ORIGINAL ARTICLE

Predictors of Knowledge, Attitude and Practice of Noise Induced Hearing Loss among Workers in an Automotive Industry in Malaysia

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ABSTRACT

Introduction: Automotive workers are exposed to high level of noise as part of their daily work routine. Determining the predictors of knowledge, attitude and practice of noise induced hearing loss (NIHL) among automotive is important because it may help prevent a serious irreversible disease known as noise induced hearing loss. **Methods:** A cross sectional study in an automotive plant in Shah Alam, Selangor was conducted from January 2015 to May 2015 among 550 workers with response rate of 83%. Respondents were workers from the operational divisions, selected based on simple random sampling using validated, published (1) and reliable self-administered questionnaire that focused on knowledge, attitude and practice towards NIHL. **Results:** Logistic Regression was used to determine predictors and the predictors for satisfactory knowledge on noise induced hearing loss were perceived noise exposure as harmful noise (AOR=0.54, 95%CI = 1.02 - 3.41), years in service for more than 10 years (AOR=2.79, 95%CI = 1.71 – 4.56) and had received training on safety (AOR=1.94, 95%CI = 1.12 – 3.36). For satisfactory attitude the predictors were perceived noise exposure as harmful noise (AOR=3.79, 95%CI = 2.36 – 6.10), years in service for more than 10 years (AOR=0.56, 95%CI = 0.34 – 0.83) and tertiary level of education (AOR=3.61, 95%CI = 1.67 - 7.81). As for satisfactory practice the predictors were more than 10 years in service (AOR=2.16, 95%CI = 1.24 – 3.75) and had received training on safety (AOR=1.94, 95%CI = 1.26 – 2.99). **Conclusions:** The results from this study may be used to set appropriate measures and identify workers who are at risk of developing noise induced hearing loss.

Keywords: Noise induced hearing loss, Automotive workers, Predictors

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INTRODUCTION

Noise induced hearing loss is the gradual bilateral sensorineural hearing loss that occurs due to the effect of workplace noise. In all workplaces there is always risk of exposure to occupational noise but some workers are more susceptible to a higher exposure of workplace noise in comparison to others. Malaysia being a rapidly fast growing economy recorded an increase in car registrations and higher production of locally made automobiles (2). This high demand for automobiles places an automotive worker to a higher rate of exposure thus placing workers at a higher risk of developing sensorineural hearing loss due to prolonged exposure. The Department of Occupational Safety and Health (DOSH) reported that for 2015 the most common (83.7%) of occupational diseases reported and investigated was noise induced hearing loss. The importance of being able to help reduce the risk of developing sensorineural hearing loss has never been more pressing than ever before (3). The international acceptable threshold of noise has been set to 85dB (A) and below. The World Health Organization (WHO) reported that for 2010 there are currently 360 million people suffering from hearing loss, of which about 85% of this has been work related (4). In the United States alone there have been estimates of up to 30 million workers who are exposed to hazardous noise at the workplace (5). In the United States for the year 2010 alone more than $242 million US Dollars were spent on loss-hearing treatment and claims alone (6). For the automotive industry alone there are more than 6 million workers who are at risk of noise induced hearing loss and workers in the body assembly and stamping are at the highest exposure with continuous noise levels of more than 100dB(A). The International Journal of

Automotive Technology and Industry recently reported that for 2013 alone there were a total of 80.2 million cars sold worldwide. This was an increase 4.2 percent which translated to 2.6 cars being sold per second in 2013. The issue has been found to be a result from the knowledge, attitude and practice of the workers and has been researched and studied in several countries (7-9). Research has also found that workers who are high risk to develop noise-induced hearing loss should be identified (10).

The risk of developing noise induced hearing loss can be dramatically brought down by the use of hearing protection such as earplugs and earmuffs. A proper health screening should also be done to those who are suspected of showings signs of early hearing loss so that adequate treatment can be given (11).

Some studies have also established the link between the level of attitude to the practice towards noise induced hearing loss. It has been found that workers had a poor attitude in the usage of personal protective equipment. In a study conducted in Thailand 28 noise exposed workers in the Chiang Mai Province were interviewed and it was found that the majority (>90%) were categorized as having poor attitude towards usage of personal protective equipment (12) which demonstrates that that the basic understanding and attitude will have an effect on the use of equipment that may lower the risk of developing noise induced hearing loss. Hence, the aim of this study was to determine the level of knowledge, attitude and practice of noise induced hearing loss and their predictors among the automotive workers in Selangor.

MATERIALS AND METHODS

A cross sectional study was conducted from January 2015 to May 2015, involving workers from the operational departments of an automotive company in Malaysia, that was selected as it is the biggest automotive company in the country. The inclusion criteria were current employees who have been employed for 2 years or more, permanent staff, full time and Malaysian whereas the exclusion criteria were any history of hearing loss or deformity or those on overseas training or medical leave. The sample size for this study were 550 respondents, which was obtained using the two proportions formula (13) and the respondents were selected based on simple random sampling, and data was collected using an adapted, validated and reliable self-administered questionnaire. The questionnaire consisted of questions on sociodemographic, years in service, training in safety, perceive noise exposure, 10 questions for knowledge, 20 questions on attitude and 10 questions on practice of workers towards noise induced hearing loss. The respondents were approached during their morning daily break. The workers would each have a specific congregation area and the team leader of each cluster of workers would then distribute the questionnaire and collect them at the end of the break from the selected respondents. Respondents were not allowed to keep the questionnaire or take it home to be returned at a later date. From the adapted questionnaire (1) the minimum score needed to be classified as satisfactory for each component was 75% and above. The dependent variables were level of knowledge, level of attitude and practice on noise induced hearing loss and the independent variables were age, gender, ethnicity, level of education, perceived noise exposure, years of service and training on safety. Experts reviewed by occupational health physician on the questionnaire was also being conducted and necessary corrections had been made. The Cronbach's Alpha for knowledge questions was 0.75, attitude questions was 0.83 and practice questions was 0.81. Analysis was done using Statistical Package for Social Sciences (SPSS) Version 22, Chi-square test was used to measure association and Binary Logistic Regression was used to determine predictors of satisfactory knowledge, attitude and practice on NIHL. Ethical approval was obtained from the Human Ethical Committee of the Universiti Putra Malaysia (UPM) and permission to conduct the study was consented by the board of the automotive company.

RESULTS

The response rate in this study was 83% resulting in 457 respondents. The median age of the respondents was 40 years old (IQR ± 25th, 75th; 31, 47). The reported ages had the youngest respondent was at age 19 and the oldest respondent at 59 years old. More than half (50.3%) of the respondents were aged 40 years and above. Male formed the majority (99.6%) of the respondents with only 0.4% respondents being female. For the education levels there were diverse among the respondents but the majority of them (89.9%) had obtained education up to the SPM (O-level) certificate. The smallest number of respondents (2.0%) had reported the lowest level of education, which was PMR. Higher-level certificates or tertiary education were obtained only by 8.1% of the respondents.

The majority of respondents (71.8%) had been working in the company for 11 years or more. The remaining respondents were those of experience up to 10 years in service. The perceived noise exposure as reported by the respondents showed a large group (57.8%) of them noting that their work area is noisy but not harmful. The others were closely divided regarding perceiving that their workplace was noisy. The majority of respondents (67.2%) had acknowledged to have received training regarding noise induced hearing loss.

Only 21.7% of the respondents had satisfactory level of knowledge. Table 1 below shows the significant

association between factors with knowledge on noise induced hearing loss. There was a significant association between age group and level of knowledge (X^2=17.831; *df* 3; p<0.001), perceived noise exposure (X^2=6.237; *df* 2; p=0.044), years in service (X^2=618.588; *df* 3; p<0.001) and training on safety (X^2=9.129; *df* 1; p=0.001) with the knowledge on noise induced hearing loss.

The predictors for satisfactory level of knowledge are shown in Table 2. Those who have been in service for 10 years and more are three times more likely to obtain satisfactory knowledge in comparison to those who have work 10 years or less (AOR = 2.787, 95% CI = 1.708 - 4.550). As for training on safety, it showed that those who reported receiving training are two times more likely to obtain satisfactory knowledge on noise induced hearing loss in comparison to those who did not received training on safety (AOR = 1.938, 95% CI = 1.119 - 3.355).

The level of attitude on noise induced hearing loss in this study was 39.8%. There was a significant association between level of education with and the level of attitude on noise induced hearing loss. (X^2=20.934; *df* 3; p<0.001), perceived noise exposure (X^2=54.560; *df* 2; p<0.001) and years in service (X^2=19.464; *df* 3; p<0.001). The Table 3 shows that the significant association between factors with attitude on noise induced hearing loss.

Table 1: Association between factors with knowledge on noise induced hearing loss.

	Knowledge						
	Unsatisfactory		Satisfactory		X^2	*df*	*p*
	n	(%)	n	(%)			
Age Group					17.831	3	**<0.001***
18-29	88	(24.6)	11	(11.1)			
30-39	108	(30.2)	20	(20.2)			
40-49	120	(33.5)	49	(49.5)			
50 and above	42	(11.7)	19	(19.2)			
Perceived noise exposure					6.237	2	**0.044***
Not noisy	74	(20.7)	15	(15.2)			
Noisy but not harmful	196	(54.8)	68	(68.7)			
Noisy and harmful	88	(24.5)	16	(16.1)			
Years in service					18.588	3	**<0.001***
Below 5 years	60	(16.8)	8	(8.1)			
6-10 years	52	(14.5)	9	(9.1)			
11-20 years	139	(38.8)	30	(30.3)			
More than 20 years	107	(29.9)	52	(52.5)			
Training on Safety					9.129	1	**0.001***
Yes	228	(63.7)	79	(79.8)			
No	130	(36.3)	20	(20.2)			

p value = 0.05

Table 2: Predictors of Satisfactory Level of Knowledge on Noise Induced Hearing Loss

Factors	B	SE	Wald	*df*	*p*	AOR	95% CI	
							Lower	Upper
Perceived noise exposure								
Not harmful noise						1		
Noisy and harmful	-0.619	0.309	4.012	1	**0.045**	0.539	0.294	0.987
Years in service								
Up to 10 years						1		
10 years and more	1.025	0.250	16.82	1	**<0.001**	2.787	1.708	4.550
Training on Safety								
No						1		
Yes	0.662	0.280	5.579	1	**0.018**	1.938	1.119	3.355

Table 3: Association between factors with attitude on noise induced hearing loss.

	Unsatisfactory		Satisfactory		X^2	*df*	*p*
	n	(%)	n	(%)			
Level of Education					20.934	3	**<0.001***
PMR	4	(1.5)	5	(2.8)			
SPM	260	(94.5)	151	(83.0)			
Diploma	10	(3.6)	14	(7.7)			
Degree	1	(0.4)	12	(6.5)			
Perceived noise exposure					54.560	2	**<0.001***
Not noisy	76	(27.6)	13	(7.1)			
Noisy but not harmful	164	(59.6)	100	(54.9)			
Noisy and harmful	35	(12.8)	69	(38.0)			
	275	(100.0)	182	(100.0)			
Years in service					19.464	3	**<0.001***
Below 5 years	39	(14.2)	29	(15.9)			
6-10 years	45	(16.4)	16	(8.8)			
11-20 years	115	(41.8)	54	(29.7)			
More than 20 years	76	(27.6)	83	(45.6)			
	275	(100.0)	182	(100.0)			

p value = 0.05

Table 4: Predictors of Satisfactory Level of Attitude towards Noise Induced Hearing Loss

Factors	B	SE	Wald	*df*	*p*	AOR	95% CI	
							Lower	Upper
Perceived noise exposure								
Not harmful noise						1		
Noisy and harmful	1.333	0.242	30.233	1	**<0.001**	3.793	2.358	6.101
Years in service								
Up to 10 years						1		
10 years and more	0.599	0.206	8.444	1	**0.004**	1.820	1.215	2.725
Education								
Secondary						1		
Tertiary	1.282	0.394	10.602	1	**0.001**	3.605	1.666	7.802

As for predictors of satisfactory level of attitude that is illustrated in Table 4, the odds of obtaining a satisfactory attitude towards noise induced hearing loss was four times higher in those who perceived noise exposure as noisy and harmful in comparison to those who perceived noise exposure not harmful noise (AOR = 3.793, 95% CI = 2.358 - 6.101). Those who worked 10 years and more were two times more likely to have a satisfactory attitude towards noise induced hearing loss in comparison to those who worked 10 years and less (AOR = 1.820, 95% CI = 1.215 - 2.725). Those who received tertiary education were three times more likely to obtain a satisfactory attitude in comparison to those who received secondary education. (AOR = 3.605, 95% CI = 1.666 - 7.802). The Hosmer and Lemeshow test also showed that the model fits well (p = 0.787).

Where as the level of practice on noise induced hearing loss was 38.1%. Table 5 shows that the significant association of factors with practice toward noise induced hearing loss where there was a significant association between age group and the level of practice on noise induced hearing loss (X^2=15.153; *df* 3; p=0.002), years in service (X^2=14.680; *df* 3; p=0.002) and training on safety (X^2=12.234; *df* 1; p<0.001).

Table 6 shows that the predictors for satisfactory level of practice of workers towards Noise Induced Hearing Loss. The odds of obtaining satisfactory level of practice on noise induced hearing loss was two times higher in those who worked over 10 years in comparison to those who worked less than 10 years (AOR = 2.159, 95% CI = 1.244, 3.746). Those who reported receiving training on

Table 5: Association between factors with practice on noise induced hearing loss.

	Practice				X^2	*df*	*p*
	Unsatisfactory		Satisfactory				
	n	(%)	n	(%)			
Age Group					15.153	3	**0.002***
18-29	76	(26.9)	23	(13.2)			
30-39	77	(27.2)	51	(29.3)			
40-49	90	(31.8)	79	(45.4)			
50 and above	40	(14.1)	21	(12.1)			
Years in service					14.680	3	**0.002***
Below 5 years	55	(19.4)	13	(7.5)			
6-10 years	39	(13.7)	22	(12.6)			
11-20 years	103	(36.4)	66	(37.9)			
More than 20 years	86	(30.5)	73	(42.0)			
Training on Safety					12.324	1	**<0.001***
Yes	173	(61.0)	134	(77.0)			
No	110	(39.0)	40	(23.0)			

p value = 0.05

Table 6: Predictors of Satisfactory Level of Practice of workers towards Noise Induced Hearing Loss

Factors	B	SE	Wald	*df*	*p*	AOR	95% CI	
							Lower	Upper
Years in service								
Up to 10 years						1		
10 years and more	0.770	0.281	7.487	1	**0.006**	2.159	1.244	3.746
Training on Safety								
No						1		
Yes	0.664	0.222	8.982	1	**0.003**	1.942	1.258	2.998

safety were two times more likely to obtain a satisfactory level of practice in comparison to those who did not (AOR = 1.942, 95% CI = 1.258, 2.998). The Hosmer and Lemeshow test also showed that the model fits well (p = 0.926).

DISCUSSION

The most important predictor of satisfactory knowledge on noise induced hearing loss was years in service. The likelihood of having satisfactory knowledge on noise induced hearing loss increased three folds when respondents were in service for 10 years or more. This was also seen in other studies where the knowledge increased with years in service and it was also seen that those with more years of service produced more satisfactory knowledge than others (3, 14). Years in service plays an important role in determining satisfactory knowledge as the number of years adds to a higher level of experience regarding the surrounding work area and also warnings. Repetitive exposure to monitoring and random checks by employers also ensures that those with more years in service are able to produce more satisfactory knowledge results than others with considerably lesser years in service. Training on safety was predicted to increase the likelihood of obtaining satisfactory knowledge on noise induced hearing loss by two folds. Similar studies also noted that those who had received training on safety were more likely to have a satisfactory knowledge on noise induced hearing loss (15-16). Training on safety plays an important role in any organization and more in factories and plants dealing with machinery. The protective mechanism of an individual increases the likelihood of them paying more attention and receiving more information when undergoing training on safety. This was also noted in a study where it was noted increases the amount of knowledge of the workers who attend and receive training on safety, thus elevating their satisfactory level of knowledge on noise induced hearing loss (17). Perceived noise exposure was found to be protective. This showed that those who perceived noise exposure as not harmful were 50% more likely to obtain satisfactory knowledge on noise induced hearing loss. However this was different in another study where the likelihood of satisfactory knowledge increased five folds when respondents were able to perceive noise exposure as harmful (18). The difference in the two studies may

arise from the background of the respondents where the majority of those in this study had up to secondary level of education while those in the other study were among who had tertiary level of education which might have elevated their ability and knowledge on noise induced hearing loss to be better than this study.

Education is one of the most important predictor for satisfactory level of attitude on noise induced hearing loss. Those with tertiary level of education were four folds more likely to obtain a satisfactory attitude on noise induced hearing loss in comparison to those only up to secondary level. A study also found that those with a higher level of education were found to have satisfactory attitude on noise induced hearing loss, (19) and this predictor is important as we are able to see that with the higher progression of education the higher the likelihood of satisfactory attitude on noise induced hearing loss. Those with a higher level of education are able to understand better regarding the effects of noise induced hearing loss and this result can be seen through the satisfactory attitude of the workers on noise induced hearing loss (9). The second important predictor that increases the likelihood by four folds of obtaining a satisfactory attitude on noise induced hearing loss is those who perceived noise exposure as harmful. Studies noted that perceiving the proper noise exposure has an effect on the attitude on noise induced hearing loss, and those who perceived noise exposure as not harmful had poor attitude on noise induced hearing loss (14, 20). This predictor can be explained as those who are able to perceive their work area as noisy and harmful would take the necessary measure to ensure that they have the right attitude with dealing on noise induced hearing loss. This effect creates awareness, which elevates respondent's attitude, and a direct result can be seen in their satisfactory attitude on noise induced hearing loss. Another predictor of satisfactory attitude was more than 10 years in service that increased the likelihood by two folds. A study noted that quarry workers who had been in the service for more than 5 years had better attitude on noise induced hearing loss in comparison to others who had worked lesser (21). This predictor can be explained that those working over a longer period of time had more exposure to the working environment. The increase of service years also allows these workers to have had gone through multiple sessions of training and courses on noise induced hearing loss. The likelihood of the workers having undergone audiometric testing would also be higher over many years, thus enabling a transfer of information from the occupational health doctors to the workers.

The main predictor of satisfactory level of practice was, those with more than 10 years in service. Their likelihood increased two folds to obtaining satisfactory practice. A study noted that this likelihood was more than four folds for respondents to have satisfactory attitude (22). This attribute can be explained that the assimilation of the workers to the working environment over the many years contribute to the increase in the practice of noise induced hearing loss. With the more strict enforcement of rules and regulations through laws such as the Factories and Machineries Act, and monitoring by the Department of Safety and Health (DOSH), workers are more aware regarding their practice. A study also showed workers who had worked over a longer duration perceived risk much higher to contract noise induced hearing loss (8). This resulted in the workers having satisfactory practice in terms of utilizing personal protective equipment's such as earplugs and earmuff to protect them from excessive noise exposure. This was however different in another study where they were able to predict that those working over a longer duration had better practice on noise induced hearing loss but the increase was minimal (5.1%) (11). That meant that the majority of workers (94.9%) who reported to using the personal protective equipment were observed and showed that 31.7% who are workers with more than 5 years in service only used the hearing protectors. This occurrence can be explained as misreporting of the respondents. The years in service are still an important predictor to satisfactory practice on noise induced hearing loss. Training on safety is also an important predictor in the practice on noise induced hearing loss. The likelihood of obtaining satisfactory practice increased two fold when respondents received training on safety. It was also observed that workers who underwent intensive training on safety had a two fold increase in the satisfactory practice on noise induced hearing loss, which was measured through the usage of hearing protective devices (22). Training on safety plays an important role in the increment of satisfactory practice on noise induced hearing loss for workers (23). This can be explained as those receiving training are refreshed regarding the good practices and also the benefits and advantages of doing so. The more training a worker attends should enable the worker to obtain more satisfactory practice on noise induced hearing loss.

There was however certain limitations in conducting the study notably the cross-sectional study design. Infer causal relationships will not be possible as the study design is a cross sectional study. There could have been a possibility of information bias as the data were all self-reported. More respondents would have contributed to a better output in determining predictors. With diseases such as Noise-Induced Hearing Loss a more extensive and in-depth study such as a cohort would yield more data and results. The study also included only a single automotive company and may not be representative of the general automotive industry in Malaysia.

CONCLUSIONS

The results from this study may be used to set appropriate measures and identify workers who are at risk of developing noise induced hearing loss. The overall

satisfactory level for knowledge was 21.7%, attitude was 39.8% and practice 38.1%. The predictors for level of knowledge on noise induced hearing loss was years in service and training on safety. As for level of attitude they were perceived noise exposure, years in service and education. The predictors for level of practice was years in service and training on safety.

The findings of this study can help planners from the automotive organizations to develop public areas identified. Specialized training and specifically tailored to the identified workers at risk can be developed by the employer to ensure a more sustainable, protected and informed workforce. Data from this study indicate some predictors for the satisfactory knowledge, attitude and practice on noise induced hearing loss.

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