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The Subjective use of Noise Safety Practices as an Intervention Strategy for the Protection of Hearing Threshold Levels, of Workers Exposed to Occupational Noise in Woodwork Settings in the Fako Division, Cameroon

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ABSTRACT

Excessive noise is an occupational hazard with many adverse effects, that may impair worker's efficiency and lead to temporary or permanent hearing damage not only to the workers involved with noisy operations but also to those around them. This study sought to examine Intervention Strategies for the Prevention of Noise Induced Hearing Loss (NIHL) for workers in Woodwork Settings in the Fako Division, South West Region of Cameroon. The specific objective of the study sought to investigate the extent to which the practical use of noise safety practices protects the objective hearing threshold levels of woodworkers to prevent NIHL. The study employed a mixed method approach (sequential explanatory) where quantitative data was preceded by qualitative data. A quasi-experimental design was embedded into the rigorous explanatory mixed method design. A combination design which consisted of a Pre-test and Post Test Design with Non-Randomized Experimental and Control Groups was utilized. The sample of the study constituted (175) participants (160 wood workers and 15 administrators) drawn from50 woodwork processing settings in Limbe, Buea and Tiko Sub Divisions; through a Multistage sampling technique. Data were collected using questionnaire, observation checklist, interview guide and audiograms. The sample for the quasi experiment constituted (20) participants wood workers drawn from four woodwork processing settings in Buea Sub Division drawn through a Multistage sampling technique. The quantitative data derived for the study were analysed using Statistical Package for Social Science (SPSS version 23.0) with the aid of descriptive and inferential statistics. The descriptive statistical tools used were frequency count and percentages bar charts and Ling graphs. The Pearson (parametric test) was used in testing the hypotheses. The normality assumption of the data was tested using the Kolmogorov-Smirnovtest. The findings for Hypothesis one showed a significant and positive relationship between the use of noise safety practices and the protection of the hearing threshold levels of workers exposed to occupational noise in woodwork settings ($R= 0.780^{**}$, $P=0.000$, < 0.05). The positivity of this relationship is supported by a high explanatory power of 90.2% (Pseudo R-Square).The positivity of the relationship above reveal that when noise safety practices are adequately used at wood work settings, hearing threshold levels are significantly protected thus, the occurrence of NIHL loss is significantly prevented .The study thus recommends that effective measures be put in place to curb work related injury (hearing loss) rate by enhancing health and safety promotion programmes with emphasis on noise safety and training for newly recruited workers, respect for engineering and administrative control, provision of workers with suitable hearing protection devices, hearing health surveillance as well as rendering other accompanying noise safety Practices. The researcher finally proposed further research in same and related content area to get a deeper insight on this content and a lasting solution in occupations.

KEYWORDS: *noise safety practices, intervention strategy protection of the hearing threshold, workers exposed to occupational noise, woodwork settings*

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INTRODUCTION

This article investigates noise safety practices that can be used to ameliorate hearing loss caused by consistent exposure to occupational noise in workplace. The paper's concern is specifically noise induced-hearing loss created through working in an organization or institution that through its activities generates much noise. In this occupation context if the workers do not have protective aids or use protective strategies, it is anticipated that their hearing will be affected (Zieve 2010). Noise is one of the biggest pollutants in work-places and almost one of the most harmful agents Particularly (Concha-Barrientos, 2004). Noise presents health and social problems in industrial operations, and the source is related to the machineries used in the industries (Bugliarello et al., 1976).

Economic wood processing, which is one of the major activities in Africa with Cameroon inclusive, is not possible without employing the use of machines for sawing, cutting, chipping and milling of timber (Environmental Protection Authority [EPA, 2012]).Persistent exposure to noise is common in woodwork settings and may be detrimental to workers hearing health (Qutubuddin et al, 2013[10]). The environmental impacts of woodworking and wood processing operations, in the form of dust, noise and odours, have highly significant consequences worldwide and in Cameroon.(Oyeyemi et al., 2018;Tak, et al., 2009; Parsons, 2017; Ali, 2011; Ekerbicer 2008 & Eleftherou,2002).

Hearing loss from noise can be caused by exposure to constant loud sounds over a long period of time Alberti (1979). This type of hearing loss may be referred to as occupational noise induced hearing loss. Occupational hearing loss includes acoustic traumatic injury and noise-induced hearing loss (NIHL) and can be defined as a partial or complete hearing loss in one or both ears as a result of one's employment (Kryter (1994). Noise induced hearing loss is also called hearing loss from exposure to noise at work, occupational hearing loss, or professional deafness (Samelli, 2004). According to Emmett and Francis (2015), the inability of a person to hear can affect his holistic being that eventually makes him/her socially isolated.

Most previous research studies in Cameroon like that of Tambe (2017); Alemagi et al. (2006); Angwe (1987 have failed to handle issues on noise pollution especially in relation to hearing loss and disability, prevention strategies for hearing loss and the use of noise safety practices among industrial operators. Carrying out research studies related to occupational and environmental noise may be more reliable and relevant in relation to disability and hearing impairment if undertaken by special educators or the educational sector to ameliorate this condition in the educational and social world (Ehlert, 2017; Dale et al. 2013). As a result, the present study is an educational piece of work based on intervention strategies for occupational noise and the prevention of noise induced hearing loss in the Fako Division, South West Region of Cameroon.

Background to the Study

Humankind has developed over the years, techniques and technologies to assist with the gathering and production of resources, transportation, research, and fulfilling different needs of their everyday lives in order to survive (Blignaut & De Wit, 2013). These techniques and technologies according to Blignaut and his colleague are all used in different activities in the primary, secondary, or tertiary sectors. Even though these activities all provide different advantages, some of them also result in side effects‟, such as pollution.

Human effects on the environment are not processes that have only recently started to take place. There is evidence that older civilizations also had great negative effects on the environment (Harada & Glasby, 2000). Several centuries later in timeline, pollution was greatly accelerated by the Industrial Revolution. It started in Britain during the 17th century, and has spread to the rest of the world. Machinery was used in factories as a cheaper alternative to human labour, which led to mass production. This, in turn, led to the acceleration of the development of several environmental hazards (Eco-Issues, 2012). Today, economic growth and population have increased the potential for pollution, in additional ways. Pollution also increased due to the use of unclean fuels such as coal, and because of a poor understanding of the causes and consequences of pollution (Butterfield, 2013).

One type of pollution that is often overlooked and has been neglected over the years is noise pollution (The Watchung Environmental Commission, n.d.). Noise has been one of the most common workplace health hazards in heavy industrial and manufacturing environments (woodwork, transport and metalwork), as well as in farms, Libraries and cafeterias (Tambe 2017). One type of pollution that is often overlooked and has been neglected over the years is noise pollution (The Watching Environmental Commission, n.d.). Noise has been one of the most common workplace health hazards in heavy industrial and manufacturing environments (woodwork, transport and metalwork), as well as in farms, Libraries and cafeterias (Tambe 2017).

The importance of noise pollution should not be underestimated as it can degrade lives, by causing health problems, reducing social-wellbeing, and by causing negative psychological effects (Yuen, 2014). Among the physiological effects, most of the common issue is hearing loss. Permanent hearing loss remains a main and major health concern alongside annoyance, stress and interference with speech communication in noisy offices, industries, schools, workshops and computer rooms (Attarchi, 2010;Fada, 2017).

Hearing is one of our most versatile senses, which means it is extremely important to take care of the ears and all the parts that make up the hearing mechanism (Bellmam & Symfon, 2010). The human ear and lower auditory system continuously receive stimuli from the world around (World Health Organization document on the Guidelines for Community Noise,1999). Kryter (1994) stated that chronic exposure to loud noises along with other factors may contribute to hearing loss over time which may impair an individual's ability to benefit from the versatile nature of the sense of hearing. The above condition is known as noise-induced hearing loss (Meinke & Stephenson, 2007).

It is well established and documented that hearing loss is the most common problem associated with exposure to noise and noise pollution. Towards the end of the 1960s Passchier-Vermeer reported that increasing noise levels caused hearing damage in workers after analysing quantitative data from 4,600 workers (Passchier-Vermeer,1986). It is estimated that there are currently around 466 million people with disabling hearing loss globally in 2020. With the rise and ageing of the global population, the number of people with hearing loss is growing at a rapid pace (World Health

Organization [WHO 2004]). These WHO projections here suggest that unless action is taken, there will be 630 million people living with disabling hearing loss by the year 2030, with that number expected to grow to over 900 million by 2050.

Ramazzini first described the relationship between loud workplace noises and hearing impairment in 1713, by describing the relationship between the hammering of metal to hearing impairment and deafness in coppersmiths (Wright, 1940). The beginning of the industrial revolution in the U.S. and in Europe marked the departure from an agricultural-based to an industrial-based labour force. As a result, workers became increasingly exposed to hazardous noise. Several early studies had also been carried out

Explicitly, Wood workers are not an exception from being victims of various occupational diseases. Through observations in audiology practice during practicum in the university of Buea, most clients of severe to profound hearing loss (80 %) in Cameroon today happen to be more of retired and elderly persons; mainly wood workers who had spent a greater part of their occupational lives in settings exposed to loud noise than suggesting that loud noise exposure may pose severe threats on the outcome of workers hearing ability and levels. (Researcher's Audiogram reports, 2018). This therefore

As the impact of human activities and issues of environmental health have become increasingly global in scale and extent, the need to recognize and to address the health risks associated with environmental pollution becomes even more urgent (Adeniji, 1975).). The cost in action arising from these environmental challenges will be too high to be neglected in the future. Addressing these challenges today for a pollution free future should therefore be a priority (Ratnasingam et al. 2016:1195).

Economic wood processing, which stands as one of the major activities in Africa with Cameroon inclusive, is not possible without employing the use of machines for sawing, cutting, chipping and milling of timber (Environmental Protection Authority [EPA, 2012]).

The effect of noise on workers could be injurious if allowable exposure level is exceeded. Noise presents health and social problems in industrial operations, and the source is related to the machine used in the industries (Oyeyemi et al., 2018).The main sources of noise associated with the sawmill operation include: transportation, unloading and loading of logs; Chain saw use for off-cuts, and damaged or out of specification timber; Milling and plaining operations (including headrig, edger, resaw and planer); wood by product chipper; desticking, stacking, and loading for dispatch of boards; Fans in the re-conditioner (tonal noise); Heat plant (boiler forced air and induced draft fans); Chipping; Reversing alarms on vehicles; and Kiln associated noises such as fans (Southwood Resources, 2016; D'Angelo et al., 1985 & Owoyemi et al.,2017).

Economic wood processing involves employing the use of machines for sawing, cutting, chipping and milling of timber (Bugliarello et al., 1976). All these above-mentioned activities produce a lot of noise (Samir et al., 2013). Noises are generated by operational activities of a diversity of machine tools and equipment. Noise nuisance from wood processing is generated from circular saws, planers, routers and other equipment (Owoyemi et al., 2017). Machinery It has been found that exposure to continuous noise of more than 85 to 90 dB, particularly over a life time in industrial settings, can lead to hearing impairment and ultimately noise-induced Hearing Loss (Hu, Hangauer, & Henderson 2005).

Verbeek et al. (2009). defines noise-induced Hearing Loss (NIHL) as hearing loss caused by prolonged exposure to noise. Noise induced hearing loss is referred to as a functional limitation of the hearing organ (the ear) to perceive sounds normally due to exposure to noise for a period of time in an individual's work place. In other words, it is a reduction of one's hearing capability as a result of loud noise exposure in an individual's workplace, over a period of time. This condition may be permanent or temporal. Degeneration of the hair cells of the cochlea and damage to the auditory nerve result in either temporary or permanent noise-induced threshold shifts (NITS) (Temporary noise induced hearing loss occurs when a person is subjected to a sudden, extremely loud noise (WHO,2001). The symptoms can include muffled hearing, dizziness, and pain in the ear. On the other hand, Long-term noise induced hearing loss happens when a person has been exposed to continuous loud noises over a long period of time. Often long-term NIHL usually occurs in a noisy workplace environment.

A 2016 National Academies of Sciences report "Hearing Health Care for Adults: Priorities for Improving Access and Affordability" included a call to action for government agencies to strengthen efforts to collect, analyze, and disseminate population-based data on hearing loss in adults (Carroll et al. 2017).As a result, the above mentioned authors (Carroll, Eichwald, Scinicariello, Hoffman, Deitchman, Radke, Themann & Breysse, carried out a research on. noise-Induced Hearing Loss among adults in the United States. Following the study's method, CDC analyzed the most recent available data collected both by questionnaire and audiometric tests of adult participants aged 20–69 years in the 2011–2012 National Health and Nutrition Examination Survey (NHANES) to determine the presence of audiometric notches indicative of noise-induced hearing loss. Prevalence of both unilateral and bilateral audiometric notches and their association with socio demographics and self-reported exposure to loud noise were calculated.Results revealed that nearly one in four adults (24%) had audiometric notches, suggesting a high prevalence of noise-induced hearing loss. The prevalence of notches was higher among males. Almost one in four U.S. adults who reported excellent or good hearing had audiometric notches (5.5% bilateral and 18.0% unilateral). Among participants who reported exposure to loud noise at work, almost one third had a notch. Conclusions and Implications for Public Health Practice were that Noise-induced hearing loss is a significant, often unrecognized health problem among U.S. adults. Discussions between patients and personal health care providers about hearing loss symptoms, tests, and ways to protect hearing might help with early diagnosis of hearing loss and provide opportunities to prevent harmful noise exposures. Avoiding prolonged exposure to loud environments and using personal hearing protection devices can prevent noise-induced hearing loss.

High levels of noise are a disturbance to the human environment (WHO, 1999). Noise in industries is an occupational hazard because of its attendant effects on workers' health (WHO, 2015). Safety practices to reduce noise include the adequate use of engineering and administrative controls, having a system of staff consultation respecting legal noise limit, reducing noise levels, using hearing protection devices and carrying out regular hearing checks and audiometric testing.

Engineering controls form the primary preventive action because they reduce or eliminate noise at source most effectively, affecting everyone in the work environment (Suter, 2012). Engineering controls are defined as: "Methods that reduce noise exposure by decreasing the amount of noise reaching the employee through engineering design approaches. Engineering controls isolate the noise from the worker through noise reduction" (NIOSH, 1996a). With respect to legal noise limits: administrators and workers should take specific action if noise exposure is at or above the lower exposure action values of daily or weekly exposure of 80 dB (32 exposure points) peak sound pressure of 135 dB. Additional controls will be needed if staff is exposed at the upper exposure action values of daily or weekly exposure of 85 dB (100 exposure points) peak sound pressure of 137dB. Administrators should consider the use of alternative equipment or safe systems of work including shock absorber, well maintained equipment. Sound barriers, absorbers or reflectors, designing work areas to separate noisy machines, silencers and vibration dampers to machines and tools, limiting the amount of time employees need to spend in noisy areas each day are all safe workplace practices to combat noise damage.

Moreover, it is equally essential to make sure that people spend time working in quiet areas too (Suter, 2002). This strategy is known as administrative control. Administrative controls are defined as methods that reduce exposure by limiting the time a worker is exposed to noise through administrative approaches. It isolates the worker from the noise by reducing exposure" (NIOSH, 1996a). Administrative control refers to the process of changing work practices, management policies or worker behaviour (NIOSH, 2004). It is the way work is organised to reduce either the number of workers who are exposed or the length of time they are exposed to noise. Administrative controls simply focus on the reduction of noise exposure by limiting the time a worker spends in noisy environments. This may involve the rotation of workers out of noisy jobs to areas and tasks producing safer levels of noise. Also, trying to run noisy equipment early or late in the day when fewer people will be exposed is essential. However, these administrative controls may not be practical as they could interfere with work processes and productivity (Suter, 2002).

Providing Hearing Protection (Reddy,2014) is a necessary safety practice against noise dangers and pollution. However, hearing protection in noisy environments should normally only be considered as a temporary measure. Administrators and workers should work to reduce noise levels to below exposure action values. While working to reduce noise levels, it is good practice to provide suitable hearing protection to staff exposed above 80db(A).Where noise exposure exceeds 85 dB (A), hearing protection must be provided to everyone exposed and make sure it is used. It is essential to make sure that hearing protection is properly maintained identify zones with signs to show where hearing protection must be worn, introduce a health surveillance program for hearing assessments if required, provide information, instruction and training on how to use, take care of and reorder hearing protection. Hearing protection comes in two main types; those that cover the ear and those that are inserted in the ear. Hearing protection often needs to be worn with other protective equipment such as glasses or hard hats.

Importantly, having a system of staff consultation (hearing health surveillance)is an essential factor is an essential safety practice for avoiding hearing loss. Organisations should have a system of staff consultation. Staff should be able to raise concerns about noise levels and other health and safety issues in the workplace (HSE, 2005). Workers may need more than one control measure if noise comes from a variety of sources in the workplace. Workers should try to reduce noise levels to the lowest practicable level. Carrying out hearing checks and audiometric testing according to Centre for disease control may be another protective factor to be considered in a noisy occupational environment. Hearing checks must be provided when employees are exposed regularly to high noise levels at increased risk of hearing loss, perhaps from a pre-existing medical condition. It is good practice to carry out hearing checks for new employees working in noisy workplaces. This will allow you to gather base line health and hearing information. This will help identify potential risk of hearing loss throughout the employees working life control (Carroll et al. 2011–2012).

The WHO's Healthy Workplace Framework and Model developed by Joan Burton in 2010 provides some practical guidance to occupational health and/or safety professionals, scientists, and medical practitioners to provide the scientific basis for a healthy workplace framework. It suggests a flexible, evidence-based framework for healthy workplaces that can be applied by employers in collaboration with workers regardless of the sector or size of the enterprise, the level of development, regulatory or cultural background of the country (Burton, 2010:1).

The World Health Organization Workplace Model is a comprehensive framework for creating a healthy workplace program that can be used by any workplace, of any size. The model emphasizes leadership support, worker involvement and the integration of healthy workplace initiatives in the organizations business strategy as critical to the success of healthy workplace programs and initiatives. The WHO model emphasizes leadership support, worker involvement and the integration of healthy workplace initiatives in the organizations business strategy as critical to the success of healthy workplace programs and initiatives.

In the South West Region of Cameroon, the magnitude of noise released from many occupational settings may be estimated to be far above normal bearable noise level (75 decibels) (Tambe, 2017). As a matter of fact, these high noise levels may be problematic and may induce hearing loss in individuals (Mirza, et al., 2018).). This has to be avoided because, at this level, short or long-term effects that can cause damage to the tympanic membrane (the ear drum) is likely to occur. Noise that must be avoided is heard regularly in saw mills, carpentry workshops, bars, churches and many other settings (Adeneji, 1975). This may increase the likelihood of the occurrence of hearing loss and needs to be checked. In the midst of the above circumstances, little is known about intervention strategies that organizations put in place to control health related disabilities that may arise from these loud noises in work places as well as their effectiveness. Many woodworkers in such noisy conditions may be at risk of exposure to NIHL which demands the effective use of interventions to combat this situation to safe the hearing capabilities of this vulnerable population.

Conceptual Diagram

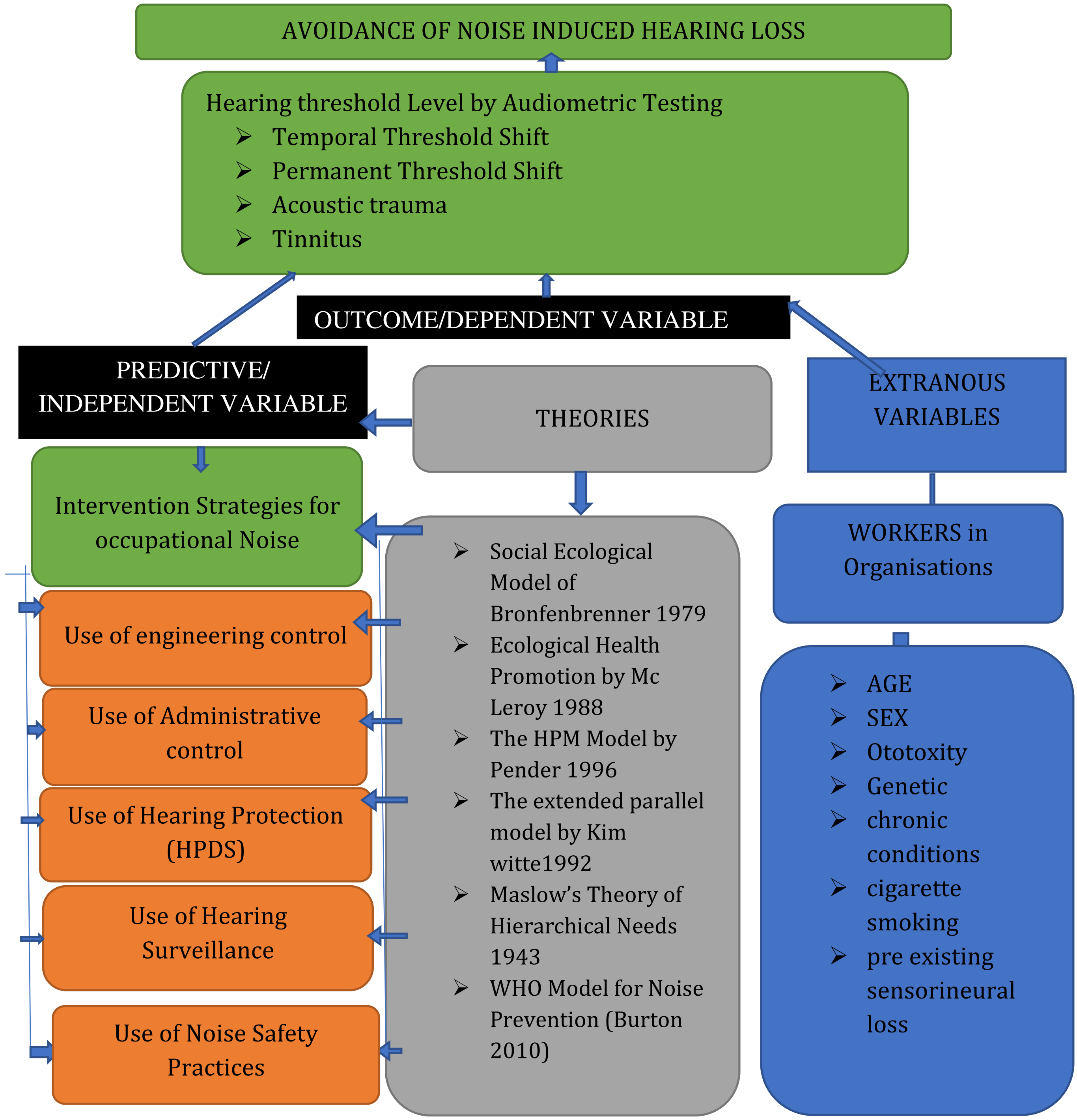

Figure 1: The Conceptual Framework Depicting the Interconnectedness between Intervention Strategies for Occupational Noise and The Avoidance of Noise Induced Hearing Loss.

Statement of the Problem

In Cameroon, the woodwork industrial sector has made great strides in socio-economic contributions (Tambe 2017). Despite the socio-economic importance of the industrial sector to Cameroon's national economy, noise emanating from industrial activities along the South West Region of Cameroon seems to have inflicted a wide range of complications to safety, health and environmental quality standpoint of workers. Following the researcher's visits to some carpentry workshops in the Fako Division in the South West Region of Cameroon, it was observed that most woodworkers were regularly and extremely close to noise sources. Nevertheless, little is known about intervention strategies and noise safety practices that organizations put in place as well as the effectiveness of these practices to prevent health related disabilities that may arise from these loud noises as workers carry out continuous and daily routines in work places. Engineering controls used by the wood workers to reduce or eliminate noise at source, affecting everyone in the work environment as well as its effectiveness in reducing the risks of acquiring noise induced hearing loss were not evident. Also, from observation workers, seem to spend much time in these noisy settings. A pertinent question to ask here is, do industries use administrative controls which focus on the reduction of noise exposure by limiting the time a worker spends in noisy environments? Most often these administrative controls may not be considered practical in workplaces as they interfere with work processes and productivity.

Moreover, in some work places with extreme loud sounds, woodworkers are often seen without visible hearing protectors. This suggests that health safety precautions may be lacking in many job settings or workers simply neglect them.. In all of these, there is a perceived lack of audiological measurements essential for organizations to determine and overcome the outcomes of these risky conditions in occupational settings. The absence or inadequate use of noise safety practices for the prevention of Hearing loss for workers in woodwork settings may lead to severe hearing loss which may result to far reaching consequences affecting worker's holistic well-being (physical, psychological, physiological, cognitive, social work performance). This may range from poor quality of life, hearing effect, irritability and stress, reduction of productivity, increased blood pressure, low educational attainment and even after controlling for education and other relevant demographic factors, the condition may independently be associated with economic hardship; including low income, unemployment and underemployment (Emmett & Francis, 2015). It is against this backdrop that a research was proposed on the use of noise safety practices for the protection of noise induced hearing loss in woodwork industrial settings in the Fako Division, South West Region of Cameroon.

Scope of the Study

Geographically, this study is limited to occupational settings in the Fako Division of the South West Region of Cameroon. The study will be limited to workers in woodwork settings in some three subdivisions in the Fako Division (Buea, Limbe and Tiko). Fifty (50) workshops located in these above stated areas were employed for the study (10 from each Town).Content wise, the this study is limited to the effect of noise safety practices on wood workers hearing threshold in occupational settings in Fako Division, South West Region of Cameroon was measured.

Methodologically, the research design that was envisaged for this study was limited to a mixed method design. The type of mixed method design was a sequential explanatory mixed method design which embodied initially the quantitative and later, the qualitative data. A mechanical device (digital sound measurement meter and a checklist were primarily used to measure environmental noise. A multistage sampling technique was used to recruit a sample of one hundred and seventy-five (175) wood workers; including proprietors who were used as main population for the study. A study was carried out on the sample to assess the effect of intervention strategies on hearing in the woodwork settings. The study was intended to determine through questionnaires, interview, observational checklists and quasi-experiment, the extent to which intervention practices prevent the occurrence of noise induced hearing loss. One Hundred and fifty (150) participants, were requested to respond to a twenty-six (26) item researcher made questionnaire while fifteen woodwork proprietors were entitled to respond to an interview of noise prevention strategies. For Observation, thirty (30) out of the fifty (50) woodwork industries from three subdivisions (Buea, Limbe and Tiko) were purposefully selected, observed and scrutinized.

An experimental design was adopted and embedded into the explanatory mixed method design and this design was specifically the quasi-experimental design to provide results on this objective of the study. The type of quasi-experimental design that was used was a combination design (the Pre-test and Post Test Design with Non-Randomized Experimental and Control Groups). A pure-tone audiometer was used for pre and post testing to determine hearing levels of the workers and the results recorded on an audiogram. Comparison groups were used in this study as the baseline to determine the effect of intervention strategies for occupational noise for the prevention of noise induced hearing loss.

Most importantly, the Ecological Systems Theory by (Urie Bronfenbrenner, 1979), the Ecological Model for Health Promotion (McLeroy1988) the Extended Parallel Process Model (EPPM),Maslow's hierarchy of proponent needs (1943) and the The World Health Organization (WHO) Workplace Model Joan Burton in 2010 will be applied as theoretical framework for this study.

Research Objectives

To assess the capacity to which the subjective use of noise safety practices protects the hearing threshold levels, of workers exposed to occupational noise in woodwork settings in the Fako Division.

Specific Research Questions

To what capacity does the subjective use of noise safety practices protect the objective hearing threshold levels, of workers exposed to occupational noise in woodwork settings in Fako Division?

Research Hypotheses

Ho: The subjective use of noise safety Practices does not significantly protect the hearing threshold levels, of workers exposed to occupational noise in woodwork settings in the Fako Division.

Ha: The subjective use of noise safety Practices significantly protects the hearing threshold levels, of workers exposed to occupational noise in woodwork settings in the Fako Division.

RESEARCH METHOD

Research Design

The study adopted a quasi-experimental study as participants were assigned to the experimental (intervention) or control groups based on their availability to attend the intervention. The study adopted a combination design. Combination design which combines elements of both the nonequivalent groups design or the pretest-posttest design. Here, there is a treatment group that is given a pretest, receives a treatment, and then is given a posttest. At the same time there is a control group that is given a pretest, does not receive the treatment, and then is given a posttest. The question, then, is not simply whether participants who receive the treatment improve but whether they improve more than participants who do not receive the treatment (Price et al.,2015; Two (2) groups comparison study with non-randomised assignment were used due to the limited number of venues participating in the intervention. All of the venues were located in different areas and had no relationships to the other participating venue. If the treatment and control group consisted of employees from the same venue there could be a contamination of the control group i.e. the control group may have been influenced by their co-workers engaged in noise control training (Price et al., 2015). For efficiency, the participants were assigned into experimental (intervention) or control groups. Only the experimental group was subjected to the intervention exercise. For pretesting and post testing, a pure-tone audiometer was used to determine hearing levels of workers before and after the study. The Pretest was carried out two months (8 weeks) after the posttest and six (6) weeks after the intervention to be able to measure the effect of change.

Area of the Study

This study was undertaken in Fako Division, which is made up of six (6) Sub-Divisions (Muyuka, Tiko, Limbe, Idenau and Buea). Specifically, the study was carried out in two (2) out of the six Sub Divisions (Buea andLimbe,). Fako division was chosen for this study because it is located in the coastal timber-producing area of Cameroon. It is one of six divisions that make up the South West Region of Cameroon and consists of six administrative units: Buea, Limbe, Tiko, Muyuka and Idenau. The largest concentration of woodshops reported by (Ayuk 2017) was in Muyuka, Buea and Tiko due to its dense human population, the availability of timber as well as the current high demand for wood products in the booming building construction industry. This has led to a high concentration of woodworking activities in the Fako division; undertaken by small scale and informal enterprises predominantly owned by private sector individuals. These enterprises consist of fewer than 25 workers with owners often workers themselves and providing entry to the world of woodwork for young people and redundant workers. Moreover, another reason for the choice of the study area was that the biophysical environment of divisions in Fako has been greatly tempered with and exploited for habitation, settlement and agriculture due to its rich volcanic soils, increasing population, and demands for housing and furniture materials through Cutting down of tress (The Buea Community development plan, 2012).

Population of the Study

The population of this study constituted all workers in some woodwork establishments in the FakoDivision of the South West Region of Cameroon. Statistically; according to report from Ayuk (2017), the number of workers in woodwork related industries in the south west region from July 4th to 30th, 2016 was estimated at two hundred and twenty-three (223) workers working in 88 small-scale and informal wood processing industries in Tiko, Mutengene, Buea, Ekona, and Muyuka areas. Recently, with respect to wood work industries, and from the statistics of the last Census gotten from the Divisional Delegation of Forestry in Limbe, the number of wood processing units as well as wood workers has tremendously increased. A total of ninety-six (96) wood processing units exist~~s~~ in the fako Division; excluding Muyuka. Statistics reveal that thirty-two (32) of these wood processing units are in existence in Buea, while Limbe, has a total of forty-six 46 of the units. A total of 15 wood processing units exists in Tiko and three (3) in Idenau). However, some defined statistics presently remains unclear on the proportion of wood processing units and its defined population in the Fako division because records of these wood working processing units from Muyuka were unavailable due to the severity of the socio-political unrest and political instability intensified in some areas in some regions in Cameroon. Though this statistic may not be true for all, the Divisional Delegation of Forestry in Limbe further revealed that approximately five industrial workers with proprietors inclusive, are present in each of the wood processing units. Going by this calculation, the total population of wood workers in the Fako Division stands at approximately five hundred and twelve (512). Buea is reported to have one hundred and sixty workers (160) and (32) administrators; giving a sum total of one hundred and ninety-two (192). The total population of wood workers in Limbe is one hundred and (184) workers and (46) administrators; giving a sum total of 230. Finally, the total population of wood workers in w0033Tiko is 60 and administrators fifteen (15); giving a sum total of seventy-five (75) while that of Idenau is twelve (12) for workers and three for administrators; giving a total of fifteen woodworkers.

Table 1: Statistics of Woodwork Processing Units and Population from 2019 Recent Census by Divisional Delegation of Forestry for the South West Region, 2019

Divisions in FAKO	Towns	Number of Wood processing units	Number of workers	Number of Administrators	Total
Buea Sub Division	Buea	32	160	32	192
Limbe Sub Division	Limbe	46	184	46	230
Tiko Sub Division	Tiko	15	60	15	75
Idenau Sub Division	Idenau	3	12	3	15
Muyuka Sub Division	Muyuka	Unknown	0	0	0
Total		96	416	96	512

Target and Accessible Population

The target and accessible population of the study included workers and workshop owners in woodwork industrial workshops in the three purposefully selected subdivisions (Buea, Limbe and Tiko), all in Fako Division. This study's target population particularly involved four hundred and four (404) workers and ninety-three (93) administrators from ninety-three (93) wood processing units in the Fako Division. The total target population of the study was four hundred and ninety-seven (497) wood operators. The accessible population of the study comprised of 175 participants. Seventy five were obtained (75) from Buea, sixty (65) from Limbe and thirty (35) from Tiko sub Divisions.

Table 2: Showing Target and Accessible Population

POPULATION		TARGET POPULATION			ACCESSIBLE POPULATION		
Workers and proprietors in Fako		Number of workers	Number of Proprietors	FQ	Workers	Proprietors	FQ
Towns	No of Wood Processing units						
Buea	32	160	32	192	60	5	75
Limbe	46	184	46	276	70	5	65
Tiko	15	60	15	90	30	5	35
Idenau	3						
Muyuka	Unknown						
Total	96	404	93	497	160	15	175

Sample Population

The sampling for this study was done at three levels. A sample of one hundred and seventy-five (175) wood workers including some selected employers, obtained from woodwork occupational settings in the Fako Division was recruited for the study. Out of the one hundred and seventy-five (175) participants mentioned above, one hundred and sixty (160) workers; excluding proprietors were requested to fill a researcher, self-constructed questionnaire for the study to answer the research question.

Table 3: Sample Distribution for (Main Study)

Sub Divisions	Towns	No of wood processing units	Total number of units for each Sub Division	No of wood workers	Number of wood proprietors	Total number of Participants
Buea	Molyko	7	18	35		
	Great soppo	4		15		
	Bonduma	4		6		
	Small soppo	3		4	5	65
Limbe	Church Street	6	22	20		
	Cassava Farm	6		20		
	New Town	10		30	5	75
Tiko	Mutengene	4	20	10		
	Ombe	6		20		
					5	35
Total		50		160	15	175

From table three (3), a total number of one hundred and sixty (160) wood workers were obtained from three Sub Divisions in the Fako Division for survey. All one hundred and sixty (160) participants were obtained from woodwork occupational grounds such as saw mills carpentry workshops, plaining mills (all of which were woodwork industries). Opinions of one hundred and sixty (160) woodwork workers of the selected industries in these towns were sampled using Questionnaires. Eighteen (18) woodwork industries with 60 workers were recruited from Buea (7 from Molyko 4 from Great soppo, 4 from Bonduma and 3 from Small soppo. Furthermore, twenty-two 22 woodwork industries with 70 workers were employed from 3 Towns in Limbe (20 workers from Church Street, 20 from Cassava Farm and 30 from New Town. Lastly, the opinion of thirty (30) workers from ten (10) woodwork industries was sampled from Tiko (4 from Mutengene and 6 from Ombe. Summarily, the sum total of all participant workshop workers as outlined above was 160 from the large sample of one hundred and seventy-five (175) participants.

Similarly, and for data consistency, a sample of wood workshops were observed to find out if workers used prevention strategies and measures to combat the occurrence of noise induced hearing loss. The observation was specifically used to appraise the practice of noise prevention in woodwork industries and in order to confirm if the workers under the perceived preceding high noise exposure are actually using intervention or control strategies during their work sessions to prevent and control the occurrence of hearing loss as per their possible questionnaire responses. A total of Thirty (30) out of fifty (50) woodwork industries were observed in three towns in Fako. These areas include Buea, Limbe and Tiko. An unequal proportion of workshops were specifically withdrawn from the three Sub Divisions in the Fako Division (Buea, Limbe and Tiko) for the observation exercise. The inequality was purposeful because of the inequality that existed in the distribution of the number of wood processing industries in the area. Specifically, ten (10) woodwork shops were observed in Buea, fifteen (15) in Limbe and five (5) in Tiko. This amounted to a total of 30 workshops observed.

Table 4: Tabular Distribution of Sample for Observation

Sub Divisions	Towns	Number of wood processing units	Total number of units	Total of wood work units observed
Buea	Molyko	7	18	10
	Great soppo	4		
	Bonduma	4		
	Small soppo	3		
Limbe	Church Street	6	22	15
	Cassava Farm	6		
	New Town	10		
Tiko	Mutengene	4	10	5
	Ombe	6		
Total		50	50	30

Purposefully, a sub sample of twenty (20) workers was withdrawn out of the 175 participants from two giant wood workshops for a quasi-experimental study in Buea. These workers were selected from Four (4) woodwork industrial settings the researcher primarily titled industries (A, B, C and D) in the Buea Municipality. The selected industrial participants were obtained from Molyko and Great soppo. Two industries from Great Soppo out of the four selected ones with 5 workers each were merged into one by the researcher and named industry (AB) and the other two industries were similarly merged into industry (CD). Ten (10) workers each were used from industry (AB) and (10) from woodwork industry (CD), giving a sum total of (20 participants). These workers purposely were divided into an experimental and control group for pre and post testing. An equal number of 10 participants from each group formed both the experimental and control group with industry (AB) being the experimental and (CD) being the control group.

Table 5: **Sample Distribution of participants for Experimental Procedure**

Groups for Quasi Experiment	Single Industries	Frequency	Combined Industries	Frequency
EXPERIMENTAL GROUP	Industry A	5	Industry AB	10
	Industry B	5		
CONTROLGROUP	Industry C	5	Industry CD	10
	Industry D	5		
Total		20		20

Exclusion criteria for the Quasi experimental procedure

A total of one hundred and fifty-five (155) participant workers and administrators from the large sample were excluded from the quasi experimental study. Only the machinists operating plaining machines and other noisy machines were included. Also, the researcher desired to use only the machinists who spent longer periods in operating plaining machines and other noisy ones that produce continuous and loud noise. Their activity in the workshop may render them more vulnerable to noise health hazards; rendering them credible for the experimental procedure for better results. Based on the above criteria, those who did not belong to this category were excluded. Also, the towns of Tiko and Limbe were excluded because Buea had quite a reasonable number of wood processing manufacturing industries and the researcher found the proximity of the workshops closer and convenient to monitor workers to fortify the intervention and control exercise. Furthermore, the purposive sampling and recruitment of these sub-group of twenty (20) participants was preferred because of the existence of other instruments that were also meant for measuring same other objective and due to time constraint and complexity involved in carrying out effective audiometric testing for 150 participants. Reducing the number of participants could enhance efficiency of the testing procedure. Moreover, the experimental paradigm study excluded workers with a personal or family history of congenital deafness, ear surgery, prolonged exposure to ototoxic `agents (e.g., anti-tuberculosis agents, salicylates, aminoglycoside antibiotics, carbon monoxide, lead, and benzene), a history of hypertension for more than 5 years with poor control or blood pressure values higher than 140/90 mgHg at the time of the assessment. Subjects with a history of poorly controlled diabetes mellitus for more than 5 years, alcoholism, moderate or severe head trauma, mumps and measles, and typhoid fever were also excluded.

A sample of 15 Proprietors was withdrawn for interview, the researcher purposefully decided to withdraw half of the industrial proprietors out of the 30 workshops sampled for observation to sample their opinions on intervention strategies on the prevention of noise induced hearing loss. To this effect the proprietors were withdrawn from all the selected Sub-Divisions involved in the study. She purposefully decided to interview five (5) wood workshop proprietors each from all of the towns (Buea, Limbe and Tiko); making a total of fifteen (15) proprietors.

Table 5: Distribution of Sample for Interview

Towns in Fako	Number of Woodwork Industries	Frequency
Buea	5	5
Limbe	5	5
Tiko	5	5
Total	**15**	**15**

Table six (6) depicts that fifteen (15) heads of wood workshops were interviewed in Fako. Five interviewees each were withdrawn from each of the following Sub-Divisions and towns: Buea, Limbe and Tiko. Summarily, a combination of all the number of recruited industry heads amounted to fifteen (15) participants that were slated for the interview

Table 6: Demographic Characteristics of Respondents

Demographic characteristics		Frequency	Percentage (%)
Gender	Male	160	100
Age range	Less than 20	30	18.8
	20-25	35	21.9
	26-30	54	33.8
	31-35	12	7.5
	36-40	16	10.0
	41 and above	13	8.1
	Total	**160**	**100**
Level of education	Primary	41	25.6
	CAP/ Ordinary Level	47	29.4
	Advanced Level/Baccalaureate	40	25.0
	Secondary with no certificate obtained	27	16.9
	Probatoire	3	1.9
	Bachelor's Degree	2	1.3
	Total	**160**	**100**
Work description	Carpenter/Machinists	144	90.0
	Sawyer	16	10.0
	Total	**160**	**100**

Duration of stay in the industry	Less than 1 year	6	3.8
	1-5 years	64	40.0
	6-10 years	47	29.4
	11-15 years	16	10.0
	16 years and above	27	16.9
	Total	**160**	**100**
Number of hours spends in a week at the workshop	Less than 10 hours	21	13.1
	10-20 hours	12	7.5
	21-30 hours	8	5.0
	31-40 hours	60	37.5
	41 hours and above	59	36.9
	Total	**160**	**100**

Gender

Among the 160 workers sampled, all of them were male depicting that woodworking industries is primarily populated by the male Gender.

Age range

Describing the respondents by age range, 30 (18.8%) of them were less than 20 years of age, 35 (21.9%) of them were within 20-25 years of age, 54 (33.8%) of them were within 26-30 years of age, 12 (7.5%) of them were within 31-35 years of age, 16 (10%) of them were within 36-40 years of age and 13 (8.1%) of the workers were above 40 years of age.

Level of education

Furthermore, describing the respondents by level of education, the highest level of education for 41 (25.6%) of the respondents was primary, for 47 (29.4%) of the respondents had CAP/ Ordinary Level while for 40 (25.0%) of them had Advanced Level/Baccalaureate. Also, 27 (16.9%) of the respondents had gone to secondary school but failed to obtain a certificate. Lastly, 3 (1.9%) and 2 (1.6%) of the respondents respectively, had Probatoire and Bachelor's Degree.

Work description

Describing the respondents by their work description, 144 (90.0%) of them were carpenters and machinists and 16 (10.0%) of them were wood operators.

Duration of stay in the industry

Furthermore, describing the respondents by duration of stay in the woodwork industry, 6 (3.8%) of them had been in the sector for less than a year, 64 (40.0%) of them had been in the sector for 1-5 years, 47 (29.4%) of them had been in the sector for 6-10 years, 16 (10.0%) of them had been there for 11-15 years and 27 (16.9%) of them had been in the wood work industry for more than 16 years.

Number of hours spent in a week at the workshop

Finally, describing the respondents by number of hours spent in a week at the workshop, 21 (13.1%) of them spent less than 10 hours, 12 (7.5%) of them spent 10-20 hours, 8 (5.0%) of them spend 21-30 hours, 60 (37.5%) of them spent 31-40 hours and 59 (36.9%) of them spent above 40 hours

Sampling Technique

With respect to sampling and combating a biased selection of participants and sample of the study, A multistage sampling procedure was employed which involves the taking of samples in stages using smaller and smaller sampling units at each stage to make the sampling process more practical (Sedgwick, 2015). In this study, both probability and non-probability sampling options were utilized. The following sampling techniques were considered: Explicitly, the first stage was the selection of towns for sampling using a Probability sampling and the next stage was the selection of wood workshops and sample sizes using a non-probability sampling procedure. The three (3) Sub Divisions in Fako involved in the study were obtained through random sampling. Here, the names of the various Sub Divisions were written and ballots carried out for the careful selection of the sample in the ballot boxes and replacements made for reselection to render equal chances and probability for every member in the group to be selected. Similar procedure was repeated to select three Towns that represented at least half of the towns in Fako Division.The next stage of sampling proceeded to a non-probability sampling technique for the selection of woodwork occupational settings in the randomly selected towns as well as the sample of the study located using convenient sampling. Specifically, the type of convenient sampling technique used was the purposive sampling also known as judgment, selective or subjective sampling. Furthermore, the type of purposive sampling used to locate workshops in these different areas was the Snowball Sampling technique. The researcher's preference of this technique was based on the fact that representativeness of the sample (wood workers) is not guaranteed. The researcher had no idea of the true distribution of the population and the destinations of the intended sample. With this approach, early sample members in woodwork industries were asked to identify and refer other people who met the eligibility criteria for the study (being wood workers in woodwork settings).This sampling technique was used in locating and selecting various woodwork occupational settings (50 workshops) for the study from the different three sub-Divisions in Fako (Buea, Limbe and Tiko). The purposive sampling technique was equally used in selecting the sample of one hundred and sixty 160 workers from the identified occupational settings as the researcher chose to use all the workers that were found in the selected workplace through accidental sampling as sample and participants of the study if they met with the study's criteria of noise exposure susceptibility and woodworking. Purposefully, the researcher decided to withdraw more than half of the woodwork fifty (50) industries for observation to ensure data consistency and for confirmation from workers opinion derived.

For the experimental study, a purposive sampling technique was adopted to select a group of twenty (20) workers among the one hundred and seventy-five (175) participants originally obtained through the snowball sampling. Summarily, industries (AB) for control and industry (CD) for experimental groups were purposefully selected as well as members of the control and intervention groups for the study. Explicitly, the purposive homogenous sampling technique was utilized as the researcher decided to use workers who shared similar characteristics in terms of job activity, noise exposure, health status, age range etc. Specifically, the purposive sampling and recruitment of this sub-group of twenty (20) participants was preferred because the researcher desired to use only the machinists who spent longer periods in operating paining machines and other noisy ones that produce continuous and loud noise for data efficiency. For interview, the researcher purposefully decided to withdraw half of the industrial proprietors out of the 30 selected workshops for observation for convenience and fairness to ensure that all the towns were represented for interview. Fifteen (15) proprietors from all towns were represented in the study. She purposefully decided to interview five (5) wood workshop proprietors from each of the towns making a total of fifteen (15) proprietors.

Instruments used for Data Collection

In order to assess how preventive measures for occupational noise influences the prevention of noise induced hearing loss for workers in woodwork industries in Buea municipality in the South West Region of Cameroon, a mechanical device was used (a noise detection software; sound level measurement meter) and a noise hazard identification checklist. Primarily these two instruments were used, for diagnosing the possibility of the existence of noise hazards, measure noise level in the environment, threat and severity. The instruments were used as a diagnostic tool to collect data to check for presence of environmental hazards in woodwork industrial settings. Specifically, instruments used for data collection in this study included, audiograms; questionnaire, observation checklist and interview guide questionnaires, observational checklists and interview guide were used as instruments. Workers exposed to industrial noise were given a researcher made 25-item questionnaire to fill. Section (A) consisted of participant's demographic data which was made up of the name of the worker under noise exposure, the industry name and the sex of the worker and other personal information. The sexes and ages of the workers for the study was taken into consideration during this study though not used for data analyses. Sections (B) of the questionnaire was composed of items to answer research questions (1) and consisted of indicators of noise safety practices for occupational noise and the prevention of noise induced hearing loss. These indicators included the use of engineering control, administrative measures, the use of hearing protection devices, and hearing health surveillance.

To ensure consistency the sampled workshops and workers of the selected workshops were observed and their use of noise control strategies evaluated using an observation checklist. The response options used in the observation guide was in terms of always, sometimes and never with necessary comments attached to each of them. The observation guide was made of five sections (Section A - E). Section (A) was meant to identify the workplace and the work type, the socio-demographic characteristics of workshops, and the description of the working environment with attention paid to types and degrees of noise. Section (B to E) consisted of the indicators characterizing intervention strategies for occupational noise organized under and based on the specific objectives of the study.

For the quasi experimental study of 20 participants, an audiometric test was used for pre and post testing after intervention. An audiometer was employed to test the workers hearing health and level to determine their existing and current hearing level and threshold before and after the study. Summarily, hearing ability was measured, using pure-tone audiometry while results was answer research question. Preceding the quantitative component, semi-structured interviews with a purposefully selected subgroup of fifteen (15) heads of workshops that form the sample of woodwork industries further explored worker's perception on the intervention strategies for occupational noise and the avoidance of the occurrence of noise induced hearing loss.

Testing

Pretesting and post testing were conducted on participants who were assigned into experimental (intervention) or control groups. For pretesting and post testing, a pure-tone audiometer was used to determine hearing levels of workers before and after the study. The Pretest was carried out two months (8 weeks) after the posttest and six (6) weeks after the intervention which was reserved only for the experimental group. These tests were performed with a standard, calibrated audiometer (Redus 75®). Air-conduction hearing thresholds was explored at 1,000 Hz, 2,000 Hz, 3,000 Hz, 4,000 Hz, 6,000 Hz, and 8,000 Hz frequencies in both ears, in 5 dB increments. To diagnose thresholds and NIHL, the researcher used the Klockhoff-modified criteria. Based on these criteria, NIHL was defined as having a history of occupational noise exposure, bilateral hearing impairment, and a threshold level higher than 25 dB at frequencies between 1,000 Hz and 8,000 Hz in the absence of other conditions affecting hearing.

The audiometric tests were conducted in a researcher's made audiometric chamber. The designed chamber had an outside to inside Sound Transmission Class (STC) of >40 dB at 1 kHz. Before audiometric measurement, the volunteers were explained about the study and testing protocol. They were allowed a test session to get an understanding of the test, noise exposure, and their response. Before the experiment, it was ensured that the test environment was quiet and free of distractions to the test volunteer and the experimenter. The testing was performed using GSI 61 Clinical Audiometer (Grason-Stadler Inc., Littleton, MA, USA). Pure tone audiometry was performed on both ears, one at a time, at frequencies of 0.125, 0.250, 0.5, 0.750, 1, 1.5, 2, 3, 4, 6, and 8 kHz. Before the test, the volunteer was enquired to identify his or her better ear. On confirmation, the test was started for his or her better ear. In case, he or she could not notice any difference between the right and left ears, the test was started in the right ear at 1000 Hz (intensity, 30 dB hearing level) proceeding to higher octave frequencies. After testing at 8000 Hz, lower octave frequencies were evaluated starting at 125–750 Hz. In case of a no response at 30 dB, the intensity was increased in 10 dB steps until a response was recorded and then the descending bracketing method was initiated again. A pulsed tone of more than 200 ms duration was given for each frequency being tested. Volunteers were instructed to press a hand-held response switch upon hearing a tone, to hold the key down as long as they hear the tone, and to release it when they no longer hear the tone. A short rest period was given in between testing of right and left ears for air conduction (AC) audiometry.

Validity of Instrument

To ensure the effectiveness of the instruments, face validity, content validity and construct validity were checked. The instruments that were specially designed to collect data had to be checked for neatness, orderliness in presentation, content appropriateness, the comprehensiveness of the instruments and coherency of the instruments. As a result, these instruments were submitted by the researcher to an expert for necessary corrections and comprehensiveness. To ensure the effectiveness of the instruments, face validity, content validity and construct validity were checked.To ensure validity of the instruments, questionnaire, interview guide and checklist that were specially designed to collect data had to be checked for neatness, orderliness in presentation, content appropriateness, the comprehensiveness of the instruments and coherency of the instruments. As a result, these instruments were submitted by the researcher to her supervisor for necessary corrections. In this light, the researcher under the guidance of the supervisor ensured that all the items in the questionnaire, interview guide and checklist reflected the specific objectives of the study. All the items of the instruments were critically examined for orderliness, neatness, appropriateness, and comprehensiveness.In this study, content validity was done with the assistance of experts in the field of Special Education and the research supervisor. Content validity was checked to address the logicality of the instruments in getting at the intended variables, the adequacy of the sample of items or questions in representing the complete content that was intended to be measured and the appropriateness of the format of the instrument. The content validity was determined using the Content Validity Index (CVI) which will be calculated based on expert judgment using the formula stated below:

CVI=number of judges/number of judges who termed the instrument valid

CVI=3/3=1

Nana (2012) recommends that CVI be 0.75 or above.

Construct validity makes sure that conceptual definitions of the study concepts or theories are in line with the operational definitions of variables or study indicators. In this study, the construct validity was determined through the use of literature, other lecturers of Special Education of the University of Buea and the expertise judgment of the research supervisor. This necessitated that the supervisor and a lecturer review the first draft to ensure that the language used was adequate and understandable. Also, it was much more important to make sure that the concept or terminology used met the standard, were unambiguous and really fit the theoretical and operational perspective of the study.

Reliability of Instrument

A pilot study was carried out using four (4) workers from woodwork occupational settings in two saw mills which were not part of the sample setting. This pilot study was conducted for a period of one-week Bokoko village. During the pilot phase these (four) workers followed the same assessment procedure of instrument administration that those who had to take part in the study proper had to follow. The main reason for carrying out this pilot study was to find out whether the items on the instruments were rightly framed and understood so that necessary changes could be made before conducting the main study. During this exercise, the time that was needed for each worker to complete the questionnaire was taken into consideration, in order to make sure that it does not take too long and boring for the respondents. Equally, a checklist was used for a critical examination of the presence of preventive measures in the workplace and the avoidance of noise induced hearing impairment. An interview guide was then used to interview three (3) administrators of the organisations. The information collected after scoring the responses from the pilot study exercise was useful in amending the questionnaire items, interview guide and checklist used in the study. After the pilot study it was intended that some items were to be reformulated if some of the workers do not understand some of the words used in the statements. The time needed for a worker to complete any of the instruments ranged between 16-30 minutes which is assumedly estimated reasonable.A reliability analysis was performed on all items related to preventive measures of noise to see whether there was a relationship between the two variables (noise safety practices and the protection of worker's hearing thresh hold shifts). The control groups' demographics will be compared with the training intervention group. A repeated measures ANOVA will also be used to assess whether the control measures perceptions were altered by the training session. The overall scale and sub-set scales will be examined.

Reliability Analysis

Generally, participants' responses were expected to follow a consistent pattern. Cronbach Alpha Reliability coefficient enables us to ascertain whether the internal consistency of the responses was satisfactory to an acceptable level. For this assumption to be accepted, Alpha should not be less than 0.5.Cronbach Alpha as many other statistical tests focuses on variability which is the deviation from the general trend, and the strength of the test reside in the fact that it combines variability of individual items and composite scale scores. A conceptual formula for Cronbach's Alpha is as follows:

$$\& = \frac{k}{k-1}\left[1 - \frac{\sum \text{Items variances}}{\text{Scale variance}}\right]$$

Where *&* = Cronbach's Alpha

K= number of items

The normal range of the values for the coefficient alpha is between 0.00 and +1; the higher the value, the better the internal consistency. Low Alpha values in the context where indicators or variables are interrelated indicate that either respondents were not serious or they did not understand the instrument. However, the interpretation of reliability coefficient should be first of all conceptual whereby one should screen through the concepts under study to make sure that they are interrelated and so far, liable to a satisfactory internal consistency coefficient. Where items are not necessarily interconnected or enjoy a certain level of conceptual independence from each other, low Alpha should be considered as problematic. But in the context of this study, the conceptual components and their respective indicators were tested to see if they are related to each other and a satisfactory internal consistency was therefore expected.

Reliability Analysis for Pilot Study

Table 8: Reliability Statistics of the Survey Instrument

Variables	Cronbach's Alpha Coefficient values	Variance	Number of items	
Use of engineering control equipment	0.806	0.073	5	
Use of administrative control measures	0.778	0.038	6	
Use of hearing protection devices	0.756	0.024	6	
Use of hearing health surveillance	0.714	0.092	6	
Overall reliability analysis	0.784	0.047	22	

The internal consistency of the participants' responses was not violated for any of the variables with Cronbach's Alpha Coefficient values ranged from 0.714 to 0.806. The overall reliability coefficient value is 0.784 which is above the recommended threshold of 0.7 thus, implying that the respondents were consistent in their responses which equally made the questionnaire valid and reliable for the study.

Table 9: Reliability Statistics of the Experimental Instrument

Variables	Test level	Group	Cronbach's Alpha coefficient values	Variance
The subjective use of noise safety practices	Pre-test	Experimental	0.789	0.106
		Control	0.897	0.295
	Post-test	Experimental	0.854	0.163
		Control	0.721	0.189
	Pre-test Vs Post test	Experimental	0.798	0.176
		Control	0.894	0.309

The reliability analysis report from the experimental lay out of the study showed that the Alpha Cronbach Coefficient values ranged from 0.721 to 0.897 which are all above the recommended threshold of 0.7. Thus, the results from the experimental layout of the study were accepted for analysis.

Procedure for Data Collection

In order to collect data for the main study the researcher undertook the following procedure: visiting the various occupational settings selected for the study and carrying on the main study. The procedure that was carried out is explained below:

The Main Study

The following section outlined the steps taken to deliver instruments and training intervention to the participating venues. A noise measurement metre was primarily used to check noise level in the environment. Thereafter, questionnaires were distributed to the workers to determine and test their awareness and perception on the use of intervention strategies for occupational noise and the avoidance of noise induced hearing loss in the industry while observation checklists were used for the purpose of data consistency and confirmation, to determine the existence and effectiveness of noise control measures in the workplace. A quasi-experimental design was then used within the experimental and control groups. A pure-tone audiometer was used for pre and post testing to determine hearing levels and conditions of the 20 purposefully selected non randomised workers before and after intervention. Results from the above quantitative phase, were used to inform the qualitative phase where qualitative data (text) were collected from proprietors using interview guides and analyzed second in the sequence to help explain, or elaborate on, the quantitative results obtained in the first phase.

Visits to Worksites

Contact visits were made to the selected occupational grounds to explain to them the purpose of the study and seek their collaboration. Also, before going to the field, the introductory letter that was given to the researcher by the Head of Department of Educational Psychology, Faculty of Education of the University of Buea was presented to the various woodwork administrators of the various woodwork settings. This letter indicated that the bearer was a student on research from the Department of Educational Psychology and needs collaboration from woodwork industrial organisations (See appendix). A consent form was equally issued for participants to declare their willingness (See appendix 5).

Experimental Procedure

For implementation of the experimentation, participants in the intervention group were asked to complete the consent form. Sound measurement was carried out to determine noise levels in the environment. Audiometric based test, set up in a quiet space for pretesting was carried out for two groups (control and experimental groups). This audiometric test was used as pretest and also to raise the participants' awareness of the effects of noise on their auditory health. The control group completed the consent form and pre-test but was omitted from the training. There after the Pre-test, a training programme (an intervention) was carried out on noise prevention strategies and noise safety practices for two weeks were the researcher trained wood workers involved in the experimental process. Training was held on-site outside operating hours. The training was kept as informal as possible with the instructor encouraging questions and discussion from the participants. To ensure that training was engaging, videos, audio clips, demonstrations of hearing protection and its fit, was used to illustrate noise induced hearing loss prevention strategies. Post-test course evaluation and retesting was done eleven (11) to twelve (12) weeks.

Administration of the Instrument
The researcher was given an authorization letter signed by the authorities of the Faculty of Education in the University of Buea to enable her gain access to the various woodwork industrial settings to collect data for analyses and findings. The researcher took permission from the various workshop authorities before administering her instruments on the woodworkers and their proprietors after presenting the letter of authorization from the faculty. The questionnaires, observations, interview and tests were personally administered by the researcher who equally interpreted and explained the questions and procedures to the respondents for better responses and to minimize possible infiltrations of findings.

Analysis of data
The quantitative data derived for the study were analysed using Statistical Package for Social Science (SPSS version 23.0) with the aid of descriptive and inferential statistics. The descriptive statistical tools used were frequency count and percentages. The Pearson parametric test was used in testing the hypotheses of the study because the data for the variables were approximately normally distributed and did not significantly deviate from the normal distribution pattern.

The normality assumption of the data was tested using the Kolmogorov-Smirnovtest which is an advanced test of testing for normality assumption of data. The reason for choosing this test over the Shapiro-Wilk test was because; the sample size was above 50. With a sample size of less than 50, the Shapiro-Wilk test becomes appropriate over the Kolmogorov-Smirnovtest. The result of the normality assumption of the data is presented on the test of normality table below. Testing for normality assumption is very essential in study contexts that demand the use of either parametric or non-parametric test in testing for hypotheses such as the Spearman's rho test or the Pearson test, so that the right test to be used is chosen, thereby, avoiding the possibilities of committing either the type I or II hypothesis errors.

In addition to the Pearson test used in testing the hypotheses, the Cox and the Snell test with the aid of the Pseudo R- Square was used in estimating in terms of percentage the magnitude of the effect of the use of engineering control measures, administrative control measures, personal hearing protection devices and hearing health surveillance on the reduction/protection of the ear from noise induced hearing loss.

Decision rule for testing hypotheses
If the computed P-value is > the margin error of 5% (that is the 0.05 level of significance), the null hypothesis is accepted and alternative hypothesis rejected

If the computed P-value is < the margin error of 5%, the null hypothesis is rejected and the alternative hypothesis is accepted.

Formula for calculating Percentage (%) $= \frac{Frequencycount\ (n)}{Totalnumberofpersons\ (N)} \times \frac{100}{1}$

Pearson Product Moment Correlation Coefficient

Raw Score method

$$\frac{n(\varepsilon xy) - (\varepsilon x)(\varepsilon y)}{\sqrt{[n(\varepsilon x^2) - (\varepsilon x)^2][n(\varepsilon y^2) - n(\varepsilon y)^2]}}$$

Where

∑=Summation

Y=Values corresponding to the independent variable

X=Values corresponding to the dependent variable

Ethical Consideration
Research involving human subjects usually requires the respect of certain ethical principles such as informed consent. Informed consent requires that the researcher informs the subjects of the purpose of the study and related consequences of their involvement. Before administering the test, the researcher sought the consent of authorities or workers in order to get their approval and willingness to take part in the study. In addition, the informed consent form guaranteed confidentiality of the information provided by the subjects. For confidentiality, the researcher promised the workers that they will not be referred to by name in any of the documents relating to the research and that data generated as a result of the research study shall be treated confidentially. The workers from occupational grounds (woodwork industries) were assured that information collected about them and the work premises would remain very confidential and anonymous in the study. For more confidence and transparency, the researcher promised workers that if they wish to avail of these free risk assessments and noise measurements or have any additional questions, they should please feel free to contact her by email.

Findings

Objective One: To Assess the Extent to which the Subjective Use of Noise Safety Practices Protects the Hearing Threshold Levels, of Workers Exposed to Occupational Noise in Woodwork Settings in the Fako Division.

Table 10: Observing the Use of Noise Safety Practices at Woodwork Settings (N=30)

Items	Always	Sometimes	Never
Noise sources are controlled or blocked to limit sound exposure	13 (43.3%)	17 (56.7%)	0 (0.0%)
Workers are kept or taken away from persistent loud noise with modified timetables	9 (30.0%)	21 (70.0%)	0 (0.0%)
Workers use hearing protection devices while working	8 (26.7%)	21 (70.0%)	1 (3.3%)
Hearing checks are frequently carried out	11 (36.7%)	19 (63.3%)	0 (0.0%)
Workers practice noise safety measures	10 (33.3%)	20 (66.7%)	0 (0.0%)
Noise sources are located further away from workers	4 (13.3%)	26 (86.7%)	0 (0.0%)
At work places, most metal components are changed to plastic components.	4 (13.3%)	26 (86.7%)	0 (0.0%)
Conclusion remark	**Adequate 8 (26.7%)**	**Inadequate 22 (73.3%)**	

Based on the use of noise safety practices by woodwork settings, it was observed that in 17 (56.7%) of the woodwork settings noise sources were sometimes control or blocked to limit sound exposure while 13 (43.3%) of the woodwork settings always do it. Again, it was observed that in many of the woodwork settings 21 (70.0%) workers were sometimes kept away from persistent noise and wear hearing protection devices while working. Furthermore, it was observed that in many of the woodwork settings, hearing checks were sometimes carried out, noise sources sometimes located further away from workers and metal components changed to plastic components while less than 35% of the woodwork settings always do it. In conclusion, it was observed that the use of safety noise practices was adequate just for 8 (26.7%) of the woodwork settings while it was inadequately used for many of the woodwork settings 22 (73.3%). This can also be seen on the figure below.

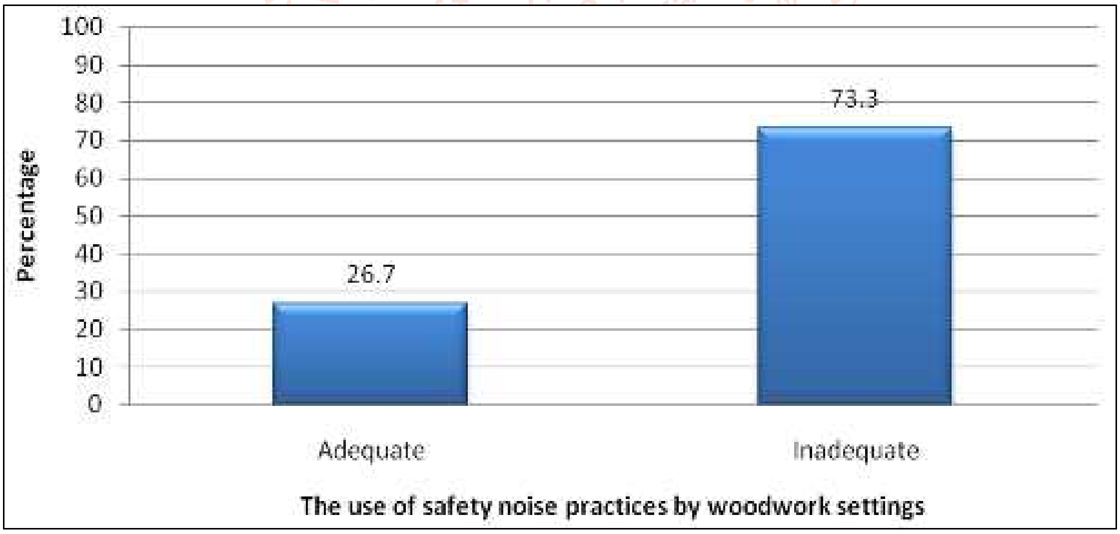

Figure 2: Distribution showing woodwork Settings by the Use of Noise Safety Practices

Proprietors' Opinion on the Use of other Safety Practices at Woodwork Settings Aside Noise

Among the proprietors interviewed, findings showed that all of them said they use other safety practices at their woodwork setting aside noise. These safety practices are the wearing of gloves for the protection of fingers, wearing of industrial shoes for the protection of workers' feet, use of nose masks to prevent the inhaling of dust particles in the shop and also eye glasses to protect their eyes because their workers cannot buy eyes from the market neither any other body part. However, findings also showed that the proprietors also said that it is not always that these safety practices are implemented in the work place as most at times, workers work without even wearing most of the above-mentioned safety practices.

Results from the Experimental Study on the Use of Noise Safety Practices

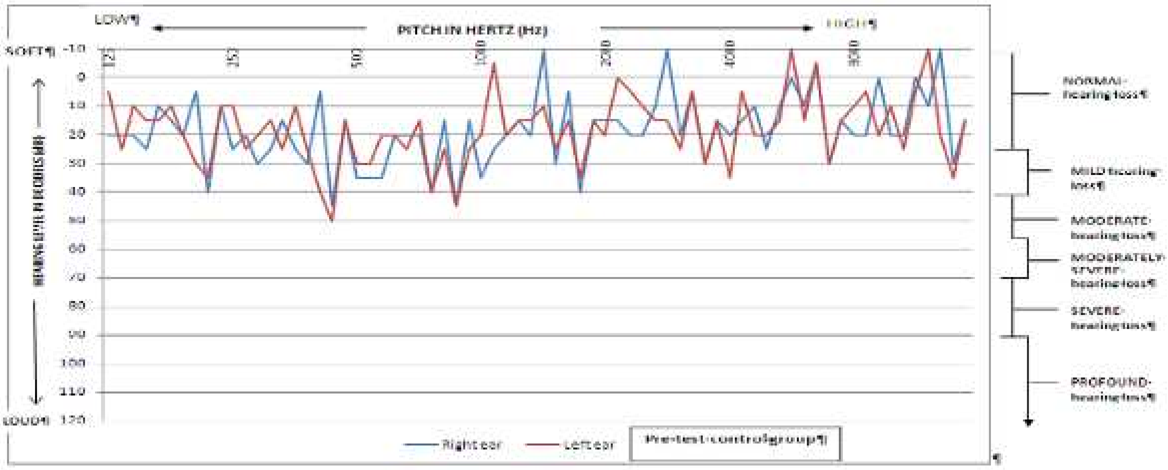

Figure 3: Ling Graph Showing the Pre-Test Results for the Control Group

From the pre-test result of the control group, it showed that one of the participants had moderate hearing loss in both ears even when the pitch was low. However, as the pitch was becoming high, results showed that many of the participants had mild hearing loss in both ears with the results appearing to be symmetric at the different pitch levels.

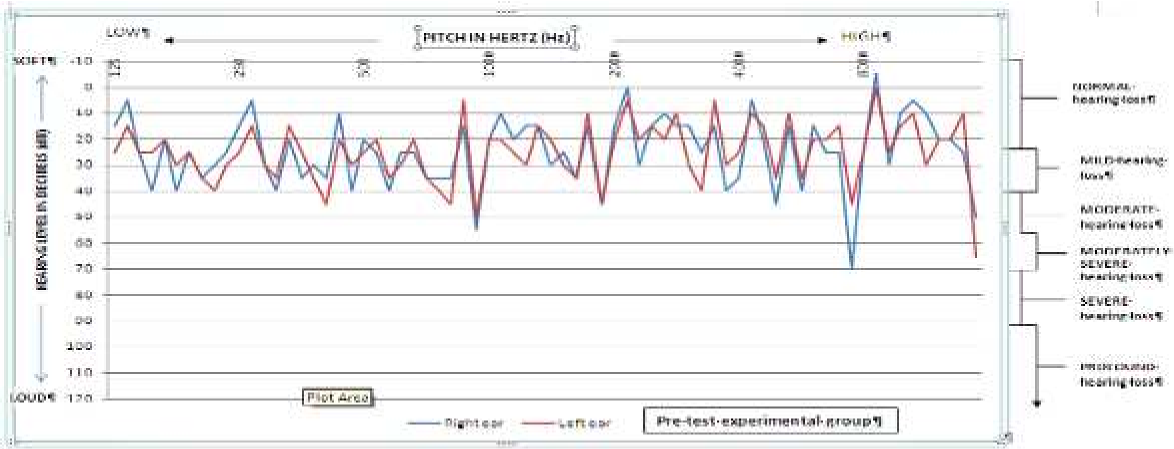

Figure 4: Ling Graph Showing the Pre-Test Results for the Experimental Group

Similarly, from the pre-test result of the experimental group, it showed that six (06) of the participants had moderate hearing loss in both ears, two (2) of them were also found to have moderately severe hearing loss, one (1) on the right ear and another on the left ear. Also, many of the participants had mild hearing loss in both ears at the different pitch levels with the results appearing to be symmetric.

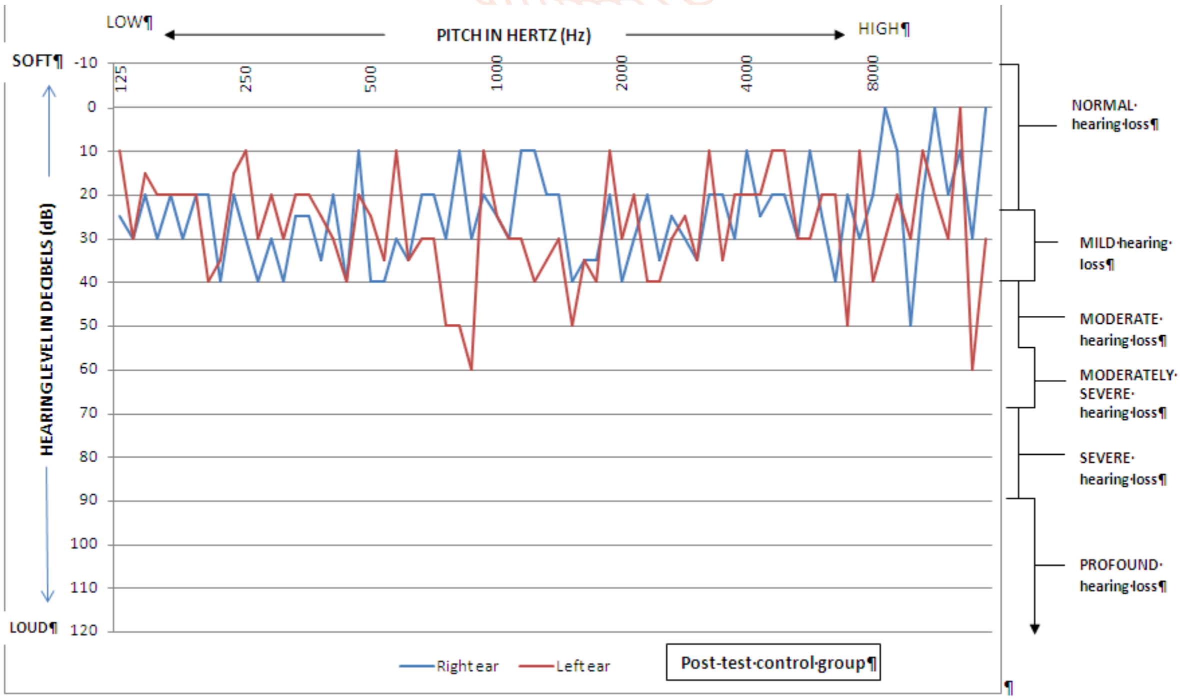

Figure5: Ling Graph Showing the Post-Test Results for the Control Group

Based on the post-test result of the control group, it showed that two (02) of the participants had moderately severe hearing loss in the left ear while that for the right ear was moderate hearing loss thus, making the results to be asymmetric. However, despite this, results also showed that in both ears, many of participants had mild hearing loss and the results were asymmetric for both ears at the different pitch levels for many of them. The reason that accounted for two of the participants having moderately severe hearing loss at the post test level which was not observed at the pre-test level might be due to the fact that as members of the control group, they were not subjected to any noise safety practice and as the researcher waited for some weeks before conducting the post test, the intensity of noise at the work settings may have had a severe impact on the two participants in the left ear.

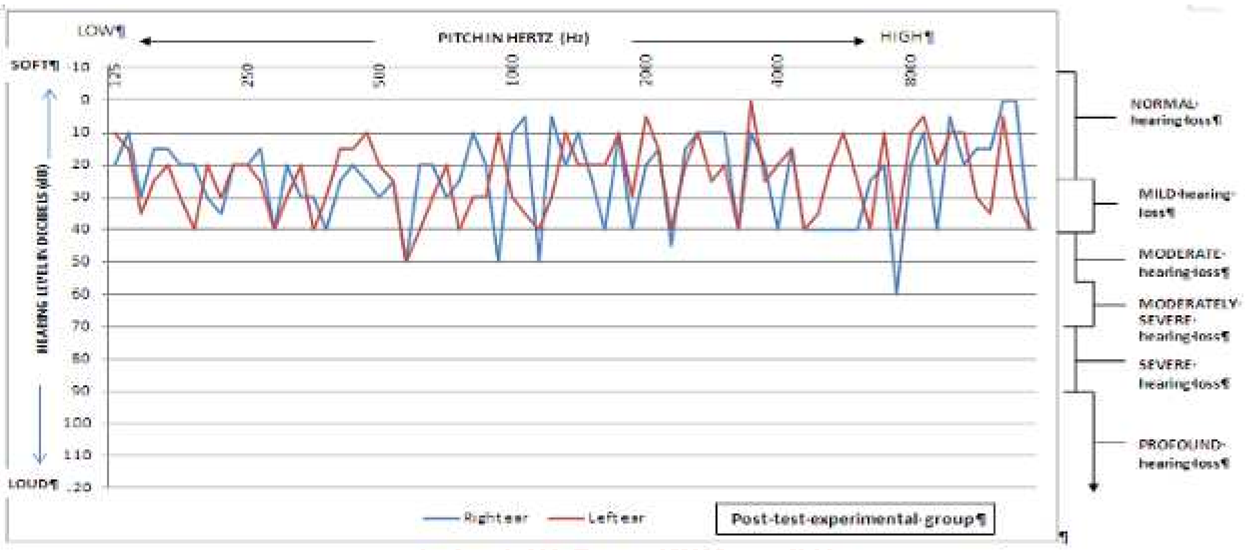

Figure 6: Ling Graph Showing the Post-Test Results for the Experimental Group

From post-test result of the experimental group, it showed that the six (06) participants who had moderate hearing loss in both ears at pre-test experimental group, dropped to three (03) persons and two (02) out of three (03) of the persons had moderate hearing loss only with their right ear while one of them had moderate hearing loss with both ears. To express in terms of percentage, there was a drop by 50% for those who had moderate hearing loss. With respect to the two (02) persons who had moderately severe hearing loss at the pre-test level of the experiential group, the number dropped to one (01) at the post test level of the experimental group. That is a drop of 50% was also recorded. Lastly, the number of persons who had moderate hearing loss is lower compare to those at the pre test level of the experimental group.

The changes and improvement realized for the experimental group was probably due to lessons of noise prevention and the intervention given to them for two months and their subjection to the use of noise safety practices. The lessons and practice of engineering, administrative controls, hearing Protection devices and other noise safety practices seemed to have led to this change in hearing threshold.

Testing of hypothesis One:

Ho: The subjective use of noise safety practices does not significantly protect the hearing threshold levels, of workers exposed to occupational noise in woodwork settings.

Ha: The subjective use of noise safety practices significantly protects the hearing threshold levels of workers exposed to occupational noise in woodwork settings.

Table 11: The effect of the use of safety practices on the protection of hearing threshold levels by workers exposed to occupational noise in woodwork settings

Test	Statistical parameters	The subjective use of noise safety practices	Protection of hearing threshold levels by workers exposed to occupational noise in woodwork settings	Explanatory power on the subjective use of noise safety practices on the protection of workers hearing threshold levels exposed to occupational noise in woodwork settings in terms of % (Pseudo R-Square)
Pearson test	R-value	1	.780**	90.2%
	P-value		.000	
	N	160	160	

****. Correlation is significant at the 0.01 level (2-tailed).**

Statistically, findings portrayed that there is a very significant and positive relationship between the subjective use of noise safety practices and the protection of hearing threshold levels by workers exposed to occupational noise in woodwork settings ($R= 0.780^{**}$, $P=0.000$, far < 0.05). The positive sign of the relationship implies that when noise safety practices are adequately used by workers exposed to occupational noise at wood work settings, the hearing threshold levels of the workers is more likely to be protected and this relationship is supported with a high explanatory power of 90.2% (Pseudo R-Square). Therefore, the null hypothesis that states that the subjective use of noise safety practices does not significantly protect the hearing threshold levels, of workers exposed to occupational noise in woodwork settings is rejected and the alternative hypothesis that states that the subjective use of noise safety practices significantly protects the hearing threshold levels, of workers exposed to occupational noise in woodwork settings is accepted.

Conclusion

Concerns about reducing noise pollution in the industry are multiple and directed to problems aimed at preventing the noise at source, on the propagation paths and at receiver. Noise control methods are effective when all the factors related to the nature of noise, the device which produces noise; the propagation pathways and the environment in which it propagates are studied. A majority of the workers working at woodwork settings in the Fako division, South-West region of Cameroon are exposed to high levels of noise that range from 80decibels to 130 decibels which is capable of causing hearing loss. However, despite this high levels of noise that workers at woodwork settings are exposed to, the study which aimed at investigating the intervention strategies for the prevention of noise induced hearing loss in woodwork settings showed that the use of safety practices such as engineering control measures, administrative control measures, personal hearing protection devices, hearing health surveillance significantly reduce the occurrence of noise induced hearing loss. The positive sign of the significant relationship that exists between the above intervention strategies and the prevention of noise induced hearing loss implies that when these intervention strategies and noise safety practices are adequately provided and used by workers exposed to occupational noise at wood work settings, noise induced hearing loss is prevented and the hearing threshold levels of the workers is more likely to be protected.

However, despite the usefulness of the above intervention strategies, findings also revealed that such intervention strategies are not used or regularly used in woodwork settings in Fako. Moreover, the woodwork settings that happen to use some of the intervention strategies, do not adequately use them. As a result of this, it may be concluded that industrial workers in woodwork industries in Fako are vulnerable to health and social problems due to the extreme exposure to loud noise characterizing the industrial environment with intervention strategies being lacking or inadequately used in the settings. This is a cause for concern that requires that, intervention strategies and noise safety practices be adequately practiced and utilized in woodwork industries to significantly reduce the occurrence of noise induced hearing loss.

Recommendation

- The ability of any enterprise to implement healthy workplace intervention strategies and noise safety practices for the prevention of noise induced hearing loss can be influenced by the government's legislative, policy and regulatory disposition.
- Importantly, there is need for the Government of Cameroon to adopt a new more comprehensive Occupational Health and Safety (OHS) legislation that includes provisions adapted to the characteristics and needs of woodworking activities.
- Policy makers should develop a health and safety guidelines. to enable woodworkers to comply with workplace and the Occupational Health and Safety regulation (Decree 039/MTPS/IMT dated 26 August 1984) that applies to all workplaces in all the sectors of the Cameroonian economy.
- There is a need for the government to deploy labour inspectors to the field to play a decisive role in enforcing health and safety, and ensuring that the woodshop owners conform to national laws and regulations. This can be realised by increasing the number of workplace inspections. Equally, the government should introduce incentives to conformist employers to induce the adoption of OHS culture in their business practices.
- Moreover, it is recommended all workplaces should be organized in conformity with the world health organizational model for a healthy Physical, Psychosocial and personal work environment, to improve the health of workers, their families and the community
- The Ministry of Labour and Social Security should develop and implement strategies to ensure that OHS legislation is effectively implemented and enforced. This can be done through the creation of a competent body to put in place measures to ensure that woodworkers can benefit from the health and safety protection afforded by the ministry. These measures include: guaranteeing compliance with regulations, disseminating information and addressing hazards and risks in woodshops, developing appropriate educational programmes and materials, and providing OHS training for woodworkers concerning work-related hazards.
- In Cameroon, collaboration in Occupational Health and Safety (OHS) matters should fall in line with International Labour Organisation (ILO) stipulations. The ILO and the World Health Organisation should occasionally have joint workshops on specific OHS issues, and employers and government agencies should be encouraged to participate in these to improve workplace health and safety.
- Reducing exposure to excessive noise in the workplace can be accomplished in many different ways. Both proprietors and workers should engage in changing or modifying equipment, locating equipment in a more isolated area, or sound proof of the room. Moreover, it is equally essential to make sure that people spend time working in quiet areas too and run noisy equipment early or late in the day when fewer people will be exposed, using personal hearing protection such as ear plugs or ear muffs, locating the equipment in a more isolated area, or soundproof of the room and carrying out regular hearing audiometric tests are equally reliable options.
- With respect to legal noise limits, administrators and workers should take specific action if noise exposure is at or above the lower exposure action values of daily or weekly exposure of 80 dB (32 exposure points) peak sound pressure of 135 dB. Additional controls will be needed if staff is exposed at the upper exposure action values of daily or weekly exposure of 85 dB (100 exposure points) peak sound pressure of 137dB. Workers should not be exposed to levels at or above the exposure limit values of daily or weekly exposure of 87 dB peak sound pressure of 140 dB. Reduced noise levels will directly reduce the risk of hearing loss for employees.
- Employers should implement all preventive measures to ensure the health and safety of workers at work. They must declare possible hazards at their sites to the Ministry of Labour and Social Security, ensure that employees are provided with Personal Protective

Equipment (PPE) for free and must are aware of workers' rights to work in a safe and healthy work environment.

- Administrators should consider the use of alternative equipment or safe systems of work including shock absorber, well maintained equipment sound barriers, absorbers or reflectors, designing work areas to separate noisy machines, silencers and vibration dampers to machines and tools, limiting the amount of time employees need to spend in noisy areas each day are all safe workplace practices to combat noise damage.
- Moreover, all workers should strictly comply with the laws and regulations related to health and safety at workplaces and to respect decisions of the employers in order not to disrupt the implementation of the preventive measures.
- The Ministry of Urban Development, Ministry of Decentralization and Councils, Ministry of Territorial Administration, Municipal and local administrative authorities and the Ministry of Education Should ensure the adequate supervision of noise safety practices and compel that industries, Occupational settings and the inhabitants of Fako to respect noise safety intervention practices in their area of jurisdiction to ensure that engineering and administrative controls, hearing protection devices, and hearing surveillance is actually used and practised in their areas.
- Finally, the Ministry of Education and health should ensure that more audiologists are trained in the area of audiometric evaluations and hearing health surveillance in order to assess workers hearing in different occupational environments like schools, woodwork and transport industries to determine workers likelihood of acquiring a hearing loss for nececcaryprecautions, intervention and preventions.

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