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Original Article

Burden of Noise Induced Hearing Loss among Manufacturing Industrial Workers in Malaysia

Noraita TAHIR [1, 2], Syed Mohamed ALJUNID [1], Jamal Hisham HASHIM [1], Jaseema BEGUM [2]

1. *United Nation University, International Institute for Global Health, Malaysia*
2. *Dept. of Occupational Safety and Health, Malaysia*

***Corresponding Author:** Email: noraita.tahir@gmail.com

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Abstract

Background: Noise induced hearing loss (NIHL) is the highest reported occupational disease among industrial workers but there is scarcity of data on disease burden in Malaysia. This study estimated the risks and burden of NIHL in manufacturing industries in Malaysia.

Methods: This cross-sectional industrial survey was conducted by interviewing OSH practitioners at 26 industries categorized as food, tobacco, textile, wearing apparel, wood products except furniture, paper, refined petroleum, chemicals, non-metallic mineral, basic metal, fabricated metal, motor vehicle parts. The catchment population is imputed based on stratified sampling design involving 60% of workers diagnosed with NIHL.

Results: A total of 18 industries exposed to noise level of 86-90dBA and 8 industries at more than 91dBA were identified. All industries provide regular awareness training and hearing protection device to their workers but none of them implement attenuation, majority of them (81%) conduct onsite audiometric test annually. In overall, the risk of NIHL and incidence per 100,000 manufacturing workers projected is 8% (139 new cases), the highest risk and incidence is 32% (26) in motor vehicle parts industry; followed by 23% (1140 new cases) in tobacco industry and 23% (269 new cases) in fabricated metal industry. Male workers (89%) were exposed to a greater risk compared to female (11%). It was estimated that 103,000 workers were potentially affected by NIHL in Malaysia.

Conclusion: NIHL is a major burden among industrial workers in Malaysia. Implementation of effective hearing conservation program and self-enforcement of noise regulations by the employer could potentially reduce the burden.

Keywords: Noise, Hearing loss, Manufacturing, Malaysia

Introduction

Malaysia has become part of the world's manufacturer among Asian country. This has put manufacturing industry as a major sector in the foreign direct investment (FDI) in this country. However, this recognition has created occupational safety and health (OSH) issues among the workers while they are at work. These emerging OSH issues impacted additional noise sources, use of hazardous material, insufficient number of OSH competent person, lacking of competent service provider and more workers were at risk in developing noise induced hearing loss (NIHL)(1). Other economic sectors that are also at risk of occupational noise were agriculture, mining, service sector and utility. But, there were limited number of NIHL cases reported to the authority in this sectors compared to manufacturing (1,2,3). NIHL has been the most common occupational health problem in the

world. A study on global burden of occupational NIHL in Malaysia by World Health Organization (WHO) calculated the attributable fraction (AF) of adult-onset hearing loss were highest (34%) in male adult age ranging from 15 to 29 years old. The percentage of AF became smaller as the adults grow older for instance, 8% in female adult age ranging 60 to 69 years old (2).

In Malaysia, hazardous noise were enforced according to The Factories and Machinery (Noise Regulation) 1986. The regulations aimed to protect workers from excessive noise while at work and to prevent workers being affected by NIHL. This common disease has shown a raising trend in the list of occupational disease under the Department of Occupational Safety and Health (DOSH) since more than a decade ago. NIHL was the highest reported occupational disease cases compared to other diseases such as muscular skeleton, back pain, skin and lung disease (2). This trend has resulted to a significant increase of eligibility for compensation from the Social Security Organization (SOCSO) from year to year. Despite the increase of awareness to notify NIHL cases, the number of workers with NIHL is not well established.

This study aimed to estimate the total number of workers exposed to occupational noise and implementation of hearing conservation program in manufacturing industries in Malaysia.

Materials and Methods

This cross-sectional study was carried out from November 2012 until March 2013 at 26 manufacturing industries with highest reported NIHL cases to DOSH in Malaysia. The sampling frame consisted of 26 Occupational Safety and Health (OSH) practitioner representing the employer or owner of the industries were grouped (5) into food (5 industries), tobacco (1 industry), textile (2 industries), wearing apparel (1 industry), wood products except furniture (1 industry), paper (2 industries), refined petroleum (2 industries), chemicals (3 industries), non-metallic mineral (1 industry), basic metal (3 industries), fabricated metal (4 industries), motor vehicle parts (1 industry). All the industries were stratified in four regions namely Northern (Pulau Pinang), Central (Selangor), Southern (Johor) and East (Terengganu and Pahang).

Social demographic characteristics, level of noise exposure from noise monitoring report, audiometric test results, provision of hearing protection devices, awareness training and attenuation of hearing protection device and number of workers exposed to noise more than action level data obtained from questionnaires administered by the OSH practitioners. The OSH practitioners reviewed all relevant documents such as noise monitoring report, audiometric test report, training log and hearing protection device distribution inventory and completed the questionnaires within a week.

In this study, NIHL cases were obtained from the list of occupational diseases investigated and compiled by Occupational Health Division of DOSH headquarters. The total of NIHL cases reported in the relevant industries were food (30 cases), tobacco (29 cases), textile (40 cases), wearing apparel (32 cases), wood products except furniture (6 cases), paper (36 cases), refined petroleum (30 cases), chemicals (41 cases), non-metallic mineral (6 cases), basic metal (89 cases), fabricated metal (22 cases) and 11 NIHL cases in motor vehicle parts. The total employment and number of workers exposed to noise according to their respective work station were determined from the Human Resource Department in each industry. However, the total population of manufacturing workers were obtained from the Economic Census (6).

The risk of NIHL was calculated from the total of NIHL cases in current year and total manufacturing workers exposed to noise in the same year. Where else, the incidence rate was estimated from the total NIHL cases and total population of manufacturing workers. Further to that, potential workers affected with NIHL were estimated from the percentage of exposed workers and total population manufacturing workers.

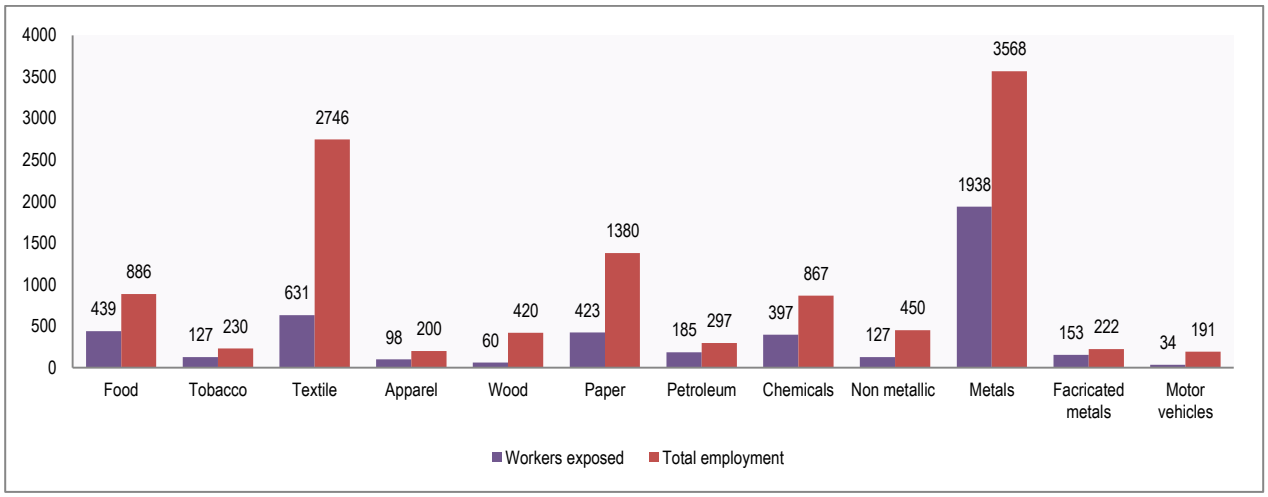

Fig. 1: Distribution of workers exposed to noise (more than action level) and total employment by industry

Results

A total of 26 OSH practitioners with working experience ranging from 1 to 31 years in occupational safety and health were involved in this study. They were predominantly male (85%) and Malays (81%).

Almost 70% of the manufacturing industries were exposed to noise level in the range of 86-90 dBA (lower range) including tobacco, textile, wearing apparel, paper, refined petroleum, sheet glass and fabricated metal factories. The noise exposure level in the wooden pallet and automotive filter factories were at the higher range of 91-140 dBA (higher range).

In food manufacturing industry, three palm oil processing plants had higher range noise level and two factories manufacture of chocolate and animal feed had lower range noise level. In chemical industries, two factories manufacturing pesticides and industrial gas exposed to lower range noise level except for engineering plastic factories that were at higher range. In basic metal industries, manufacturer of magnetic wire and steel bar (southern region) were identified having higher range noise level, in contrary to the other three steel bar manufacturers.

All responded industries conducted regular awareness training on noise exposure and hearing protection to the workers. Hearing protection device (HPD) was distributed to all workers exposed to noise (7). About half of respondents provided ear plug and the other half provided both ear plug and ear muff for their workers. HPD utilizes by all responded industries attenuate the employee exposure to noise level below PEL or action level. Unfortunately, none of the industries validate the attenuation of HPD fitted at each worker.

A total of 4612 (40%) people working in noisy environment more than action level as in Fig. 1. Of this, 8% (372) were diagnosed as NIHL cases that affected more male workers (89%) than female (11%). Regular audiometric test were implemented in majority (85%) responded industries in compliance of noise regulations. A number of factories failed to comply for some reasons.

Table 1 showed the most high risk workplace to excessive noise exposure was in the automotive filter manufacturer (32%) compared to tobacco and fabricated metal (23% respectively); paper (13%) and chemicals (12%). Risk of excessive noise exposure in other type of manufacturing industries were ten percent and below.

However, tobacco manufacturing industries noted the highest incidence (1140 per 100,000 workers) among all industries. This were followed by refined petroleum (434 per 100,000 workers) and textile (343 per 100,000 workers) incidence. In overall, total employment of all manufacturing industries were 267,964 workers and resulted 139

incidence of NIHL in every 100,000 workers. The percentage of workers exposed to noise level more than action level was about 40% and the total potential workers affected with NIHL were estimated to be 103,000 workers.

Table 1: The Risk, Incidence Rate and Potential NIHL cases in Manufacturing Industries in Malaysia

Industrial classification	Total working population**	Risk (%)	Incidence rate (per 100,000 workers)	Potential NIHL cases
Food	51466	7	58	25501
Tobacco	2543	23	1140	1404
Textile	11666	10	343	6549
Wearing apparel	40022	10	80	5445
Wood	3330	6	180	1632
Paper product	28725	13	125	9623
Refined Petroleum	6915	8	434	1996
Chemicals	30445	12	135	17623
Non metallic mineral	9332	5	64	2634
Basic metal	33453	4	266	18170
Fabricated metal	8182	23	269	5639
Motor vehicle	41885	32	26	7456

** Economic Census 2011 (6)

Discussion

Manufacturing industries has been the most popular industrial sector among researchers in the studies of prevalence of NIHL and noise level in Asia. Various research methodologies have been applied with similar objectives and resulted high prevalence of NIHL.

In this study, noise exposure level was obtained from single noise exposure measurement according to the requirement of Noise Regulations. This is similar to a study in India which noise was reported in dBA. Single noise levels were measured in the driver's cabin at the time of starting the engine, raising the engine, putting all gears appropriately (8). Otherwise, in Mainland China, noise levels at each site were sampled three times per minute and time-weighted averages (TWA) were calculated. Cumulative noise exposure was reported in Leq (dBA) (9).

Active participation from the industrial player not only showed their compliance-conscious but also indicated the awareness on noise exposure and NIHL issues among them. This attitude is crucial to be able to manage noise hazards and risks effectively.

In textile industries, the noise exposure level in Malaysia was lower (86 - 90dBA) as to compare to textile industries in Mainland China (84 – 103 dBA) (9) and Pakistan (88 – 104dBA) (10). The highest noise exposure level was at the weaving mills (103 Leq dBA), however there was a limited data on the highest point of exposure in this study. Further investigations were proposed to identify the difference. The low noise exposure level in this study has resulted only 10% of workers affected with NIHL compared to 24% in China (9) and 17% in Pakistan (10).

The refined petroleum industry in Malaysia marked noise level ranging 86 to 90 dBA of exposure, about the same range for oil refinery in Taiwan (73 – 89dBA)(11) and Iran (57 – 93 dBA)(12). However, higher prevalence of NIHL among workers in Taiwan and Iran marked at 38% and 39% respectively, compared to this study (8%).

Although the highest noise level in the fabricated metal industries in Malaysia were 90dBA, noise mapping in the same industry in Nigeria showed noise levels varying from 49 to 93 dBA (13). Despite the lower noise level in Malaysia, the risk of

NIHL is high (32%). This might be due to the workforce reduction exercise implemented in the industry. However, the prevalence of NIHL among the workers in Nigeria were 28.2% had mild to moderate sensorineural hearing loss in their better ear and 56.8% of them had mild to moderate sensorineural hearing loss in their worse ear.

Noise regulations required the employer to provide their workers with HPD to protect them against noise effects. In reality, most of employer practiced administrative control such as ear plug and ear muff, as their preferable measures. Engineering control was rather costly and time consuming but data on this issue were limited and further investigation for the cost of control measures in the manufacturing industries are to be explored.

Every worker who exposed to excessive noise was provided with HPD to protect them against noise-induced hearing loss. It is vital to select the right type of HPD according to the work environment to ensure effective attenuation levels. High performance of HPDs is more about how HPD fit the workers. However, validation on attenuation of HPD was not in the compliance list. This has resulted none of the employer implement it. The author in opinion that ear fit validation shall be conducted to generate personal attenuation rate for each worker. The validation activity measures the adequacy of protection in relation to the noise hazard at the place of work and further training needs on fitting and usage of HPD. In Canada, a study was carried out in relation to evaluating the performance of HPD by using individualized attenuation data and performance rating for HPD. This study resulted a fluctuations graphs, attributed to variations in the low-frequency content in the noise for ear muffs as well as poor insertion and/or fitting of earplugs (14).

Among the industries that involved in this study, 15% of employers were not able to implement regular audiometric test as required by noise regulations. The incompliance was related to the limited number of noise competent person, audiometric testing centre and the location of the factories. Currently, the ratio of audiometric testing centre and the total number of registered factories in Malaysia were inappropriate (<1%) (1). Industries that were located at rural area and out circuits paid higher service charges and travelling fee. Despite the higher service charges, the industries were to bid for service provider schedule all year round. Encouragement to develop audiometric service as one of business options can be made by creating support-compliance incentives.

This study was conducted in collaboration with DOSH Malaysia for retrieving noise management records at the specific industries. A large proportion of the information was obtained from the OSH practitioners and the questionnaire drawn up for this study. There were some limitations relating to the information gathered. Based on the survey, the total number of workers affected by NIHL and referred to medical centre was very low. NIHL new cases were identified from the form JKKP 7 of which, some of the reports were only based on audiometric test results in compliance of noise regulations. Diagnoses from the othoringologist after the test were more appropriate for the prevalence data.

Conclusions

The manufacturing industrial workers in Malaysia were highly exposed to noise more than action level and majority of them were male workers. Therefore, implementation of effective hearing conservation program and self-enforcement of noise regulations by the employer could potentially reduce the burden. Apart from that, it is timely to integrate the existing noise regulation into the Occupational Safety and Health Act (OSHA) as strategized in the Malaysia OSH Master Plan 2015.

Ethical considerations

The Research Ethics Committee of the Medical Faculty, National University of Malaysia approved the study proposal. Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication

and/or submission, redundancy, etc.) have been completely observed by the authors.

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