



# 4-Year retrospective study hearing level among of Oil Refinery Company employees based on the results of medical examinations

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## Abstract

**Introduction:** The purpose of this study was to determine the volume of workplace noise and the process of changing the hearing threshold of workers in different units of a company oil refinery products over a period of 4 years.

**Methods:** The type of historical study is retrospective. It was intended that the process of employee health be measured and studied according to the exposure of people to workplace noise and its impact on the level of physical health of employees during a period of 4 years. The sample size is 101 according to Cochran's formula. Data collection was done by registering the data in the periodic staff examination file in predetermined forms and by field method.

**Results:** The results showed that at most frequencies in different years the mean hearing threshold has increased. For example, based on the results of the study, the mean and standard deviation of noise measured in the maintenance unit from 2014 to 2017 are equal to 88 (5) dB, 93 (9) dB, 94 (8) dB, and 96 (11) dB respectively, which indicates the increasing trend of sound level in the workplace.

**Discussion:** Hearing loss as a consequence of workplace noise threatens the health of workers in the broadcasting company and therefore it is suggested that in addition to management controls, engineering controls be a priority for the HSE unit and the company's management.

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## 1. Introduction

Sound is one of the occupational hazards in the industrial sector, and many workers are exposed to this harmful factor (Zamanian, Rostami, Hasanzadeh, & Hashemi, 2015). Estimates show that about 2 million workers in Iran are exposed to harmful noise. Continuous and long-term exposure to sound pressure levels above 85 dB can cause temporary and permanent hearing loss. This complication leads to impaired speech communication in terms of quantity and quality and as a result, lack of correct and effective understanding of warning signs will follow (Miri, Zamani, Nasri, & Hadizadeh goki, 2020). Prolonged exposure to sound in the workplace will also increase fatigue, which will increase this issue.

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Reduces concentration and increases human error. Prolonged exposure to sound may cause other complications such as cardiovascular, neurological, and gastrointestinal disorders (Zaw et al., 2020). Many internal factors, such as gender, race, medical history, and genetics, are declining. Hearing has an effect, but age, work experience and duration of exposure are important factors that along with sound have a significant effect on hearing loss. In Iran, limited studies have been conducted on the relationship between the equivalent level of exposure and hearing loss, and most researchers have considered the sound pressure level of exposure in their studies (Zamanian et al., 2015) (Asivandzadeh, Jamalizadeh, Mohebi, Yari, & Fazeli, 2019). Research shows that there is a significant relationship between noise exposure, work experience and age with hearing loss (Amouei, Talebian, Fallah, Asgharnia, & Aghalari, 2019) The study shows that the sound pressure level of 90-95 decibels can lead to hearing loss greater than 25 decibels. But in comparison with the sound pressure level less than 80 decibels, it does not cause significant hearing loss (Zaw et al., 2020). Exposure to loud noise in a short period of time (from a few seconds to a few hours) causes temporary hearing loss, which is a temporary change in hearing threshold and usually returns after 24 hours. If repeated contact with sounds that initially change the thresholds were heard, there would be a permanent change in the threshold. Which is commonly seen in employees who deal with loud noises. Permanent hearing loss due to sound mainly starts from the frequency of 4000 Hz. Therefore, at first the person does not notice his hearing loss and when he realizes that he is limited in speech and social communication and mainly does not respond to treatment. OSHA estimates that hearing loss is one of the 10 most common work-related illnesses (Sinyai & Choi, 2020). In another study that examined the trend of workers' audiometric changes over a 3-year period and compared the changes with the first year of audiometry, age and gender were two influential factors in occupational hearing loss (Miri et al., 2020). In a study comparing the hearing threshold of people exposed to sound with controls showed that except at a frequency of 250 Hz, in all studied frequencies the hearing threshold of people exposed to sound is significantly different from the hearing threshold of controls(). Age-related hearing loss was one of the most common causes of high-frequency hearing loss, and its effect began around age forty [16,28]. Research by Tajik et al. In 2008 showed that there was a significant relationship between hearing loss and variables of volume, age, work experience and number of working days per week among metal industry workers with noise pollution (Tajik, Ghadami, & Ghamari, 2009).

## **2. Methods**

In this research, using the field method, using the documents in the periodic examination files of the employees of Imam Khomeini Shazand Oil Refining Company, the data in the files are collected and processed from 2014 to the end of 2017. Therefore, the type of historical study is retrospective. It was intended that the process of employee health be measured and studied according to the exposure of people to workplace noise and its impact on the level of physical health of employees during a period of 4 years. In medical research and the category of health services management in order to comply with medical ethics, there are limitations and they were numbered by others. Annually, the staff and the measured noise of the workplace were examined. The statistical population is the information and health documents of the employees of the exploitation units of Imam Khomeini Shazand Oil Refining Company. The sample size is 551 according to Cochran's formula. Data collection was done by registering the data in the periodic staff examination file in predetermined forms and by field method. This information includes the following and has been recorded and reviewed in various tables:

- The results of ear examinations performed by an audiologist
- Extracting age, job, background and exposure to workplace noise

After extracting the results from the staff periodic examination file, the results were analyzed by SPSS 20 software, which used chi-square test for qualitative data and student t-test for quantitative data. Excel program is used to draw graphs. The criterion used to determine hearing loss was an mean threshold of 25 dB at each of the frequencies listed.

### 3. Results

The mean age of participants was 38.88 with a standard deviation of 9.92 years (range: 24- 54 years) and the mean age of work experience was 18.94 years with a standard deviation of 11.92 years (range: 1- 27 years). In the present study, workers aged 40 and older were two times more likely to have hearing loss than others. Hearing loss was particularly high among workers with long industry backgrounds. In this study, workers with more than 15 years of experience in the company were twice as likely as those with 8 years or less of experience to have hearing loss. The sound pressure level in different parts of the studied industry is shown in Table 1.

**Table 1:** Mean (standard deviation) sound level

No.	Unit	Years	Sound level (dB(A))			
			2014	2015	2016	2017
1	Operation		88 (5)	93 (9)	94 (8)	96 (11)
2	Repair and maintenance		90 (6)	92 (5)	92 (9)	94 (9)
3	Administrative		70 (3)	69 (3)	68 (2)	69 (3)

Table 1 shows the mean right ear threshold at different frequencies over 4 years. The results showed that at most frequencies in different years the mean hearing threshold has increased. For example, based on the results of the study, the mean and standard deviation of noise measured in the maintenance unit from 2014 to 2017 are equal to 88 (5) dB, 93 (9) dB, 94 (8) dB, and 96 (11) dB respectively, which indicates the increasing trend of sound level in the workplace.

Table 2 shows the results of Hearing threshold of the Right(R) and Left(L) ears of the studied workers in the Oil Distribution and Refining Company from 2014 to 2017.

**Table 2:** Mean (standard deviation) Hearing threshold of the ear of the studied workers

Ear -Frequency	Sound level (dB(A))			
	2014	2015	2016	2017
R-1000	13.14 (6)	17.54 (8)	21.08 (7)	24.61 (12)
L-1000	11.32 (10)	16.14 (11)	21.91 (11)	22.78 (11)
R-4000	16.51 (11)	20.14 (9)	26.76 (8)	29.19 (13)
L-4000	15.49 (8)	22.14 (9)	28.55 (9)	31.40 (9)
R-6000	15.66 (9)	20.14 (12)	25.71 (12)	29.14 (8)
L-6000	15.83 (10)	21.14 (11)	25.37 (10)	28.46 (9)

Table 3 shows the results of the statistical test of the difference between the mean hearing threshold of the Right(R) and Left(L) ears of the studied employees in different years studied in terms of P value.

**Table 2:** Statistical analysis of hearing threshold of the studied employees in different years

Ear -Frequency	P value			
	2014-2015	2014-2016	2015-2017	2014-2017
R-1000	0.371	0.09	0.081	0.000
L-1000	0.365	0.110	0.087	0.000
R-4000	0.111	0.043	0.031	0.000
L-4000	0.126	0.041	0.037	0.000
R-6000	0.198	0.049	0.053	0.000
L-6000	0.344	0.069	0.058	0.000

The results showed that the difference in the mean threshold was significant in most of the years studied.

#### 4. Conclusion

In the present study, the noise level of the work environment and the trend of changing the hearing threshold of the workers of the refining and distribution company of petroleum products in a 4-year period were investigated. The framework of this study is a cross-sectional study over a period of 4 years and the impact of workplace noise on employees' hearing loss is examined and measured. The results showed that the difference in the mean threshold was significant in most of the studied years, especially in comparison with 2014 and 2017, which was significant at the level of  $\alpha < 0.01$  in all studied frequencies. In addition, age also had a direct effect on increasing hearing loss, and this has been consistent with studies by others (Fang et al., 2018). In the present study, workers aged 40 and older were two times more likely to have hearing loss than others. Hearing loss was particularly high among workers with long industry backgrounds. In this study, workers with more than 15 years of experience in the company were twice as likely as those with 8 years or less of experience to have hearing loss. This finding was consistent with other studies in Studies (Miri et al., 2020) and (Zaw et al., 2020). Hearing loss as a consequence of workplace noise threatens the health of workers in the broadcasting company and therefore it is suggested that in addition to management controls, engineering controls be a priority for the HSE unit and the company's management

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