HEARING CAPACITY IN RELATION TO NOISE LEVELS AND OTHER POTENTIAL RISK FACTORS AMONG PRESS PART MACHINES WORKERS IN AUTO PART FACTORY IN SAMUTPRAKARN, THAILAND, 2012

Yupha Pakakate

College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand

ABSTRACT:

Background: This study evaluated associations between abnormal hearing and occupational noise measurement, socio demographic characteristics, protective behavior, and other factors that effect on the employees who worked at press parts factory; automotive part, motorcycle part, and fuel tank part in Samutprakran province Thailand.

Methods: Three hundred and fifty nine participants who worked at the Auto part factory more than 2 years were selected in the study. They were interviewed by using a standardized pre-tested questionnaire. Hearing tests and noise measurements were conducted in 2012.

Results: Most respondents were male (83%), aged 34 - 41 years. About 92% of them did not use personal protective equipment (PPE) foam. For experience with pressing part, they have done this for more than 9 years (60.2%). Result also showed the married, income more over than 15 THB, were significant, there were *P-value* 0.038, 0.002, 0.006 respectively (p< 0.05), noise-sensitive, married, education, there were *P-value* 0.015, 0.116, 0.148 (p< 0.15). The association between age and hearing capacity test in 2012 was OR=1.311, p<0.001, CI=1.227-1.401. However, no statistically significant associations between the PPE training, press experience more than 9 years, over noise standard, press experience more than 9 years, PPE training, attitude, average noise level. Prevalence of abnormal hearing was 20.9%. Characteristics associated with hearing loss differed substantially from year to year. Abnormal hearing was positively associated with the high level of workplace noise, but not with the average noise level. Unmeasured factors may also be associated with abnormal hearing.

Conclusion: Further research, which incorporates multiple regression analysis, is needed to confirm associations with abnormal hearing at the study location and elsewhere in Thailand.

Keywords : Hearing Capacity Test, Noise levels, factors, Press part machine, Thailand

DOI: 10.14456/jhr.2015.77 *Received: November 2013; Accepted: December 2015*

INTRODUCTION

In Thailand, the automotive industry has become more export oriented since 1996. Vehicle export units increased from 14,000 units in 1996 to 152,800 units in 2000 [1]. The automotive industry in Thailand is expected to produce almost 2,000,000 units in 2012, representing a 33 percent increase compared to the same period in 2011. This increasing in the number of export units is the result of new vehicles investment and brand new car production in the country [2].

Even though the Thai automotive industry employs high technology in many parts of the production lines, staff manpower is still very important for operating and controlling the running machinery [3]. Most of staff have the alternative for their work in two shifts between 08:00 - 17:00 and 20:00 - 05:00 hrs. While working on the job site, the operation staff will be affected by the noise from operating machines for approximately 8 hours continuously. A noise measurement investigation

* *Correspondence to: Yupha Pakakate*
E-mail: yumi_love_sut @hotmail.com

Cite this article as: Pakakate Y. Hearing capacity in relation to noise levels and other potential risk factors among press part machines workers in auto part factory in Samutprakarn, Thailand, 2012. J Health Res. 2015; 29(Suppl.2): S251-5. DOI: 10.14456/jhr.2015.77

into 55 operation sites at an auto part factory in Samutprakran province revealed that 22 of the sites (40% of the monitoring area) measured average noise between 90 – 94.5 dB(A) throughout an 8 hour shift [4].

Based on the results of the medical examination conducted in 2012, hearing capacity test results found that out of 379 employees [5] who took the hearing test, 58 persons were found to have irregular hearing: in the left ear, at a frequency of 3000 Hz, was found to be irregular 0.3% of the total. At hearing frequency 4000 Hz were found to be irregular 0.8%. At hearing frequency 6000 Hz were found to be irregular 4.5%. At hearing frequency 8000 Hz were found to be irregular 0.8%. At hearing frequency 1000,2000,4000,8000 Hz were found irregular 0.5%. At hearing frequency 3000, 4000 Hz was found irregular 0.3%. At hearing frequency 1000-8000 Hz were found irregular 0.8%. At hearing frequency 2000-8000 Hz was found to be irregular 0.3%. At hearing frequency 3000-8000 Hz was found to be irregular 0.3%. At hearing frequency 3000-6000 Hz were found to be irregular 0.5%. At hearing frequency 3000-8000 Hz were found to be irregular 0.8%. At hearing frequency 4000-6000 Hz were found to be irregular 0.5%. At hearing frequency 4000-8000 Hz were found to be irregular 2.1%. At hearing frequency 6000-8000 Hz were found to be irregular 2.6%.

In the right ear at hearing frequency 4000 Hz were found to be irregular 1.06 %. At hearing frequency 6000 Hz were found to be irregular 0.8%. At hearing frequency 8000 Hz were found to be irregular 0.53%. At hearing frequency 4000, 8000 Hz was found to be irregular or 0.27%. At hearing frequency 6000, 8000 Hz were found to be irregular or 1.33%. At hearing frequency 3000, 6000, 8000 Hz was found to be irregular 0.27%. At hearing frequency 1000-8000 Hz were found to be irregular 0.8%. At hearing frequency 3000-6000 Hz were found to be irregular 1.33%. At hearing frequency 3000-8000 Hz were found to be irregular 0.8%. At hearing frequency 4000-6000 Hz were found to be irregular 1.06%. At hearing frequency 4000-8000 Hz were found to be irregular 0.53%.

The proposed study focuses on hearing levels in relation to noise level among the staff who work at the pressing parts production section at the auto part factory, Samutprakran province, Thailand.

Ultimately, this study will provide recommendations and guidelines to reduce the exposure of factory staff to noise levels that exceed noise standards in the automotive and other heavy industries.

MATERIALS AND METHODS

A cross-sectional study based on data collected by hearing capacity tests, noise measurements and a questionnaire on knowledge, attitude, and behavior to prevention hearing loss was conducted in the auto part factory, Bangplee district, Samuthprakarn province, Thailand.

The participants were pressing part workers who have been permanent workers, worked in this parts for more than 2 years, used PPE for the prevention of hearing loss, and having results from hearing capacity tests conducted in 2012.

Hearing test capacity, noise measurement and structured questionnaire was employed with face-to-face interviews. The questionnaire was modified by following World Health Organization (WHO) guidelines on the development of general knowledge, attitude, and practice (KAP) survey [6].

A structured questionnaire with the socio–demographic characteristics of pressing part workers in the area of study, knowledge, attitude, and practice towards using earplugs for hearing loss prevention was used.

SPSS software (with the license of Chulalongkorn University) was used for data analysis. Chi-square test, logistic regression and descriptive statistic were applied in this study.

Ethical consideration

The Ethics Review Committee for Research involving Human Research Subjects, Chulalongkorn University approved this study (Research Number 195.1/55) on September 27, 2013.

RESULTS

Table 1, according to the noise average level in press part working area in 2012, noise levels during

the pressing part process at the auto parts factory comparative with standard found that the minimum of level monitoring at working area was 87.6 dB(A) and maximum level monitoring at working area was 93.8 - 94.6 dB(A). Average of noise average level was 89.0 - 90.4 dB(A) and standard deviation was 1.67 that the result conforms to Department of Disease Control of Thailand. The standard range for noise exposure outlined by the Ministry of Industry Thailand indicates that noise levels should not exceed 90 dB(A) per 8 hour-shift. Exposure to noise levels exceeding the recommended maximum noise level in a period of time might induce hearing problems and hearing loss in the long term [5]. According to the, noise levels during the pressing part process at the auto parts factory

Table 1 Noise levels during the pressing part process at the auto parts factory in 2012

Noise level dB (A)	**Noise (high level)**
	Min=92.3 Max=102.2 Mean 95.5 SD= 2.11
	Noise (average level)
	Min= 87.6 Max=93.7 Mean= 89 SD=1.71

Table 2 Hearing capacity test result in 2012

Hearing test result	**Hearing capacity test result**		
	Right ear	**Left ear**	**Both ears**
	n(%)	**n(%)**	**n(%)**
Normal	324(90.3)	284(79.1)	284(79.1)
Not Normal	35(9.7)	75(20.9)	75(20.9)

Table 3 Logistic regression relating socio-demographics to hearing capacity test in 2012

Variables	**Odds Ratio**	**95 % CI**	***P-value***
Working year experiences 3 (years)	1.254	0.988 – 1.591	0.063
Age (years)	1.311	1.227 – 1.401	0.000
High noise level dB(A)	1.097	0.976 – 1.233	0.122
Noise average level dB(A)	0.974	0.839 – 1.131	0.731

Table 4 Associations of variables and year of working

Variables	**Year 2012**
Noise level	
High noise level	(Positive) 0.122
Average noise level	
Over noise standard	
Socio demographic	
Male	(Positive) 0.006
Age	(Positive) <0.001
Married	(Positive) 0.038
Income > 15K	(Positive) 0.002
Education	
Press experience > 9 years	
Work years	(Positive) 0.063
Department	(Motorcycle lower) 0.050

comparative with standard in 2012 was over standard which had noise 36.5%. Whereas the standard of noise level was 63.5 %.

According to the percentages of hearing capacity tested among working staff in pressing parts in 2012, hearing capacity test resulted with right ear, left ear and both ears was normal with 90.3 %, 79.1 % and 79.1 %, respectively. In each year, results found that there were normal cases more than not normal cases was showed in Table 2.

According to the result of chi-square test and logistic regression, as shown in Table 3 the association between socio demographics and hearing capacity test of the right ear and the left ear in 2012 were analyzed by logistic regression test among variables. Age was significantly associated with hearing capacity test at *p-value* = 0.000 ($p< 0.05$). However, working year experiences more than 3 years, noise average level and noise high level were not significantly associated with hearing capacity test at *p-value* = 0.063, 1.222 and 0.731 ($p> 0.05$) respectively.

Table 4, the association among socio demographic variable and hearing capacity test [7] in 2012, there was significant with noise married ($p < 0.15$), among income > 15 K was significant ($p < 0.15$), among male was significant ($p < 0.15$), among department was significant ($p < 0.15$), among knowledge was significant ($p < 0.15$), among work year was significant ($p < 0.15$), among age was significant ($p < 0.15$), among high noise level was significant ($p < 0.15$).

DISCUSSION

Regarding to the prevalence results with hearing capacity test in 2012 found in 2012, the abnormal hearing capacity test result with left ear and the right ear was 20.9%. This study found the hearing capacity test result was difference in each year regarding to source of hearing capacity test data.

Table 5 Relationship between knowledge attitude and behavior and hearing capacity test 2012

Measure	Level	Hearing test result				*P-value*
		Normal		Not normal		
		n	%	n	%	
Knowledge	Low	94	(75.8)	30	(24.2)	
	Moderate	148	(83.6)	29	(16.4)	0.096
	High	42	(72.4)	16	(27.6)	
Attitude	Unconcerned	272	(97.5)	70	(20.5)	
	Neutral	12	(75.0)	4	(25.0)	0.198
	Concern	0	(0.0)	1	(100.0)	
Behavior	Poor	25	(78.1)	7	(21.9)	
	Fair	115	(77.2)	34	(22.8)	0.675
	Good	144	(80.9)	34	(19.1)	

In fact, the researcher found the prevalence results with hearing capacity is probable that data analysis and conclusion of test result depended on skills, experience, examination and interpretation of each company in order to definition. The study found in 2012 are more accurate and reliable than other years. The reason is that it had a repeated examination and measurement of system control for employees to take a break for 20 minutes before test hearing, therefore, the result of re-confirmed the performance were different.

However, the researcher had been involved in monitoring work flow, employee's control and covered the gathering data from employee before checking up. They mentioned that the test result of hearing capacity in 2012 were believable.

The results of prevalence of hearing capacity test found that the employee's prevalence of the hear ability result of abnormal left ear and right ear is the lowest when compared with other years. Due to each year of test had a different methods to interpret. Also, the hearing capacity test result might depended on the individual staff or might be a cognitive difference in the data analysis and navigation of different magnitudes.

In 2012 were identified clearly in the frequency range of employees with the abnormal hearing. It may be possible that the data analysis results was interpret error, the official severity which checked the process of the hearing capacity test to the employee had not check the condition of the area, and external factors of noise . Also, the noise exposure were highest because of high productivity when comparing with preventive maintenance in other year, there were less maintenance of machinery, the mechanical conditions of use that mean machine used completely.

In 2012 were not significant possibility in those years had the establishment of inspection control and prevent noise exposure and had hearing conservation program (Hearing Conservation) [8]. Marital status in 2012 were not significant in researcher's opinion which found that the men who were in married must had the responsibility and obligations of their family and also had more stress to taking care their family which affected sleepless.

The factor with sex was found that male is the most of sex with press part worker in 2012 that were significant with the results of the hearing capacity test [9]. Male are more vulnerable than female. Therefore, gender might be correlated with the results of the hearing capacity test, while the education level of employees in the test results of the hearing capacity in 2012 were not significant.

With the result in 2012 found that the relationship between marital status and hearing capacity test was significant from the previous study [10]. Incoming factor was significant with the hearing capacity test in the researcher's opinion and found in employees who had a high income. It could imply that employees have more of working man hours and more than eight hours in one day, which factors affect the risk of noise exposure. Also it is associated with the hearing capacity of press parts staff.

The relationship between production department and hearing capacity test was significant because type of press part machine capacity [8] and press part material were difference such as material of press part of motorcycle part and fuel tank part was thin aluminum layer while the automotive press part was steel which difference from press type had effected with noise exposure when pressing and affected to hearing capacity test. As a result, the hearing capacity test of the motorcycle stamping parts was less minimum. Factor of knowledge level of the employees were found in associated with hearing capacity test when the employees had good understanding with hearing loss prevention and they can prevent themselves from noise exposure well (Table 5).

This study found most employees have the

knowledge levels in low, the employee is still not well understood [1] with hearing loss prevention that should be considered to training about preventing hearing loss. It should be strict in sending staff to attend the training. As illustration old age of employee correlated with the results of the hearing capacity test because their age effected the hearing levels of employees which had more of hearing dropped. High noise level factor was affect to the hearing capacity test of employees. In fact, the researcher found the high productivity rate in 2012 was the highest year in total production which the government policy about the first car was increased the production in automotive parts industry. Then this increasing employee were affected to the hearing capacity test result as well.

ACKNOWLEDGEMENTS

The author would like to thank to my advisor for their untried supports. Also the support from my family. The encouragement from the director, manager and all staff at the study factory.

REFERENCES

1. Archanun K. Industry upgrading and global recession: evidence of hard disk drive automotive industry in Thailand. (ADBI working paper No.283). Bangkok: [N.p.]; 2011.
2. The Thai Automotive Industry Association. Statistic of Automotive Industry. Bangkok: Association; 2012. [cited 2012 February 26]. Available from: http://www.taia.or.th/thai/index.aspx
3. Ministry of Public Health, Department of Disease Control, Bureau of Occupational and Environmental Diseases. Statistic disease from work. [cited 2012 February 20]. Available from: http://www.ddc.moph.go.th
4. Occupational Health and Safety Department, Thailand. Auto part Industry: turn over worker of May, 2012. Bangkok: Department; 2012.
5. Social and Welfare of Human Resource Department, Thailand. Health examination report of auto part factory. Bangkok: Department; 2012.
6. Chong D. Knowledge, attitude and practice of using personal protective equipment of Ratharn. Bangkok: Chulalongkorn University; 2008.
7. Anont K. Hearing loss and occupational noise exposure among workers in wing 46 airport ground service, RTAF. Bangkok: Medical Council of Thailand; 2004. [cited 2012 February 20]. Available form: http://www.rcot.org/download/resident_10_21.pdf
8. Daniell WE, Swan SS, McDaniel MM, Camp JE, Cohen MA, Stebbins JG. Noise exposure and hearing loss prevention programmes after 20 years of regulations in the United States. Occup Environ Med. 2006 May; 63(5): 343-51. doi: 10.1136/oem.2005.024588
9. Singh LP, Bhardwaj A, Deepak KK. Occupational exposure in small and medium scale industry with specific reference to heat and noise. Noise Health. 2010 Jan-Mar; 12(46): 37-48. doi: 10.4103/1463-1741.59998
10. Chavalitsakulchai P, Kawakami T, Kongmuang U, Vivatjestsadawut P, Leongsrisook W. Noise exposure and permanent hearing loss of textile workers in Thailand. Ind Health. 1989; 27(4): 165-73.