OCCUPATIONAL NOISE-EXPOSURE AND ASSESSING HEARING LOSS OF NIGHTCLUB WORKERS IN TARAKAN CITY, INDONESIA

Kresna Febriyanto[1, 2], Nutta Taneepanichskul[2], Saowanee Norkaew[3], Wattasit Siriwong[2, *]

[1] Institute of Health Sciences Muhammadiyah Samarinda, Kalimantan Timur, Indonesia
[2] College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand
[3] Faculty of Public Health, Thammasat University, Pathumthani, 12121, Thailand

ABSTRACT:

Background: Occupational noise-exposure is an important problem in the workplace. Nightclub is one sector of the entertainment industry that will grow rapidly in the future. Many overseas researchers indicate that nightclub workers are exposed to loud music constantly throughout the work shift, putting their hearing at risk.

Methods: A cross-sectional study with proportional random sampling was determined by the number of participants in each nightclub. A total 117 nightclub workers from 5 nightclubs were participated. Noise exposure level was assessed by sound level meter monitoring; and measuring hearing loss was done by audiometer. The other variables such as socio-demographic, individual factors, environmental factors, signs and symptoms were assessed by questionnaire and observation.

Results: The average noise at the nightclubs was 107.22 dBA where every employee worked more than 6 hours per day. A total of 104 respondents (88.9%) had hearing loss, while 13 respondents (11.1%) did not experience any hearing loss (normal). From 104 respondents who reported experiencing hearing loss, mostly at the level of mild (88 respondents), 15 respondents (moderate), and 1 (one) respondent in the level of severe.

Conclusion: There was no statistically sigificant relationship (p-value > 0.05) between noise exposure and hearing loss among nigthclub workers in Tarakan City, Indonesia; but multiple logistic regression analysis found that hobbies may cause hearing loss, habit of smoking, the acknowledge of noise and its effects, and also practical in taking care of ear healthiness are the factors which could the hearing disruption (p value < 0.05). The routine inspection for ear healthiness, and rotation job system also are the effective solutions to prevent the hearing loss that should be applied by management of each nightclub. Also, the government could consider regularly conduct campaigns, provide training on occupational health, and routinely perform of noise measurements.

Keywords: Noise-exposure, Hearing loss, Nightclub workers, Indonesia

DOI: *Received: June 2016; Accepted: September 2016*

INTRODUCTION

Noise is unwanted sound for the ear. Impulsive sound could harm the ears. Ears damage usually occurs at the eardrum. Noise in the workplace is a major health problem for many countries. It is estimated that at least 7 million people (35% of total population) exposed to noise > 85 dBA [1]. Noise induce Hearing Loss (NIHL) or hearing loss is a disease that damages one part or the whole hearing. It occurs in one or both ears. The damage can be mild, moderate, or severe. The damage occurs because of the constant exposure to noise in the environment [1]. Exposure to noise is measured based on the power of the sound source in units of decibel area (dBA) which is a unit for measuring sound levels. Noise exposure

[*] *Correspondence to: Wattasit Siriwong*
E-mail: wattasit.s@chula.ac.th

Cite this article as: Febriyanto K, Taneepanichskul N, Norkaew S, Siriwong W. Occupational noise-exposure and assessing hearing loss of nightclub workers in Tarakan city, Indonesia. J Health Res. 2016; 30(Suppl.1): S61-9. DOI:

can cause hearing loss in a period when long exposure times and high noise levels [2].

According to Minister of Manpower and Transmigration Republic of Indonesia Number PER.13/MEN/X 2011 on Value Threshold physical factors and chemical factors in the workplace, Threshold Limit Value (TLV) is a standard factor of danger in the workplace; as a concentration/ intensity weighted average (time weighted average) is unacceptable labor without causing disease or illness, the daily work for a period not exceeding 8 hours a day or 40 hours a week [3]. Untreated hearing loss has serious risk on the psychology of workers who are constantly exposed to noise. Psychological effects may arise such as shame, guilt and anger, feelings of humiliation, concentration problems, insecurity, and less confident [4].

The impact of noise on hearing loss among workers does not only occur in the industrial sector but also in the entertainment sector. Those workers are at risk of the undesired effects. Disc Jockey, bartenders and waiters who are constantly exposed to loud music from the loud speaker are prone to hearing loss. Research conducted by the Ministry of Manpower of Singapore 1996 amplifiers proves that music played in discotheques can cause hearing loss not only to the visitors, but also to its workers. Of the 43 workers in 5 discotheque exposed to 90-94 dBA sound throughout the work shift (average exposure of 5.1 hours/day), significantly demonstrated hearing loss early stage/ESHL (Early Sensorial Hearing Loss) 41.9% and complained of tinnitus by 21% [5].

Nightclubs is a job coming from entertainment sector and may growing rapidly with high salaries. Some workers are just high school graduate or graduate from lower lever of education who do not aware of the dangers caused by the noise. Noisy effects are known to exist of two types of effects: non-auditory effects and auditory effects. Type one includes physiological disorders, psychological disorders, communication disorders; and type two includes temporary an permanently hearing loss [6]. The data and information about the noise level that occurs in nightclubs, especially in Tarakan city still very poor and there had been no noise-related research ever done before. This data can be used as a reference in preventing diseases that cause deafness, so the noise level that occurs can be reduced to a minimum.

MATERIALS AND METHODS

Study design

This study design was cross-sectional with proportional random sampling; and it was determined by the number of participants in each nightclub. A total 117 nightclub workers from 5 nightclubs were participated. The study was conducted in North Borneo Province, Indonesia during June 2016. The data was obtained from 5 nightclubs in Tarakan City.

Sound level meter (SLM) monitoring

Digital type 2 Sound Level Meter 840029 (the tool is available in the laboratory) was placed in a fixed position behind the bar closest to the dance floor in each nightclub. The SLM was calibrated using a sound calibrator by Institute of Health Sciences Muhammadiyah Samarinda. The SLM recorded the noise expoure levels in the bar area to establish a noise level trend. The SLM was switched on 23:00, 01:00, and 03.00 to record the measurement and calculate of noise (Ln). Ln= 10 . Log 1/8 ($T5 . 10^{0,1.L5} + T6 . 10^{0,1.L6} + T7 . 10^{0,1.L7}$) dBA [7]. Where: T5: 2 hours the first time range, T6: 3 hours the second time range, T7: 3 hours the third time range, L5: Noise taken at 23:00 as a represent at 22.00-24.00, L6: Noise taken at 01:00 as a represent at 24.00-03.00, and L7 : Noise taken at 03:00 as a represent at 03.00-06.00.

Audiometry test

Audiometric tests was performed after a lapse 14 hours from the last exposure to noise to allow recovery from any Temporary Threshold Shift (TTS). For the purposes of this study, the results of hearing loss were classified into yes and no. Measurement used to determine the hearing of workers was audiometer type Oscilla SM930.

Questionnaire

The structure questionnaire was developed to collect the data. The content validity was assessed by two experts from Occupational field. And for reliability test, the researcher conducted pilot test of 20 workers. The researcher took 10 workers from nightclub in other city, and 10 workers from others workplace who work with high noise levels. The Cronbach's Alpha test was used for reliability test. The Cronbach's Alpha test was 0.928 for knowledge, 0.915 for practice, 0.945 for hearing problem, and 0.853 for sign and symptom of hearing problems. The core question questionnaire consisted of three parts as follow: Socio-demographic (such

Table 1 Noise-exposure level of 5 nightclubs

NC	Exposure level			Total noise exposure level
	T1 (23.00)	T2 (01.00)	T3 (03.00)	
Nightclub A	96.2 dBA	98.1 dBA	104.5 dBA	101.5 dBA
Nightclub B	98.7 dBA	101.7 dBA	110.3 dBA	106.8 dBA
Nightclub C	106.4 dBA	117.9 dBA	119.3 dBA	117.5 dBA
Nightclub D	96.9 dBA	99.3 dBA	105.4 dBA	102.4 dBA
Nightclub E	98.7 dBA	103.4 dBA	111.5 dBA	107.9 dBA

Table 2 Environment characteristic in each nightclub

NC characteristic	NC A	NC B	NC C	NC D	ND E
Number of loud speaker	8	8	8	6	6
Total floor area (m^2)	624	588	360	432	368
Music type	DJ	DJ	DJ	DJ	DJ

as: age, gender, educational background, and job description), individual factors (such as: hobby related to loud sounds, smoking habits, drinking alcohol, sport activities, duration work, work per day, work per week, knowledge about noise and hearing loss, and practice to prevent from hearing loss), and also and symptoms of hearing loss.

Observation

To strengthen the data, the researcher observed two things as follows: Individual Factors (characteristic the workers refers to their activities during the work, whether the workers are moving or settle in the fix position and distance the workers to the speaker) and Environment Factors (number of speakers, total floor area, and music type).

Data analysis

Descriptive statistics was used to measure variables: socio-demographic, individual factors, environment factors, sign and symptoms, and hearing loss. Therefore the data was presented by central tendency (mean, min, max, SD), frequency, and percentages. Chi-square Test was used to measure association between each independent variables (socio-demographic, individual factors, environment factors) against dependent variable (hearing loss). In case, the data did not comply with Chi Square minimum assumption, the Fisher Exact test was performed instead. The significant association was define as p value < 0.05. Statistical analysis of this study was performed by using SPSS 22.0 (University licensed).

The researcher obtained the ethical consideration from Institute of Research and Community Service, Atma Jaya Catholic University of Indonesia No: 532/III/LPPM-PM.10.05.06/2016 on June 16, 2016.

RESULTS

Noise-exposure level of 5 nightclubs (NC)

Table 1 showed result of calculations using formulas, the researcher found that nightclub C had the highest noise (117.5 dBA), while the nightclub A had the lowest noise level (101.5 dBA).

Environment characteristic in each nightclub (NC)

Measuring of the amount of the total floor area, the researcher used the method of observation with a meter to measure how the length and width of floor area every nightclub. Table 2 showed Nightclub C was a nightclub which had a total floor area of the smallest with an area of 360 m^2, while the nightclub A as largest among 5 nightclubs in Tarakan (area = 624 m^2). All the nightclub used DJ as a type of music during operation. Nightclub B, C, D, and E prior used karaoke before the DJ started, whereas before the nightclub A DJ started, the management played music from a tape recorder. Three nightclubs (A, B, and C) had a total of eight loudspeakers, while the other two nightclubs (D and E) had six loudspeakers.

Individual characteristics of respondent

The Table 3 indicated socio-demographic characteristics of respondents. A total of 74.4% workers were categorized as ≤ 25 years old. The average of age respondents were 25 years old. Over half (67.5%) respondents were woman while men were 32.5%. In terms of education level, almost three-quarter of respondents (74.4%) graduated from high school. The majority of respondents (41.9%) worked as a ladies club.

Table 3 showed total of 97 respondents (82.9%) from 117 respondents who had hobbies associated with loud noise may cause hearing loss. A majority of 66 respondents (56.4%) had a hobby of listening

Table 3 Frequency distribution of each variable

Characteristics	Level	n=117	Percentage
Age (years)	≤ 25	87	74.4
	≥ 26	30	25.6
Mean: 24.99 SD: 6.103 Min: 19 Max: 60			
Gender	Male	38	32.5
	Female	79	67.5
Education	Secondary school	24	20.5
	High school	87	74.4
	Graduate school	6	5.1
Job description	Disk jockey (DJ)	6	5.1
	Operator	9	7.7
	Dancer	15	12.8
	Ladies club	49	41.9
	Bartender	8	6.8
	Cashier	9	7.7
	Waiters	17	14.5
	Manager	4	3.4
Hobbies	related to high sound	97	82.9
	Not related to high sound	20	17.1
Hobbies	Not related to high sound	20	17.1
	Attend live music concert	1	0.9
	Diving	15	12.8
	Hunting or shooting	3	2.6
	Listening music	66	56.4
	Play music at studio	8	6.8
	Play video games	4	3.4
Smoke	Yes	89	76.1
	No	28	23.9
Smoke (bars in a day)	0-10	28	23.9
	11-20 bars	66	56.5
	> 20 bars	23	19.7
Mean: 14.94 SD: 9.644			
Drink alcohol	Yes	105	89.7
	No	12	10.3
Consume alcohol in a day	≤ 2 liter	85	72.6
	>2 liter	32	27.4
Mean: 2.10 SD: 0.885			
Time consuming	Never drink alcohol	12	10.3
	Daily	105	89.7
Doing exercise	Yes	28	23.9
	No	89	76.12
Time to do exercise	Never do exercise	89	76.1
	Daily	11	9.4
	Weekly	17	14.5
Duration work (months)	≤ 11	80	68.4
	> 11	37	31.6
Mean: 10.97 SD: 9.715			
Previous work related to high sound	Yes	3	2.6
	No	114	97.4
Work per day (hours)	≤ 7	77	65.8
	> 7	40	34.2
Mean: 6.65 SD: 1.206			
Work per week (days)	≤ 5	5	4.3
	>5	112	95.7
Mean: 6.49 SD: 0.582			

Table 3 Frequency distribution of each variable (cont.)

Characteristics	Level	n=117	Percentage
Workers characteristic	Settle on the position	37	31.6
	Moving	80	68.4
Knowledge about noise and hearing loss	Low levels	19	16.2
	Moderate levels	81	69.2
	High levels	17	14.5
Practice to prevent from hearing loss	Poor practice	99	84.6
	Good practice	18	15.4
Felt hearing problem (HP)	Yes	10	8.5
	No	107	91.5
First felt hearing problem (HP)	Don't felt any hearing problem	107	91.5
	Last 6 months	5	4.3
	Last year	4	3.4
	Others	1	0.9
History hearing problem	Low history	91	77.8
	High history	26	22.2
Sign and Symptom of HP	Low sign and symptom	96	82.1
	High sign and symptoms	21	17.9
Felt hearing loss in the ear	Right ear	40	34.2
	Left ear	28	23.9
	Both ears	49	41.9
Distances the worker to the speaker (m)	Close to the loud speaker	75	64.1
	Far from loud speaker	42	35.9

Table 4 Level of hearing loss among nightclub workers

Category	n = 117	Percentage
Normal	13	11.1
Mild	88	75.2
Moderate	15	12.8
Severe	1	0.9

to music with headset/earphone when they were not working. Even they listened till asleep. Only 28 workers did not smoke while 89 workers were active smokers. Table 3 also showed that only 12 respondents who did not consume alcohol, while 105 respondents consumed alcohol every day. A total of 89 workers never did physical activity. Most of them (80 respondents) worked in a nightclub with a vulnerable period of 0-11 months.

Based on the calculation results of the research questionnaire, Table 3 showed that there were 107 respondents (91.5%) who did not feel any hearing loss. While as many as 10 respondents (8.5%) felt a disturbance in their ears. A total of 5 respondents (4.3%) from a hearing loss felt any disturbance since the last 6 months. While 4 respondents (3.4%) experienced interference since one year ago. One respondent had trouble of hearing since 2 years ago. But on the questionnaire asking about history of hearing problems, as many as 91 respondents (77.8%) had low history of hearing problems, while 26 respondents 26 (22.2%) had a high history of hearing problems.

In the variable signs and symptoms of hearing loss, as much as 96 respondents (82.1%) had signs and symptoms of low to cause hearing loss. Off 21 respondents (17.9%) had signs and symptoms that may lead to higher hearing loss. A total of 40 respondents (34.2%) felt that their hearing loss was in the right ear; 28 respondents (23.9%) had problem in the left ear; and 41.9% (49 respondents) had impaired hearing in both ears.

Results of the 14 questions posed to 117 respondents can be concluded that the average worker had a good enough knowledge related to noise and hearing loss. Only 19 respondents had low level knowledge of the noise and hearing loss. And on average, they could distinguish between temporary and permanent hearing loss, hearing loss. A total of 99 respondents had a poor practice for prevent from hearing loss. Although they had a good enough knowledge; but self-awareness to protect their ears from hearing loss was very poor.

Table 5 Final model multiple logistic regression of hearing loss

Independent variables	Number of workers with hearing loss	Adj. Or	95% CI		*p*-value
			Lower	Upper	
Hobbies					
Related to high sound	89	1			
No related to high sound	15	0.088	0.010	0.755	0.027*
Smoke					
Yes	79	1			
No	25	0.047	0.003	0.675	0.025*
Alcohol					
Yes	95	1			
No	9	0.766	0.055	10.745	0.843
Knowledge					
Low levels	14	1			0.019*
Moderate levels	79	0.035	0.003	0.377	0.006**
High levels	11	0.447	0.040	5.046	0.515
Practice					
Poor practice	93	1			
Good practice	11	0.033	0.004	0.275	0.002**

*= p<0.05, **= p<0.01, ***=p<0.000

Level of hearing loss among nightclub workers

Table 4 showed the result of the calculation of hearing loss by using audiometer on 117 respondents. All measurements had been done by calling the workers one by one in turn. A total of 104 respondents (88.9%) had hearing loss, while 13 respondents (11.1%) did not experience any hearing loss (normal). Total 104 respondents indicated experiencing hearing loss, mostly at the level of mild (88 respondents), 15 respondents (moderate); while only 1 (one) respondent who suffered hearing loss in the level of severe.

Association among strongest predictor may affect hearing loss

Multiple logistic regression was performed by using Forward Conditional Method in order to create statistical model that can predict the probability of hearing loss. Twelve variables (noise exposure level, age, gender, education, job description, sport activities, duration work, work per day, work per week, characteristic workers, distance to the loud speaker, total loud speaker, and total floor area) were excluded from the test because there were no association with hearing loss by used Chi-square or Fisher Exact Test.

Table 5 revealed that hobbies (p<0.05), smoking (p<0.05), knowledge (p<0.005) and practice (p<0.001) were significant predictors of hearing loss. In summary, this statistical model can predict 95.7% of hearing loss among nightclub workers in Tarakan, Indonesia.

DISCUSSION

The result of this study showed that the noise intensity of 5 nightclubs in Tarakan City is exceeds the threshold limit value. The standard of noise based of Ministry of the Republic of Indonesia is about 85 dBA for 8 hours per day [8]. The average noise at those nightclubs was 107.22 dBA where the workers work 7 hours per day. Nightclub A is the lowest noise level contributor among other nightclubs; it is about 101.5 dBA while the nightclub C is the higher noise level contributor, it is about 117.5 dBA. Furthermore, nightclub A and C have 8 loudspeakers, with different broad dance areas. Nightclub A dance area is about 624 m2 (the biggest dance area) and nightclub C dance area is about 360 m2 (the smallest dance area). Moreover, with that small dance area plus high level of noise, nightclub C's workers have the close possibility to get hearing loss.

According to checkup with the audiometer all nightclub workers, from 117 workers, 104 workers have hearing loss while the other 13 workers are normal. The high noise intensity has a big role toward the case of hearing loss. According to the research by Gunderson toward the workers in a nightclub with a high level of noise intensity, showed that lots of the workers got symptoms of tinnitus and decreased their hearing quality after work. This phenomenon also showed that a worker who spent more time in the workplace with high level of noise intensity is more possible to get hearing loss than a new worker in a workplace [9].

The duration of noise exposure in a single day and the duration work at nightclub may affect the occurance of hearing loss. In Tarakan City, almost the nightclub workers work 7 days a week and more than 6 hours a day. The result of the research by Lawrence [10] found that the workers got hearing loss or tinnitus for work in long period of time. The duration of work ≥ 5 years in noise exposure about 85 dBA or higher may increase the risk of hearing impairment [11]. Irreversible of hearing neural-sensory may happen because there is continuously noise exposure about 85 dBA for 8 hours a day. The hearing losss may attack very soon at first 6 until 10 years in high noise exposure [12]. Prolonged contact in noise exposure will give more possibility of damage rather that the shortest one [1, 13]. The duration of working also may risk the hearing disruption. Workers, who work at a noise place with the higher intensity of noise about 85 dBA and up after 5 years, 1% of them will show some indications of hearing loss. Furthermore, after 10 years of working, 3 % of them will show the indications of losing their hearing ability. Then, for them who have worked for 15 years, the risk of losing the hearing ability is increasing up to 5% [14].

Additionally, the majority respondents of this research are 105 workers have worked for 6-12 months. There are 12 respondents who have worked more than more than a year. 2 respondents have worked for 1.5 years, 5 respondents have worked for 2 years, 4 respondents have worked 3 years and the last is a respondent who have worked 15 years at a nightclub as a DJ and 20 years as a manager. All the respondents of this research are working not more than 8 hours a day, it is about 6.5 hours a day. Apparently, that research has a different result with this study. After the researcher did a statistical test, the result showed that there is no relationship between noise exposure and hearing loss even thought the noise intensity among 5 nightclubs is out of the standard. Thus the length of workday and the duration work at nightclub did not have any significant relationship to the hearing loss, even thought the workers have worked at a nightclub for last 6 months with length of workday more than 6 hours a day. Additionally, this study found that the other factor which may cause hearing loss such as some hobbies that related with high sound, smoking, knowledge about noise and the step of prevent from hearing loss.

Hobby also influences to the hearing capability of the employers. A hobby with high level of noise may increases the possibility of hearing loss. According to the National Safety Council, some hobbies such as diving, hunter (with gun), racing sports, listening music with earphone, listening music with high volume, etc may affect a hearing loss [15]. Thus, the result showed that 97 respondents have a hobby related to noise. Most of those respondents (66 respondents) love to listening music with earphone, 15 respondents are divers, 8 respondents love to play music in the music studio, 4 respondents are gamers, 3 respondents are hunters with a rifle and only 1 respondent who has hobby to watch the concert events. So it can be concluded hobbies that related to high sound may cause hearing loss.

Smoking implications as ototoxic material directly due to the effects of nicotine or cause ischemia through the production of carboxy-hemoglobin, blood vessels spasm, blood viscosity or also through arteriosklerotik. Influency blood circulation system in cochlear organ caused by smoking is the cause of hearing loss in high frequency progressive and most often occurs in old age. Mizoue (2002) examined the effects of smoke and noise on hearing loss through 4,624 health checks of data steelworker in Japan. The results showed a significant of interruption of hearing at high noise frequencies due to smoking with risk three times greater [16]. The synergistic effect of smoking, noise exposure and age on hearing loss, found on his study, it was consistent with the biological interaction. Furthermore, it is possible that distinct ototoxic substances in the chemical composition of mainstream smoke may synergistically affect hearing when in combination with noise exposure [17]. The result of the research in Tarakan City showed that 89 of 117 workers of a nightclub are smokers and almost all of them are consuming 15 cigarettes a day for 3-4 years. Smoking long time and working at a workplace with the level of noise up than 85 dBA may risk more to the hearing disruption than who are not smoking [18].

Hearing conversation programs are integrated in management policy in each industry. This program has many elements that are required to be adhered by employers as well as employees [19, 20]. The elements that have been instituted in this program must be continue to prevent the hearing disruption which caused by the noise. The purpose of this program is to reduce the company financial loss. Thus, continuous education with training

regarding importance of this program should be imparted both to employees and employers [21]. The health education it was vital, since it gives information on effects and prevention of hearing loss. The continuous education also influence these workers towards positive attitudes and practices in preventing hearing loss. The education and training about health should be given at least once in 2 years. Practice to prevent from hearing loss also is important in maintaining the health of the ear. The result of this research showed that 81 respondents who have the knowledge about noise and hearing loss are in the average level and 99 respondents have bad practice in hearing loss prevention. Therefore, there is a relationship between less knowledge and less practice from the nightclub workers in hearing loss prevention.

LIMITATION

The study subjected some limitations which may have implications to outcome. The research has some other limitation including: (1) The number of sample compare to total national population as a nightclub workers was quite small. (2) Ideally, a SLM would have been placed in each area at the nightclubs. (3) Data from self-administered questionnaires may pose lots of missing data. (4) This research relied on honestly of respondents. There is no chance to confirm the respondent's answer were correct. The respondents should come at laboratory and doing a test to obtain more precise information of hearing loss. (5) The absence of standard and valid questionnaires related to noise and hearing loss are suitable to serve as a questionnaire in this study.

RECCOMENDATION AND CONCLUSION

The owner should have paid more attention to the health of their workers to do regularly checks their ears, provide time resting when the workers were work. Using a system of job rotation is also good solution for reducing noise exposure. The government should do more routine in measuring the noise exposure level in every nightclubs. Providing a workshop or training on occupational health issues. Governments also have a role to play by developing and enforcing strict legislation on recreational noise, and public information campaigns. In further research the researcher expected to provide more than one of Sound Level Meter when it will take measurements. Besides using SLM as a noise measurement, personal noise dosimeter is also needed to measure noise exposure level received by each workers when they are working, and the researcher should consider and calculate according to noise contour mapping.

ACKNOWLEADGEMENTS

This research was supported by the Grant for International Research Integration: Chula Research Scholar, Ratchadaphiseksomphot Endowment Fund (GCURS 59 06 79 01). The author would like to thank to the owner, manager and all the workers at nightclub in Tarakan City, Indonesia for their encouragement and good cooperation during my study.

REFERENCES

1. Shah RK, Isaaksoon GC. Hearing impairment. Medscape. 2011.
2. Safe Work Australia [SWA]. Managing noise and preventing hearing loss at work: code of practice. Canberra, Australia: Safe Work Australia; 2011.
3. Suma'mur PK. Higiene perusahaan dan keselamatan kerja (hiperkes). Jakarta: CV. Sagung Seto; 2009.
4. Levey S, Fligor BJ, Ginocchi C, Kagimbi L. The effects of noise-induced hearing loss on children and young adults. Contemp Issues Commun Sci Disord. 2012; 39: 76-83.
5. Silitonga N, Adnan A, Isranuri I, Haryuna TSH, Fotarisman. The Relationship Between Noise Exposure and Hearing Loss (Case Study at discotheque A, B, C in Medan). Pre Cure. 2014; 1.
6. Ballenger JJ. Audiologi. Dalam penyakit telinga, hidung, tenggorokan, kepala dan leher. 13th ed. Jakarta: Binarupa Aksara; 1997.
7. Minister of Environment. No: KEP-48/MENLH/11/1996 baku tingkat kebisingan. Jakarta: Minister of Environment; 1996.
8. Himpunan Peraturan Perundang-undangan Keselamatan dan Kesehatan Kerja; 2007.
9. Gunderson E, Moline J, Catalano P. Risks of developing noise-induced hearing loss in employees of urban music clubs. Am J Ind Med. 1997 Jan; 31(1): 75-9.
10. Lawrence N, Turrentine A. Examination of noise hazards for employees in bar environments. J Saf Health Environ Res. 2008; 5(3).
11. Gidikova P, Prakova G, Ruev P, Sandeva G. Hearing impairment among workers occupationally exposed to excessive levels of noise. Central European Journal of Medicine. 2007; 2(3): 313-8.
12. Lie A, Skogstad M, Johannessen HA, Tynes T, Mehlum IS, Nordby KC, et al. Occupational noise exposure and hearing: a systematic review. Int Arch Occup Environ Health. 2016 Apr; 89(3): 351-72.
13. Irwin J. Occupational noise-induced hearing loss. Occup Med (Lond). 1997 Jul; 47(5): 313-5.
14. Mathers C, Smith A, Concha M. Global burden of hearing loss in the year 2000. Global burden of Disease.

2000; 18(4): 1-30.

15. LaDou J. Occupational health and safety. Itasca, IL: National Safety Council; 1994.
16. Mizoue T, Miyamoto T, Shimizu T. Combined effect of smoking and occupational exposure to noise on hearing loss in steel factory workers. Occupational and Environmental Medicine. 2003 Jan; 60(1): 56-9.
17. Ferrite S, Santana V. Joint effects of smoking, noise exposure and age on hearing loss. Occup Med (Lond). 2005 Jan; 55(1): 48-53. doi: 10.1093/occmed/kqi002
18. Nomura K, Nakao M, Morimoto T. Effect of smoking on hearing loss: quality assessment and meta-analysis. Prev Med. 2005 Feb; 40(2): 138-44.
19. Franks JR, Merry C. Preventing occupational hearing loss: a practical guide. Washington, D.C.: U.S. Department of Health & Human Services; 1996.
20. Acoem Task Force on Occupational Hearing Loss, Kirchner DB, Evenson E, Dobie RA, Rabinowitz P, Crawford J, et al. Occupational noise-induced hearing loss. J Occup Environ Med. 2012 Jan; 54(1): 106-8.
21. World Health Oraganization [WHO]. Prevention of noise-induced hearing loss. Report of an informal consultation. Geneva, Switzerland: WHO. 1997.