

Health Impact of Occupational Noise on Workers in the Fabrication Facility in Port Harcourt

Osugba Emmanuel¹ & Kingsley Douglas²

^{1,2}Centre for Occupational Health, Safety and Environment, University of Port Harcourt, Rivers State.

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ABSTRACT

This study assessed the health impact of occupational noise on workers in a fabrication facility in Port Harcourt. The sample size in this study was determined using Cochran method and was computed to be 288 people who work in fabrication facilities in Port Harcourt. The study relied on primary data and adopted used questionnaire as its data collection tool. Data from the answered questionnaires were analysed both quantitatively and qualitatively using the Statistical Package for Social Sciences (SPSS). The outcome of the study indicated that there is not so much difference between participants with negative attitude towards occupational noise and participants with positive attitudes towards occupational noise impact on health and safety of fabrication facility workers. Another finding indicated that a majority of the participants has a negative perception of the concept of occupational noise and its impact on health and safety of workers. The study participants highlighted that stress is the most significant impact of noise on their health, followed by discomfort and poor concentration. Based on the study findings, it is suggested that for future studies, it is worth considering other types of workplaces and other study areas in order to validate the findings from the present study. It is also recommended for the workers to be sensitized from time to time on the health effects of high noise levels and the need to use PPEs in such environments.

Keywords: Noise, health-impact, fabrication-facilities

the air are detected by the ear. What is sound to one person can very well be noise to somebody else, but anyone who is exposed to noise is potentially at risk. The higher the level of noise, and the longer individuals are exposed to it, the more risk they have of suffering harm from it. Exposure to high occupational noise which results in health risks is commonly encountered in a variety of industrial processes. Its effects depend not only on the intensity, but also on exposure time, frequency and the type of noise. According to the World Health Organization, high levels of noise may lead to speech interference, reduction in productivity, high blood pressure, hearing defects, health disorders, sleep interference, cardiovascular effects, loss of concentration and absenteeism, and fatigue. Therefore, regulations limiting the levels of noise in which industrial workers are exposed to have been instituted in many places. For example, in Nigeria, the National Environmental Standards and Regulations Enforcement Agency mandates industrial employers to limit factory noise to a value less than 85 dB (A) for an 8-hour period as prolonged exposure to continuous sound in excess of this limit is potentially dangerous. A study showed that exposure to occupational noise of about 102 dB (A) intensity in a steel factory resulted to noise induced hearing loss in 84% of the examined workers. It has also observed that industrial machine noise in a cement factory range from 58.08 dB (A) to 104.82 dB (A) and a total of 82.5% of workers had various health defects as a result of exposure to such noise. This study assessed the health impact of occupational noise on workers in a fabrication facility in Port Harcourt.

I. INTRODUCTION

Noise-induced hearing loss is the most common preventable occupational health condition in the world. Noise is defined as 'unwanted sounds', while sound is a term used for sensation that the brain receives when pressure variations in

II. LITERATURE REVIEW

Sensorineural hearing loss is one such disease in which hair cells of the inner ear (stereocilia) lose the ability to transmit sound information to the brain. Noise-induced hearing

loss, which is damage to stereocilia caused by exposures to hazardous levels of noise, is the second most common etiology of sensorineural hearing loss. ONIHL is 100 percent preventable, but remains a substantial contributor to the overall hearing impairment of the U.S. working population. It has been well established that hazardous levels of workplace noise can cause ONIHL. According to the National Institute on Deafness and Other Communication Disorders (NIDCD), an estimated twenty-six million Americans may suffer from noise-induced hearing loss (NIHL). The National Institute for Occupational Safety and Health (NIOSH) has estimated that as many as 30 million American workers are exposed to hazardous levels of noise that could contribute to ONIHL, specifically levels greater than 85 dBA as an eight-hour time weighted average (TWA)[2]. The beginning of the industrial revolution in the U.S. and in Europe marked the departure from an agricultural-based to an industrial-based labor force. As a result, workers became increasingly exposed to hazardous noise. 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. Several early studies followed, whose authors also found a relationship between hearing impairment and other occupations; namely blacksmithing, change ringing, mining, and boiler-making. Although the relationship between loud noises and hearing impairment was evident early in the industrial revolution, the mechanisms of action and prevention methods were not yet elucidated. Following World Wars, I and II, in which countless soldiers suffered hearing impairment, there was increased interest in investigating noise-induced hearing loss (NIHL).

There are many standards that address occupational noise exposures; specifically, those published by OSHA, NIOSH, The American Conference of Governmental Industrial Hygienists (ACGIH), and the U.S. Military. OSHA regulates hazardous occupational noise exposures for general industry and constructions. OSHA requires protection, in the form of feasible engineering and/or administrative controls, and personal protective equipment (PPE), for noise levels above the permissible exposure limit (PEL) of 90 dBA, eight-hour time weighted average (TWA). OSHA also requires a hearing conservation program (HCP) when noise levels exceed the action level of 85 dBA, eight-hour TWA. Investigators have repeatedly proven that occupational noise exposure can produce adverse effects on the cardiovascular

system, including hypertension, ischemic heart disease (IHD) and stroke. Occupational noise exerts its effects on physical health via direct and indirect mechanisms [11]. The clinical impact of occupational noise exposure on blood pressure has been most widely studied after the effect on hearing. Most studies showed that long-term exposure to cardiovascular disorders such as IHD (ischemic heart disease) have been a primary focus of epidemiological noise research. However, evidence of a relationship between occupational noise exposure and IHD is limited and inconsistent.

One cohort of 27,464 blue-collar workers from 14 lumber mills in British Columbia provided evidence that chronic noise exposure was associated with an increased risk of death from acute myocardial infarction. There was an exposure-response trend, with a RR of 1.5 (95% CI: 1.1–2.2) in the group with highest exposure. The highest RRs (2.0– 4.0) were observed during the subjects' working years [2]. One meta-analysis based on just four studies quantifying the risk of IHD reported that there was an RR of 1.06 (95% CI: 0.95–1.18) among workers exposed to >70– 85 dB(A). Another meta-analysis of 15 studies suggested that occupational noise was a risk factor for IHD morbidity. Some evidence suggested a higher risk of IHD among workers exposed to objectively measured noise >75– 80 dB(A) for less than 20 years based on five studies. Out of four studies, a higher mortality risk was suggested by one moderate-quality study relying on self-rated exposure and one high-quality study using objective measures [3].

Literature on the relationship between occupational noise and atherosclerosis is scant. One population-based cohort study indicated that nighttime traffic noise was independently associated with subclinical atherosclerosis [7]. Hyperlipidemia is one of the most common risk factors for atherosclerosis. Noise is an environmental stressor that is believed to activate the endocrine system. Elevated stress hormone concentrations may stimulate an increase in blood lipids suggesting a possible mechanism for noise exposure to cause atherosclerosis [1]. Workers exposed to noise greater than 90 dB(A) without ear protection appear to have increased triglyceride level [8]. One historical cohort study included male workers in high-level (n=154) and low-level (n=146) noise exposure groups and found a significant relationship between noise exposure and triglyceride concentrations in the two groups [9]. However, study findings are not consistent. One cross-sectional study of Danish industrial (n=460) workers, with financial workers (n=69) as a

reference, reported no relationship between occupational noise exposure and serum lipid concentrations after adjusting for HPD use, body mass index and smoking status.

One cross-sectional study that included 72 paper industry workers exposed to noise and two control groups not exposed to noise found that the noise-exposed group had a higher prevalence of ECG abnormalities [10]. In the previously described study on sanitary fixture industry workers, there was also a higher frequency of ECG abnormalities among exposed versus unexposed workers ($P < 0.05$). Some evidence shows that occupational exposure to noise may lead to increased heart rate in workers. One study of workers in the automotive parts industry revealed significant differences in mean heart rate changes ($P < 0.001$) between the noise-exposed and unexposed groups [6]. Noise exposure was moderately and positively correlated with heart rate (Spearman's $\rho = 0.46$; $P < 0.001$). A study on the association between aircraft noise and CVD near Heathrow airport in London showed that high levels of aircraft noise in the community might increase the risk of stroke [5]. A population-based cohort study of 57,053 subjects showed a relationship between long-term exposure to traffic noise and increased risk of stroke

There are several ways in which noise can be controlled, which can vary from one workplace to another. There's no standard single technique or solution that is appropriate for every situation. Good understanding of plant operations and work processes is necessary to determine the most effective method of eliminating, minimizing or controlling the noise. Elimination is a process that eradicates the noise source it is the most effective way to prevent risks to workers and should always be considered when introducing a new work process, selecting new work equipment and designing the layout of the workstations. Examples of noise elimination will include avoiding the use of noisy processes or machinery, elimination of

impacts between hard objects or surfaces, outsourcing the noisy work processes and moving the noisy operations away from other work activities. Substitution is a process of replacing noisy machinery or equipment with quieter alternatives. When elimination is not possible, substitution of the noisy machinery or equipment for quieter ones may be the next-best alternative to protect workers from exposure to noise. Engineering controls are all about making changes to processes, machinery or equipment so that the workers are exposed to less noise. For example, using screens, barriers, enclosures and absorbent materials help to reduce workers' noise exposure. Administrative controls are the way work is organized to reduce either the number of workers who are exposed or the length of time they are exposed to noise. Administrative controls should be used when it is not possible to reduce noise exposure through elimination, substitution or engineering noise control measures. Personal protective equipment protects the users from any adverse effects on hearing caused by exposure to high levels of noise. It is the last option in the hierarchy of control and should be used as a last resort after all efforts to eliminate or reduce the noise levels have been exhausted through technical and organizational means.

III. METHODOLOGY

This study adopted a cross sectional descriptive design and describes health impact of occupational noise on workers in the fabrication facility in Port Harcourt, Nigeria. The study area, Port Harcourt is located in the Niger Delta region of Nigeria, and is the capital of Rivers State. A total of 288 respondents were selected and questionnaires through random sampling technique. This sample size was determined using Cochran method. The targeted population for the study is given below:

Job Roles	Sample Size
Assembly Supervisors	14
Plant managers	14
Assistant plant managers	14
Quality control personnel	26
Fabricators	26
Welders and Brazers	28
Grinders	26
Instrumentation and Control Technicians	28
Project Engineers	20

Assemblers	26
Material handlers	28
Machinists	28
Operations clerks	10
TOTAL	288

All questionnaires were coded before analysis. Data was coded by identifying themes that related to the research questions and analyzed using descriptive statistics to obtain frequencies

and percentages. The software used for analysis of the findings was Statistical Package for Social Sciences (SPSS).

IV. RESULTS AND DISCUSSIONS

Frequency Distribution of Respondents on Impact of noise

Impacts	Respondents	Rate
Stressful	86	37.50%
Discomfort	63	27.50%
Poor Concentration	48	20.90%
Negative effect on health	32	13.90%

Health Factors Associated with High Occupational Noise Levels

Health Factors Associated with High Occupational Noise Levels	Frequency	Percentages
Hypertension	8	25%
Reduction in hearing	4	12.50%
Cardiovascular diseases	13	40.60%
Tinnitus (ringing in ear)	4	12.50%
Heaviness in hearing	3	9.30%

Respondent Responses on Perception to Occupational Noise

Perception	SD	D	N	A	SA
My hearing will not be damaged by noise at work.	15	58	37	86	33
It will make no difference to my hearing if it is quieter at work.	36	77	37	52	27
Listening to loud noise at work does not affect hearing in old age.	61	106	-	49	13
Noise only affects hearing in people with sensitive ears.	47	91	53	38	-
I cannot reduce noise at work.	23	47	-	104	55
I am not sure that I can use hearing protectors correctly	54	143	-	32	-
I know how to use my earmuffs or earplugs.	-	61	31	94	43
It is difficult to make equipment quieter.	37	70	44	57	21
Hearing protectors stop me from hearing what I want to hear.	45	89	27	51	17

Hearing protectors are uncomfortable.	55	93	-	53	27
Management is not interested in Occupational Health and Safety	62	111	-	37	19
(x)	39.5	86	20.8	59.3	23.1

Source: Field Survey (2020)

Respondent Responses on Attitude to Occupational Noise

Attitude	SD	D	N	A	SA
The noise at work does not bother me.	49	83	-	64	33
I like it when it is noisy.	65	126	13	25	-
I work better if it is noisy.	45	84	57	43	-
Noise is an important occupational health and safety issue	-	41	-	131	57
Noise should be given more focus/attention/discussion	18	53	36	79	43
Noise is an issue not always taken seriously	56	88	28	43	14
People need education/awareness regarding noise	-	58	61	92	18
I would feel better if my workplace was quieter	21	84	41	66	17
I worry about noise in my workplace	46	90	-	62	31
I do not have time to do anything about the noise at work.	-	67	51	83	28
My mates at work don't worry about noise.	-	45	-	131	53
(x)	27.2	74.5	26	74.5	26.7

Source: Field Survey (2020)

V. DISCUSSIONS

The result showed that the study participants indicated that all presented impacts of noise (stressful, discomfort, poor concentration and negative effect on health) on the questionnaire were identified as impacts of noise on the fabrication facility's worker's health and safety in Port Harcourt albeit at varying degrees. Participants highlighted that stress is the most significant impact of noise on the fabrication facility's worker's health and safety. This was followed by discomfort, poor concentration and other negative effects on health respectively. However, the study recognized that this result is sensitive to the nature of the participant's job as other studies highlighted poor concentration as the most impact of noise on employees [4].

The perception/opinions of Port Harcourt fabrication facility workers about occupational noise impact on health and safety using generated questionnaire items associated with the subject was done. The responses are statistically presented and analyzed. The result showed a mean value of 39.5, 86, 20.8, 59.3 and 23.1 for strongly disagree, disagree, neutral, agree and strongly disagree

respectively. This is a strong indication of participants' (Port Harcourt fabrication facility workers) perception about occupational noise impact on health and safety

VI. CONCLUSION

The outcome of the study per the attitude of the Port Harcourt fabrication facility workers on noise effect on health and safety indicated that there is not so much difference between participants with negative attitude towards occupational noise and participants with positive attitudes towards occupational noise impact on health and safety of fabrication facility workers. This means that based on this finding, there might be need for a proper sensitization of the fabrication workers on the effect of occupational noise and the need to always use the appropriate PPEs while at work.

VII. RECOMMENDATIONS

This study concentrated only on fabrication facilities in Port Harcourt. Thus, it is recommended

- For future studies to consider other types of workplaces

- Consider other study areas in order to validate the findings from the present study.
- Sensitized the workers from time to time on the health effect of high noise levels and the need to use PPEs in such environments.

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