

PREVALENCE AND FACTORS ASSOCIATED WITH HEARING IMPAIRMENT AMONG WORKERS WORKING IN POWER STATIONS IN SARAWAK

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ABSTRACT

A cross-sectional study of hearing impairment due to occupational noise exposure was conducted among 261 workers working in power stations in Sarawak for the year 2003. The purpose of this study was to determine the prevalence of hearing impairment among these workers and factors associated with it. The study was conducted by using available annual audiometric data done in 2003. The result of this study revealed that the prevalence of hearing impairment was 55.9%. Age, duration of employment and types of electricity generator used in the power stations were factors found to be significantly associated with hearing impairment. The water-turbine generator which was found in hydroelectric power station produced less noise and had resulted in lower prevalence of hearing impairment (39.4%) when compared with that of the gas-turbine type (58.3%) which was found in power station using diesel and natural gas ($\chi^2 = 4.195, p < 0.05$). Through logistic regression analysis, variable that had significantly contributed to the hearing impairment was the duration of employment. It is concluded that the high prevalence of hearing loss among these workers is a cause of deep concern. The findings of this study highlighted the magnitude of the problem, the necessity of the application of aggressive hearing conservation program and the need for more studies in this field.

Keywords: *Hearing impairment, noise, power stations.*

INTRODUCTION

Noise induced hearing loss (NIHL) is one of the most prevalent occupational health problem. Implication to such condition is not only limited to the affected worker's health but also increasing the risk of injuries and reducing productivity of the company (Zwerling 1998). The effects could extent beyond the worker's working life and reduce the quality of one's social relationship due to difficulty in communication. NIHL is an irreversible condition but totally preventable through effective hearing conservation program (HCP). There are many electricity generating power stations located throughout the state of Sarawak. The generators are the main sources of excessive noise in these power stations. Hence, workers who work near these machines can be exposed to high noise level and at high risk of suffering from NIHL after prolong exposure. Although workers in the power stations are required to have their audiometric test done regularly, some of the audiometric reports are not being well interpreted and no further follow-up for those with hearing impairment. Furthermore there are only several studies done on the

prevalence and trends of hearing impairment among this group of workers. In view of these scenario, it is important to determine the prevalence of hearing impairment among this group of workers and study the factors associated with it. It is hoped that through this study necessary control measures could be outlined and provide essential information for future research particularly to assess the effectiveness of HCP.

METHODOLOGY

This was a cross-sectional study involving workers working in 4 regional power stations in Sarawak. All workers who worked in the power stations for 6 months or more were included in the study. Data was gathered from the results of available annual audiometric tests done in the year **2003**. Definition of hearing impairment and standard methods used for audiometric testing were based on the Factories and Machinery (Noise Exposure) Regulations 1989. Hearing impairment was defined as average hearing threshold for frequencies **0.5 kHz, 1 kHz, 2 kHz and 3 kHz** equal or more than **25 dB (A)** in one or both ears. These workers were instructed to refrain from excessive noise exposure 14 hours before the tests were conducted. The audiometric tests were conducted by trained technicians. The results of audiometric tests together with worker's particulars were entered into company's audiometric forms. Data was analyzed using Statistical Package for Social Science (SPSS).

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Characteristics of study population and prevalence of hearing impairment were **determined**. Association between hearing impairment and its risk factors i.e gender, age group, ethnic group, type of power station, type of generator and duration of employment was **determined** by using bivariate and multivariate analysis.

RESULTS

A total of 261 respondents from the power stations participated in the study. Majority of the respondents were males (98.9%) from Dayak ethnic group (42.9%) (Table 1). Mean age and duration of employment were **38.3±9.4** years old and **15.6±9.2** years respectively. Results from this study revealed that the prevalence of hearing impairment was 55.9%. Age, duration of employment and type of electricity generator used in the power stations were factors found to be significantly associated with hearing impairment (Table 2). Workers in older age groups were noted to have higher prevalence of hearing impairment as compared to those in younger age groups ($\chi^2=31.9, p<0.01$). Majority of workers who were suffering from hearing impairment (74.4%) were those who had been working for more than 20 years. Results were also showing a trend where the longer the workers worked in the power stations, the higher the prevalence of hearing impairment ($\chi^2= 25.3, p < 0.01$). Hearing impairment was higher among workers who were working in power stations using gas-turbine generator (58.3%) as compared to those working in power stations using the water-turbine generator (39.4%) ($\chi^2= 4.195, p < 0.05$).

Table 1: Characteristics of The Workers In The Study

Variables	Hearing Impairment	
	Yes (%)	No (%)
Ethnic		
Malay	65	24.9
Chinese	83	31.8
Dayak	112	42.9
Indian	1	0.4
Gender		
Male	258	98.9
Female	3	1.1
*Age (years)		
20-30	69	26.4
31-40	73	27.9
41-50	92	35.3
>50	27	10.4
*Duration of employment (years)		
1-10	86	32.9
11-20	93	35.7
>20	82	31.4

The results of area noise monitoring showed that gas-turbine generator in power stations using diesel and natural gas (highest noise level of 110 dB) produced higher noise level as compared to water-turbine generator in hydroelectric power station (highest noise level of 93 dB). Association between duration of employment and hearing impairment remain significant after adjustment for age. Through logistic regression analysis, variable that had significantly contributed to the hearing impairment was the duration of employment.

Table 2: Association of hearing impairment with selected risk factors

Variables	Hearing Impairment	
	Yes (%)	No (%)
Ethnic		
Malay	40 (61.5)	25 (38.5)
Dayak	55 (49.1)	57 (50.9)
Chinese & Others	51 (60.7)	33 (39.3)
Gender		
Male	145 (56.2)	113 (43.8)
Female	1 (33.3)	2 (66.7)
*Age (years)		
20-30	24 (34.8)	45 (65.2)
31-40	39 (53.4)	34 (46.6)
41-50	57 (62.0)	35 (38.0)
>50	26 (96.3)	1 (3.7)
*Duration of employment (years)		
1-10	31 (36.0)	55 (64.0)
11-20	54 (58.1)	39 (41.9)
>20	61 (74.4)	21 (25.6)
Type of power station		
Diesel fuel	65 (59.6)	44 (40.4)
Hydroelectric	13 (39.4)	20 (60.6)
Natural Gas	68 (57.1)	51 (42.9)
#Type of generator		
Gas-Turbine	133 (58.3)	95 (41.7)
Type		
Water-Turbine	13 (39.4)	20 (60.6)

* χ^2 test, $p<0.01$

χ^2 test, $p<0.05$

DISCUSSION

Percentage of workers experiencing hearing impairment in either one or both ears was 55.9% in this study. Prevalence of hearing impairment was high as compared to a similar study done in Trengganu by Iddrus (2002). Prevalence of hearing impairment among workers in the power station in Trengganu was only 18.1%. Therefore HCP conducted in the power stations should be reviewed of its effectiveness and employees compliance. Workers in the older age groups were noted to have higher prevalence of hearing

impairment as compared to those in the younger age groups. It has been suggested that those at extreme ages are more susceptible to noise than others (Kjellberg 2001). The chances of developing a significant degree of hearing loss with high noise exposure increase exponentially with increasing age. Duration of employment appears to be the single most important variable that significantly associated with hearing impairment in this study. Chronic exposure to noise can be hazardous because the effects of noise can accumulate over time (McFadden 1999). Thus the duration of exposure to high level of noise is one of important contributing factors for hearing impairment which is also consistent with previous studies (Raily 1998; Palmer 2002). NIHL usually develops slowly over years. The rate of hearing loss is the greatest during the first 10-15 years of exposure and decreases as the hearing threshold increases. This is different from age-related hearing loss, which accelerates over time (ACOEM 2003). In a study of hearing loss among workers at an oil refinery in Taiwan, Jong-Dar and Jui-Yuan (2003) concluded that there was an increase in hearing threshold shift for high frequencies (3kHz, 4kHz & 6kHz) in workers who had chronic exposure for more than 15 years. Prevalence of hearing impairment was found to be significant among workers at power stations using different types of electricity generator sets. In contrast, prevalence of hearing impairment among workers working in different types of power station was found to be statistically not significant. Thus it was not the type of power station but rather the types of generator set that had determined the noise exposure level and hence the prevalence of hearing impairment. The type of fuel or method used for power generation produced different level of noise. Gas-turbine generator in power stations using diesel and natural gas produced higher noise level as compared to the water-turbine generator. Type of generator in the power stations can be used as proxy for the worker's noise exposure level. At 90 dB (A) and above the risks become material, with majority of individuals accruing a significant hearing impairment (Lutman 2000). In conclusion, the findings of this study highlighted high prevalence of hearing impairment among workers in the power stations that should prompt necessary action to be put in place particularly

installing effective hearing conservation program in the workplace.

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