I am conducting a study on **"Assessment of Health Status of Artisans in Imo State, Nigeria"**. Artisans are faced with great number of health challenges due to their exposures to hazardous work environment, precarious working conditions, practices and habits. I am interested in ascertaining work-related hazards, knowledge and level of awareness and attitude of artisans towards occupational hazards as well as resultant occupational health problems from these hazards among the three selected group of automobile welders, arc welders and wood workers. Findings from this study will be helpful in understanding the factors influencing the risk of health challenges among these artisans and ensure that appropriate measures and recommendations are made.

Your perception in the study is completely voluntary. It is your choice to participate or not and we will respect your decision; you will not be forced to participate if you decide to discontinue with the interview after it has started, you are free to do so. We will ensure your responses are confidential. That is, there will be no direct reference by name to any interview. However, the findings of the study can be used for future interventions. The study findings will be made public to researchers and others to learn from. I plead for your permission in this regard.

STATEMENT BY PARTICIPANT

The content and purpose of this study has been read to me and I have been assured of confidentiality of responses. I have had the opportunity to ask questions. I agree to participate voluntarily in this study and gave my consent to the publication of findings.

Signature/Thumb print of participant

Date……

STATEMENT BY THE RESEARCHER/PERSON TAKING CONSENT

I confirm that the respondent was given opportunity to ask questions, study the questionnaire and all the questions asked by him/her have been answered correctly to the best of my knowledge. I confirm that the individual has not been forced rather his/her consent has been given freely and voluntarily.

Name of Researcher/Field Assistant

….……

Signature ……. Date ……..