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# Noise exposure, awareness, attitudes and use of hearing protection in a steel rolling mill in Nigeria

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| **Objectives** | To study exposure to noise, the attitudes and knowledge towards noise-induced hearing loss and the actual use of hearing protection in a steel rolling mill in Nigeria. |
| **Methods** | A structured questionnaire was administered to 116 randomly selected workers to collect information relating to their knowledge and attitudes towards hazardous occupational noise and preventative measures. Noise mapping of the factory was also carried out. |
| **Results** | Time weighted average noise levels were: administrative area 49 dBA, mechanic/maintenance workshop 72 dBA, mill floor 86 dBA and finishing stage 93 dBA. There was high awareness of the hazard of noise to hearing (93%) and of methods of prevention (92%) but only 27% possessed hearing protectors and only 28% of these stated that they used them all the time. |
| **Conclusion** | While noise is recognized as a hazard, initiatives are required to increase use of effective preventative measures. |
| **Key words** | Attitudes; awareness; hearing protection; Nigeria; noise exposure; steel rolling mill. |

## Introduction

Noise-induced hearing loss (NIHL) is a well- and long-recognized occupational hazard but methods of influencing attitudes towards noise hazards and prevention of hearing loss as a result are poor [1]. Less is known about this area outside the developed industrialized world. Our study examined the exposure to noise, the attitudes and knowledge of NIHL and the actual use of hearing protection in a steel rolling mill in Nigeria.

## Methods

A random sample of 116 steel rolling mill workers were selected from all sections of the factory (including the non-production areas) based on a sampling fraction of one in every four workers. A structured questionnaire was administered to obtain socio-demographic data and background factory experience as well as information related to their knowledge and attitudes towards the hazards of occupational noise and preventative measures. Noise mapping was carried out during regular working conditions on the morning shift (8:00 h to 16:00 h) to determine current noise exposure (dBA) in various parts of the factory using a Testo 815 sound level meter (Testo GmbH & Co. Lenzkirch, Germany), duly calibrated (Testo 0554.0009, Testo GmbH & Co. Lenzkirch, Germany). A sample of employees in different work-posts from each department had personal noise dosimetry with the microphone of the sound meter positioned at ear level. Readings were taken hourly from 9:00 a.m. to 4:00 p.m. (eight readings), when the sound level became steady for at least 10-s and the average of the eight readings was calculated. The representative personal noise dose exposure (%) was calculated for the respective departments using the formula [2]:

$$\text{Noise dose}, D\,(\%) = 100C/T$$

where $C$ = total length of the work-day in hours (8 h), $T$ = reference duration corresponding to measured A-weighted sound level, $L$ (dBA). $T$ could be read off a standard table or calculated using the formula [2]

$$T = 8/2^{(L-90)/5}$$

The 8 h time-weighted average (TWA) sound level in decibels was computed from the dose, in percent by means of the formula [2]: $\text{TWA} = 16.61 \log(10)\,(D/100) + 90$. For an 8 h work-shift, with the noise level constant over the entire shift, TWA is equal to the measured sound level [2].

Detailed audiological assessment, being the focus of a subsequent study, was not performed. The data generated was analysed using EPI-INFO version 6.04 computer software. Associations of, or differences between,

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the variables studied were considered statistically significant if the $P$ value was $<0.05$ or as otherwise stated.

The study protocol was approved by our University Teaching Hospital ethics committee. The consent of the management of the steel rolling mill and the individual subjects was sought and obtained.

## Results

One hundred and sixteen workers participated in the study, of whom 94% were male. About two-thirds had tertiary education. Ninety percent of the respondents had worked in the factory for between 10 and 29 years (mean 16.5 years ± SD 5.1), and had spent a mean of 12 years (± SD 6.8) in their current work area (Table 1). All but four workers worked 8 h a day for 5 days a week. Overall, 93% demonstrated awareness of the hazard of noise to hearing and 92% awareness of methods of prevention of NIHL but only 27% possessed hearing protectors and only 28% of these stated that they used them all the time. Twelve of the workers (10%) complained of hearing loss and 10 (9%) complained of tinnitus.

Noise measurement showed that 53% of factory workers were exposed to noise levels >85 dBA (Table 2). There was a statistically significant ($P < 0.001$) relationship between the measured sound levels and awareness of noise exposure.

## Discussion

Despite a high awareness of noise as an occupational hazard amongst Nigerian steel workers, the availability and use of hearing protection was poor. Only workers at the heart of the production process, i.e. mill floor and finishing stage, were considered to be exposed to harmful noise and thus eligible for hearing protectors but defective, damaged or lost hearing protectors were not replaced, accounting for why only 27% of our subjects had hearing protectors.

While this was a cross-sectional study, we also measured noise levels and managed to show a correlation between exposure to noise and awareness of noise as a health hazard. Frequently, neither managers nor workers are conscious of hazardous noise [3,4], but our study found that awareness was quite high in comparison to other studies [5]. Such awareness appears to derive from personal experience of working in noisy environments rather than from health education [6] and our study supports this as 90% of our subjects were employed at this mill for at least 10 years but only 10% had education on prevention of NIHL. Furthermore, there was a statistically significant relationship between their awareness of noise exposure and the noise level measured in the various departments.

**Table 1.** Awareness, attitudes and practices towards prevention of NIHL

| Variable | Frequency (%) |
|---|---|
| Years working in factory ($n = 108$) | |
| 0–9 | 11 (10) |
| 10–19 | 52 (48) mean 16.5 years |
| 20–29 | 45 (41) ± SD 5.1 |
| Years working in present area ($n = 112$) | |
| 0–9 | 44 (39) |
| 10–19 | 41 (37) mean 12.1 years |
| 20–29 | 27 (24) ± SD 6.8 |
| Aware that exposure to noise can cause deafness ($n = 115$) | |
| Yes | 107 (93) |
| No | 8 (7) |
| Aware that factory workers can be protected from noise ($n = 113$) | |
| Yes | 96 (85) |
| No | 17 (15) |
| Method of protection | |
| Use of ear plug/muff | 102 (98) |
| Isolation from noisy machine | 2 (2) |
| Knowledge of other preventive measures ($n = 109$) | |
| Regular machine maintenance | 29 (27) |
| Reduce exposure period | 20 (18) |
| Training workers on hazard of noise | 60 (55) |
| Have you had health education on prevention of deafness from factory noise ($n = 109$) | |
| Yes | 11 (10) |
| No | 98 (90) |
| Have you had health problems from factory noise ($n = 113$) | |
| Yes | 45 (40) |
| No | 68 (60) |
| Stated health problem | |
| Hearing loss | 12 (27) |
| Noise in the ear | 10 (22) |
| Headache | 19 (42) |
| Non-specific ill feeling | 4 (9) |
| Possess any protective device ($n = 109$) | |
| Yes | 29 (27) |
| No | 80 (73) |
| Type of device possessed ($n = 29$) | |
| Ear plug | 24 (83) |
| Ear muff | 5 (17) |
| How often is device used ($n = 29$) | |
| Always | 8 (28) |
| Sometimes | 21 (72) |
| Apart from individual protection, other methods used in this factory ($n = 94$) | |
| Yes | 10 (11) |
| No | 84 (89) |
| Have you ever checked your hearing ability in the hospital ($n = 111$) | |
| Yes | 9 (8) |
| No | 102 (92) |
| Reasons for hearing check ($n = 9$) | |
| Routine medical test | 5 (56) |
| Hearing loss | 2 (22) |
| Noise in the ear | 1 (11) |
| Cannot remember | 1 (11) |

Occupational NIHL is poorly studied in Africa. A study among South African miners showed they were poorly informed on the hazards of NIHL with reluctant and arbitrary use of hearing protectors based mainly on the workers' personal perception of noisy situations [6].

**Table 2.** Awareness of exposure to noise and sound level measured

| Work area | Admin | Maintenance | Mill floor | Finishing |
|---|---|---|---|---|
| Number of employees (%) | $n = 34$ (29) | $n = 21$ (18) | $n = 48$ (41) | $n = 13$ (11) |
| Sound level dBA (TWA) | 49 | 72 | 86 | 93 |
| Personal noise dose (%) | 0.3 | 8.3 | 57.4 | 151.6 |
| Awareness of noise exposure* | | | | |
| Yes (%) | 10 (32) | 19 (90) | 47 (98) | 13 (100) |
| No (%) | 21 (68) | 2 (10) | 1 (2) | 0 (0) |
| Reason for non-use of protective device ($n = 65$) | | | | |
| The level of noise is low (%) | 25 (76) | 3 (13) | 0 (0) | 0 (0) |
| Device not available (%) | 8 (24) | 20 (87) | 0 (0) | 0 (0) |
| Device defective (%) | 0 (0) | 0 (0) | 7 (100) | 2 (100) |

* (a) Are you exposed to noise in this unit of the factory? (b) If yes, do you consider this noise level high enough to constitute a risk of NIHL? Answer to question (b) was recorded as a measure of the awareness of exposure to harmful noise.

However, a recent study among industrial workers in Tanzania showed a good awareness (>80% of employees) that noise causes hearing loss and that NIHL could be prevented by appropriate ear protection [5]. Effective legislation against noise and NIHL preventive programmes that are well established in industrialized countries are lacking in Nigeria and many other developing countries [1,3].

Generally, measures to deal with the risk of developing NIHL are often inadequate [1,3,4], as in this factory. A study in Malaysia found that hearing protection was provided to 80% of noise-exposed factory workers, but only 5% wore them regularly [7]. There is also continuing evidence of poor compliance with NIHL preventative measures even in developed countries [8,9]. Thus, poor attitudes towards NIHL are global and may play a greater role in the universal burden of NIHL than uncontrollable harmful noise itself. As recently suggested, appropriate questions addressing noise exposure might be a useful alternative means for screening subjects exposed to high noise levels for the purpose of designing and implementing hearing-conservation programmes, where facilities for an objective assessment are not available [10]. Our study did not investigate reducing noise at source or management attitudes but these factors are an important part of a hearing conservation programme. We hope our small study can act as a catalyst for a positive change in developing countries that often lack effective legislation against noise and NIHL preventive programmes [1,3].

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## Conflicts of interest

None declared.

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