Nigerian Journal of Clinical Practice
June 2004, Vol. 7(1); 4-7

DISABLING HEARING LOSS IN TWO INDUSTRIES IN LAGOS, NIGERIA

O.O. Odusanya[1]*, C.C. Nwawolo[2], E.O. Ademuson[3]***, D.O. Akinola [3]***,**
*Departments of *Community Health & Primary Care, Lagos State University College of Medicine, P.M.B.21266, Ikeja, **Surgery, College of Medicine University of Lagos, P.M.B. 12003, Surulere, ***Occupational Health & Safety Division, Public Health Department, Federal Ministry of Health, 8, Harvey Road, Yaba, Lagos.*

ABSTRACT

Objective: To determine the prevalence of disabling hearing loss (> 40 dBA) in two industries in Lagos, Nigeria.

Methods: Cross-sectional survey conducted in a textile and a bottling industry in Lagos, Nigeria amongst 217 noise-exposed and 155 non-noise exposed subjects. Data Collection included use of a questionnaire, otological examination, audiometric and noise level measurements.

Results: The prevalence of disabling hearing loss was significantly higher in exposed subjects (17%) compared with non-noise exposed subjects (7%, p=0.008), while the attributable fraction was 58%. In the textile industry, hearing loss was significantly higher amongst exposed subjects (36%) compared with non-noise exposed group (11%, p=0.0001) but the prevalence was similar amongst the groups in the bottling industry ($p < 0.05$). Furthermore, a significantly higher proportion of all subjects in the textile company (23%) had hearing loss compared with the bottling industry (2%, p=0.0000). Hearing loss was significantly associated with age older than 35 years (p=0.009) and duration of employment greater than 5 years (p=0.02).

Conclusion: Disabling hearing loss was significantly higher in the noise-exposed subjects and indicates the need for a hearing conservation programme amongst these workers.

KEY WORDS: *Disabling hearing loss, noise, audiometry, industry.*

INTRODUCTION:

Hearing loss has been estimated to be the most prevalent disability in developed countries.[1] In Australia, 16% of the population had hearing impairment in the better ear at greater than 25 decibels (dBA) and 22% in the worse ear at the same level.[2] Hearing impairment is largely due to excessive noise. Noise pollution associated with hearing impairment has been reported in several industries including the textile industry.[3-5]. Even partly impulsive industrial noise has been found to be associated with significant hearing loss.[6]

Therefore, it is important to assess the hearing ability of workers in noise prone industries so that the workers can be better protected. This study was conducted to estimate the prevalence of disabling hearing loss in two industries, a textile and a bottling company in Lagos, Nigeria.

MATERIALS AND METHODS:

Study design:

The study was conducted as a cross sectional survey amongst employees in the two industries. The study involved three components. The first was the measurement of the noise levels in the factories. The second was the use of a self- administered questionnaire while the third was the clinical (otological and audiometric) assessment. The study was conducted between February and March 2001.

Correspondence: Dr O.O. Odusanya

Study population and sampling

All workers in both industries were informed of the objectives of the study through their management and labour unions. Both the management and trade unions granted approval for the conduct of the study. The study population was divided into two groups based on their noise exposure; the noise-exposed subjects and the non-exposed group. The consent of each individual worker was obtained verbally. Workers were selected by a simple random method from the register of names in each section of the industries. Workers were recruited from both noise prone and non-noise prone areas of the industries.

Study Procedures

a. ***Noise level measurements.***

The noise levels in the different sections of both companies were measured during the working day using a noise level meter, type 1405c with A-weighted scale and slow response. Three readings were taken daily in each section for three days. The average noise level was recorded.

b. ***Questionnaire.***

A self-administered questionnaire consisting mostly of close-ended questions was used to obtain information from the participants. The study team assisted the few workers who could not complete the questionnaire on their own. The instrument was used to investigate the socio-economic characteristics of the subjects, work experiences both current and past, activities done during leisure especially those related

to noise exposure such as playing musical instruments and the use of firearms. Other areas inquired about included medical and surgical history, use of ototoxic drugs, knowledge about effects of noise, awareness and the use of ear protectives.

c. ***Audiometric assessment.***

All subjects had an otological examination and audiometric assessment carried out by an audiologist. The assessment was done in the staff clinic of each industry. The objective of the examination was to determine the integrity of the external ear, and the tympanic membrane. The audiometry was conducted at least 8 hours after the last shift and before the worker resumed work at the factory shop. A manual diagnostic audiometer Tetratone II Model No. EB-49, Serial Nol886, calibrated according to ANSI-89 standard (Eckstein Bros Inc, Hawthorne California) was used. Pure tone audiometry using Hughson-Wetslake procedure[7] was carried out on all subjects at frequencies of 500, 1000, 2000, 4000 Hz in both ears.

Data analysis

The study team for completeness of required information reviewed each subject's data (questionnaire and clinical assessments). All subjects with middle ear pathology (as shown by past history of ear discharge or the finding of a perforated tympanic membrane) or who had been exposed to excessive noise in the past but were now working in non-noise environments were excluded from the analysis.

The diagnosis of disabling hearing loss was based on the following criteria, which has been used by other reseachers:[8]

a. Past or present history of exposure to excessive noise.
b. No history of otologic disease, surgery or head injury.
c. No evidence of middle ear abnormality.
d. Hearing threshold in the worst ear of = 40 dBA.

The data was analysed in a computer using a statistical software, Epi-Info V6.04c (CDC, USA & WHO, Geneva, Switzerland). Both descriptive and inferential statistics were determined. The level of significance was set at $p < 0.05$.

RESULTS

Three hundred and ninety-nine subjects in both industries were recruited into the study. However, 27 participants (15 noise-exposed and 12 non-noise exposed) were excluded from further analysis because of incomplete data and abnormal otological findings such as a perforated tympanic membrane. The attrition rate was not significantly different between both groups (p=0.94). Thus 372 subjects consisting of 217 noise-exposed workers and 155 non-noise exposed were included in the final analysis. There were 192 (95 noise-exposed and 97 non-noise exposed) participants in the textile company and 180 (122 noise-exposed and 58 non-noise exposed) in the bottling industry. In the textile company, 93/95 (98%) of the noise-exposed subjects were in the weaving section while in the bottling industry, 96/122 (87%) were located in the production section.

The mean age of subjects in the noise-exposed group was 34.0±7.0 years while the mean age of the non-noise exposed subjects was 34.8±8.6 years (p=0.35). There were no females in the noise-exposed group whereas in the non-noise exposed group, there were 42 (27.1%) females and 113 (72.9%) males. Subjects in the non-noise exposed group had a significantly longer duration of employment (mean = 8.0±6.0 years) compared with the noise-exposed group (mean = 6.7±4.9 years, p=0.001). Table 1 shows the average noise levels obtained in each industry and department, which are similar though the highest level of noise was obtained in the textile industry.

Hearing loss at the tested frequencies is shown on Table 2. At both 1000 and 4000 Hz, but not at the 500 and 2000 Hz, a significantly higher proportion of exposed subjects had disabling hearing loss. At 4000 Hz, 17% of exposed subjects had disabling hearing loss compared with 7% of non-noise exposed group (p=0.008). The odds ratio was found to be 2.69 (95% confidence limits 1.33 <OR< 5.46) with an attributable fraction of 58.4%. Amongst the noise-exposed subjects, 92% (34/37) of those who had hearing loss worked in the textile industry while the rest were in the bottling industry (p=0.000). Hearing loss was significantly higher amongst noise-exposed subjects compared with non-noise exposed in the textile company (p=0.0001) but not in the bottling industry. The odds ratio of disabling hearing loss for noise-exposed subjects in the textile industry was 4.36 (95% confidence limits 1.94 <OR< 9.97).

Univariate analysis showed that disabling hearing loss at 4000 Hz was significantly associated with age older than 35 years (p=0.009) and duration of employment greater than 5 years (p=0.02). When both age and duration of employment were stratified, the association was still significant (p=0.011). No significant relationship was found between workers' exposures (such as playing music instruments) and disabling hearing loss. One hundred and ninety workers (87.6%) claimed to be aware of the injurious effects of noise and 187 (85.7%) knew about ear protectives. Seventy-nine (36%) did not use protectives, ear plugs were the most frequently used type of protectives and 100 (46%) could not give any reason for not using the ear protectives.

DISCUSSION

The prevalence of disabling hearing loss (17%) obtained in our study amongst exposed subjects is much lower than the 38% reported from Saudi-Arabia[9] and the 80% found amongst workers in a textile industry in Lagos, Nigeria.[8] We are unable to offer any reasons for the lower prevalence obtained by us though we used the same diagnostic criteria as the Lagos study.[8]

Though a two-fold risk of disabling hearing loss for exposed workers was noted, the risk was four times higher amongst such subjects in the textile industry. Over half of the impairment could be attributable to noise exposure. It was also found that disabling hearing loss was significantly higher amongst subjects who were older than 35 years; those who had worked for longer than 5 years. These factors were found to be independent of each other. These observations have been reported to be important predictors of hearing loss,[8,10,11] especially that hearing loss tends to develop within the first ten years of work.[11,12]

Furthermore, disabling hearing loss was significantly worse amongst all subjects in the textile industry (23%) compared to the bottling industry (2%), p=0.0000. This may probably be due to noise levels in the textile industry against the background that nearly all (98%) noise-exposed subjects were located in the weaving section, an area, which has been associated with high prevalence rates of hearing loss.[4,5,13]

Given that the ambient noise levels in both industries are similar, there may be some other factors responsible for the higher rate of disabling hearing loss observed in the textile industry. The noise exposure in the textile industry is of a continuous nature with little room for noise free periods compared to the bottling industry where production cycle is in batches with longer noise-exposure free intervals. This may be an important factor.

Though a high percentage of our subjects knew the effects of noise and about ear protective devices, a smaller proportion (64%) of them used them. This rate is comparable to the 61 % obtained amongst airport[10] and textile workers.[12] However, non-provision of these devices and lack of understanding of their importance remain barriers to effective use.

In conclusion, these results show that one out of six subjects in the noise-exposed subjects had disabling hearing loss, and up to 60% of the cases of impairment may be preventable if the workers are adequately protected against excessive noise. A periodic audiologic examination for all workers exposed to high levels of noise, education on the hazards of noise, provision of ear protectives, measures to encourage workers to use the protectives and isolation of noisy machinery are recommended. Special attention should be given to older workers and those who have worked for more than five years.

Acknowledgements:
We wish to thank both management and Staff of the two companies for approval and cooperation in the conduct of the study. We also acknowledge the help of the staff of the Occupational Health & Safety Division of the Public Health Department, Federal Ministry of Health.

Funding
The study was partly funded by the World Health Organization office in Lagos, Nigeria.

Table 1. **Noise Level in Each Industry**

Section	Average Noise level [dBA]
Textile Company	
Noise exposed areas	
Weaving	97
Engineering	105
Generator room	97
Control areas	
Quality control	60
Administration	65
Folding	84
Audiometry room	60
Bottling Company	
Noise exposed areas:	
Engineering	103
Production	94.7
Control areas	
Administration	52
Laboratory	57.2
Finance	55
Warehouse/workshop	84
Audiometry room	50

Table 2. Prevalence of Disabling Hearing Loss Amongst Workers in Two Industries in Lagos

Frequency Exposed	Group (n=217) N(%)	Control Group (n=155) N(%)	P
500Hz	10 (4.6)	3 (1.9)	0.17
1KHz	28 (12.9)	8 (5.2)	0.02
2KHz	13 (6.0)	(1.9)	0.10
4KHz	37 (17.1)	11 (7.1)	0.008
Hearing loss at 4KHz			
Textile Industry	34/95 (35.8)	11/97 (11.3)	0.0001
Bottling Industry	3/122 (2.5)	0/58 (0.0)	0.55

REFERENCES

1. **Davis AC:** The prevalence of hearing impairment and reported hearing disability amongst adults in Great Britain. Int J Epidemiol. 1989; 18:911-17.

2. **Wilson DH, Walsh PG, Sanchez L, Davis AC, Taylor AW, Tucker G. et al:** The epidemiology of hearing impairment in an Australian adult population. Int J Epidemiol 1999; 28:247-52.

3. **Skogstad M, Haldorsen T, Amesen AR:** Auditory function among young occupational divers: a 3-year follow up study. Scand Audiol 2000; 29:245-52.

4. **Nguyen AL, Nguyen TC, Van TL, Hoang MH, Nguyen S, Jonai H et al:** Noise levels and hearing ability of female workers in a textile factory in Vietnam. Ind Health 1998; 369:61-5.

5. **Osibogun A, Ekekewe GO:** Noise-induced hearing loss in a printing industry in Lagos. Journal of Medicine & Medical Sciences. 1999; 1: 76-80.

6. **Thery L, Meyer-Bisch C:** Hearing loss due to partly impulsive industrial noise exposure levels between 87 and 90 dB (A). J Acoust Soc Am. 1998; 84: 651-9.

7. **Houghton W, Westlake H:** Manual for programme outline for rehabilitation for aural casualties both military and civilian. Trans Amer Acad Ophthal Otolaryng Suppl. 1944; 48:1-15.

8. **Osibogun A, Igweze IA, Adeniran LO:** Noise-induced hearing loss among textile workers in Lagos metropolis. Niger Postgrad Med J. 2000; 7: 104-10.

9. **Ahmed HO, Dennis JH, Badran O, Ismail M, Ballal SG, Ashoor A et al:** Occupational noise exposure and hearing loss of workers in two plants in eastern Saudi Arabia. Ann Occup Hyg 2001; 45:371-8.

10. **Hong OS, Chen SP, Conrad KM:** Noise induced hearing loss among male airport workers in Korea. AAOHN J. 1998; 46: 67-75.

11. **Celik O, Yalcin S, Ozturk A:** Hearing parameters in noise exposed industrial workers. Auris Nasus Larynx 1998; 25:369-75.

12. **Chavalitsakulchai P, Kawakami T, Kougmuang U, Vivatjestsadawut P, Leongsrisook W:** Noise exposure and permanent hearing loss of textile workers in Thailand. Ind Health 1989; 27:165-73.

13. **Wu TN, Liou SH, Shen CY, Hsu CC, Chao SH, Wang JH et al:** Surveillance of noise-induced hearing loss in Taiwan, ROC: a report of the PRESS-NHL results. Prev Med 1998; 27: 65-9.