

# Evaluating of Personal Exposure to Noise and Its Annoyance Among Dentists in Ilam

Negar Safarpour Khotbesara<sup>1</sup>, Sahar sanie<sup>2</sup> and Nematullah Kurd<sup>1\*</sup>

<sup>1</sup>Department of Occupational Health and Safety Engineering, School of Public Health, Hamadan University of Medical Sciences, Iran

<sup>2</sup>Department of Occupational Health and Safety Engineering, School of Public Health, Ilam University of Medical Sciences, Iran

\*Corresponding author: Nematullah Kurd, Department of Occupational Health and Safety Engineering, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran



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## ABSTRACT

**Introduction:** In workplaces, various hazards endanger workforce's health. An important hazard is work related noises which have negative impacts on staff's health. Dentistry is, inter alia, an occupation which has always its own noises. Hence, present study aims at evaluating personal encountering with noise and its harassment rate among dentists in Ilam.

**Methodology:** This is a cross-sectional descriptive – analytical study on dentists in 40 private dentistry offices and centers in Ilam. Initially, to evaluate noise encountering, noise measurement was conducted in normal work conditions by using Sound Level Meter, model CEL-450, in dentists' audibility range. Then, in the second phase of study and after determining exposure rate, demographical information as well as self-report on workplace noise annoyance questionnaires were distributed among participants and were completed in their attendance. Ultimately, All data were analyzed by using SPSS Version 16 software package.

**Findings:** Results from personal noise measurement indicated that 8- hour equivalent average among surveyed dentists is 86.3 dB which is higher than allowed 8- hour rate (85 dB). Likewise, the results from evaluating the intensity of workplace noise indicated that 4.34% of male dentists have reported encountering with higher than average noises while 10% of female dentists have reported encountering with average noises. 21.73% of male and 20% of female dentists have evaluated workplace noise as harassing respectively. Likewise, 39.13% of male and 60% of female dentists have reported workplace noise as relatively harassing respectively.

**Conclusion:** Considering the results from sound metering and self-reports by dentists on estimating the intensity and harassing rate of their workplace noise, the need to provide engineering – managerial guidelines to confront noises is felt.

## Introduction

In workplaces, various hazards endanger workforce's health. An important hazard is work related noises which have negative impacts on staff's health [1,2]. According to Work Safety and Health National Institute (NIOSH), noise is recognized among ten

main work related illnesses or damages [3,4]. The most important impact of noise on human health is audition reduction [5]. By damaging internal ear cochlea, work related noises reduce sensory – nervous audition. Such damage is usually symmetric in both ears and its first signs can be observed via audiometry. Although

cochlea damage is irrevocable, one can prevent its improvement by stopping encountering with noises [6-8]. Noises over allowed range can interfere the performance of other organs in addition to hearing system and, as a physical stress, it can increase blood pressure, heart beats and consumed oxygen [9,10]. Various studies suggest that in addition to sound balance, its temporal continuance and its contact length with personal factors such as age, eye color and skin can intensify its impact on health [11]. According to NIOSH, over 30 million US employees are encountering impermissible noises while in EU, over 35m people are confronting with impermissible sounds; to the same reason, job audition reduction is seen as one of the most important job diseases [12]. Audio pollution and its health impacts are not limited to industrial fuses; rather, small workplaces including dentists' offices are also exposed by its health impacts due to using devices which produce harassing noises. To some extent, labor laws and regulations in factories and workshops have addressed to prevent workers'/staff's job diseases prevent and protection while, regretfully, comprehensive laws on dentists' job health are not executed in Iran [13].

Dentistry is a job with noises. Such sources as turbines, low speed hand pieces, high speed suction, ultrasonic devices and cleaners always produces fuses in dentists' workplace and damage audition potentially [14-16]. The rate of hazards by such noises for dentists depends on personal factors including personal sensitivity, daily confrontation with noise producing devices and the patterns to utilize them [17,18]. The causal relationship between dentistry drill and audition reduction among dentists has been the aim of many studies over years. Noises in dentistry offices may have incremental impacts which can explain which a remarkable number of dentists would experience hearing loss. Al-Rawi et al conducted a study to evaluate job noises related hearing loss among dentists [19]. Their findings suggest that there is a positive correlation between work years and hearing loss. Theodor off et al studied the relationship between hearing loss and long term confrontations with dentistry high speed hand pieces [20]. Their findings indicated that dentistry clinics which used high speed hand pieces had worse hearing situation than other ones. Such findings

suggest that executing a protective strategy should help reduction in job hearing loss prevalence. Hence, the main aim of present study is to evaluate personal encountering with noise and its harassing rate among dentists in Ilam so that one can utilize such findings in preventing and controlling dentists' workplace factors.

## Methods

This is descriptive – analytical study in 40 private dentistry offices and centers in Ilam on dentists who entered the research by census. Initially, the people who suffered from transferring hearing loss were exited from the study (transferring hearing loss is a type of hearing loss due to reasons except than hearing system damages such middle ear infection, tympanic membrane tearing, etc.). To evaluate encountering with noises, noise measurement was conducted in normal work conditions by using Sound Level Meter, model CEL – 450, in dentists' audibility range in order to determine the confrontation in different section and to assess those sections with high noise balance. According to standards, Sound Level Meter calibration in workplace was CEL-110/2 calibrator with the frequency of 1000 Hz and sound pressure balance of 84 dB. In the next step, sound pressure balance and equivalent 8- hour balance was calculated for each dentist. In the second phase and upon determining people's confrontation, demographical information as well as self- report questionnaires on workplace noise harassment rate were distributed among participants and were completed in their attendance. The content validity of harassing questionnaires is achieved by obtaining the opinions of relevant experts. Preliminary test was conducted to achieve questionnaire reliability and Cronbach alpha ratio was computed 0.81 for this questionnaire [21]. This questionnaire consists of three parts, scoring test to workplace noise intensity from 0 to 10 (Figure 1), figuring workplace harassing noise from 0 to 100 (Figure 2) and determining the modes experienced by people during the day such as the feeling of exhaustion, laxity, decreasing focusing power, etc. (Figure 3) [21,22]. Finally, collected data from SPSS Version 19 and T-Statistic test and Spearman correlation coefficients were analyzed.

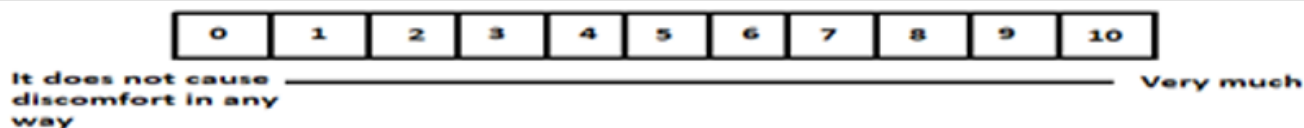


Figure 1: Scoring test to workplace noise intensity.

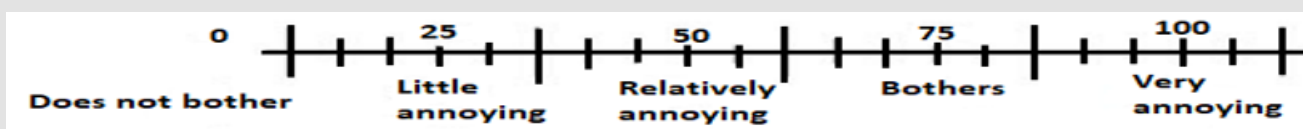


Figure 2: Scoring test to workplace harassing noise.

Daily, to what extent are you involved with the following in your work environment:

- Feeling exhausted
- Sluggishness and drowsiness
- Vertigo
- Decreased concentration
- Headache
- Sadness
- Other problems
- No problems and complaints

For each item, there are five response options: Never, Rarely, Sometimes, Mostly, Always.

Which of the following emotions do you experience daily in the workplace:

- I feel uncomfortable
- I feel vibration and trembling in my body
- I feel pressure and heaviness in my head
- I feel pressure and fullness in my ears
- I have other feelings besides the above
- I have no feelings

For each emotion, there are two response options: Yes, No.

Figure 3: Scoring test for determining the modes experienced by people during the day.

### Findings

Since 7 people left the study due to lack of cooperation and lacking entry criteria, finally, 33 dentists including 23 male and 20 female ones were studied. The average age of total sample was 39.2 years and 41.4 and 33.7 for men and women, respectively. Their working hour average in offices was 4.5 hr with 1.2 as standard deviation. 13.04% of male and 20% of female dentists have second jobs and 4.34% of male dentists were cigar smokers. Dentists' demographical traits are provided in Table 1. The results from audiometry for 33 dentists suggest that the highest and lowest

measured noises were 109/80 dB and 43/90 dB, respectively. The highest and lowest 8- hour balance were 117.48 and 82.16 respectively while the average of 8- hour balance was 86.3 dB which was higher than permitted range. The relevant findings are outlined in Table 2. The results from analyzing the questionnaire on workplace noise intensity and its harassing rate are shown in Tables 3 & 4. The findings from workplace intensity evaluation indicated that 4.34% of male dentists have reported encountering with higher than average noises (score 6) while 10% of female dentists have reported encountering with average noises (score 5).

Table 1: Demographic characteristics of the studied dentists.

Quantitative Demographic Variables		Average	Standard deviation
Age	Man	41.4	7.82
	Woman	33.7	4.11
Daily working hours	-	4.5	1.2
Qualitative Demographic Variables		Number	Percentage
Second job	Man	3	13.04
	Woman	2	20
smoking	Man	1	4.34
	Woman	-	-

**Table 2:** Results of sound measurement and calculation of Leq (8 hr).

Dental Clinic Code	Max(dB)	Min(dB)	Lav (dBA)	Leq (8 hr) (dBA)
1	86.50	62.80	73.90	95.58
2	82.10	72.40	77.30	97.98
3	88.00	75.30	81.70	93.35
4	86.00	65.00	77.70	95.39
5	93.80	54.40	77.50	96.94
6	90.60	57.20	80.60	98.29
7	81.70	64.10	72.10	105.4
8	92.50	58.80	85.60	117.48
9	85.10	64.20	76.60	107.23
10	83.10	52.70	77.70	109
11	94.20	56.20	75.60	106.8
12	107.90	44.20	77.90	102.08
13	107.90	44.20	78.80	95.12
14	94.90	45.10	83.80	98.88
15	77.90	75.80	76.80	90.9
16	88.00	54.00	71.70	84.85
17	90.10	48.30	74.00	89
18	109.80	51.10	86.70	101.58
19	95.90	59.90	84.10	98.98
20	105.80	66.60	78.90	92.73
21	84.90	69.30	74.30	87.21
22	101.20	57.70	76.40	89.73
23	94.10	58.40	76.70	80.09
24	87.30	61.20	79.30	83.21
25	103.10	56.80	77.80	91.41
26	106.30	59.70	80.90	85.13
27	106.30	59.70	80.60	84.77
28	88.50	59.70	75.40	88.53
29	95.00	43.90	72.40	84.93
30	90.70	69.90	86.20	91.50
31	89.70	49.70	70.10	82.16
32	89.50	58.80	76.80	90.21
33	90	59.10	77.21	90.70
				86.3

**Table 3:** Results of workplace noise intensity assessment.

Evaluation code	Gender	Frequency	Percentage	Cumulative Frequency
1	Man	2	8.69	8.69
	Woman	-	-	-
2	Man	6	26.08	34.77
	Woman	3	30	30
3	Man	8	34.78	69.55
	Woman	4	40	70
4	Man	2	8.69	78.24
	Woman	2	20	90

5	Man	4	17.39	95.63	
	Woman	1	10	100	
6	Man	1	4.34	99.97	
	Woman	-	-	-	
Total	Man	23	Maximum	Man	6
	Woman	10		woman	5
Minimum	Man	1	Average	Man	3.13
	Woman	2		Woman	3.1

**Table 4:** Results of evaluating the level of annoyance of workplace noise.

Evaluation code	Gender	Frequency	Percentage	Cumulative Frequency	
0	Man	-	-	-	
	Woman	-	-	-	
25	Man	9	39.13	39.13	
	Woman	2	20	20	
50	Man	9	39.13	78.26	
	Woman	6	60	80	
75	Man	5	21.73	100	
	Woman	2	20	100	
100	Man	-	-	-	
	Woman	-	-	-	
Total	Man	23	Maximum	Man	75
	Woman	10		woman	75
Minimum	Man	25	Average	Man	45.65
	Woman	25		Woman	50

The findings on evaluating workplace noise harassing rate indicate that 21.73% of male and 20% of female dentists have evaluated workplace noise as harassing, respectively. Likewise, 39.13% of male and 60% of female dentists have reported workplace noise as relatively harassing, respectively. According to figure 4, 40% of male and female dentists have reported “rarely” option in average for repeating such feelings as fatigue, laxity, sleepiness, dizziness, concentration power reduction, headache and annoyance over a day while 70% of female and 60% of male dentists have responded

positively to a feeling except than annoyance, vibration, heaviness in head and pressure in ear. Likewise, 50% of female and 40% of male dentists have responded to feeling of annoyance positively. According to T- Test findings, there is no significant association between noise harassing in different aspects and gender (male/ female) ( $P > 0.05$ ). according to Spearman correlation coefficient, there is a strong and significant correlation between workplace noise intensity and workplace noise harassing (Table 5).

**Table 5:** Statistical analysis of the results of evaluating the intensity of workplace noise and the degree of harassment among dentists.

Workplace Voice Annoyance Scale	Spearman’s Rho	
0.723	Correlation Coefficient	The amount of volume received by the work environment
0.002	Significant	
33	N	

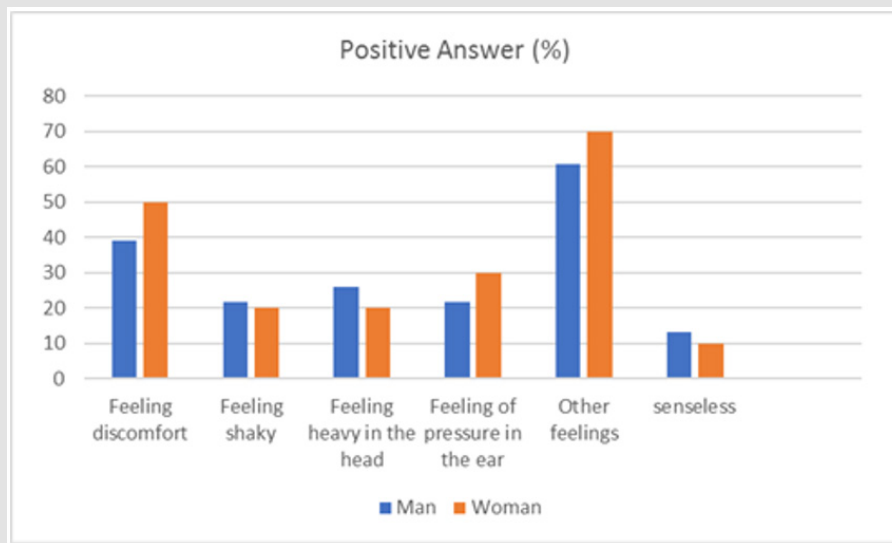


Figure 4: Percentage of positive response to complaints and feelings related to exposure to sound.

## Discussion and Conclusion

In addition to audition damages, encountering noises can influence on mental health [23,24]. Confronting sound pressure balance even less than 85db can lead into mental reactions such as anger, stress, fury and physical reactions such hypertension or magnesium excretion and can also impact on employees' performance and productivity especially in more complicated tasks [25-28]. In jobs like dentistry which have close relations to people's health, it is too vital to keep the concentration and balance [29]. Noise related annoyance in dentistry offices can yield to physicians' fatigue and concentration reduction and to increase human mistakes. It clarifies the importance of balance in confronting noises in terms of health and workplace safety. In present study conducted to evaluate personal confrontation with noise and its harassing rate among dentists in Ilam, the findings from sound level metering indicated that that 8- hour equivalent balance average among surveyed dentists is 86.3db which is higher than allowed 8- hour rate (85dB). Since dentists are repeatedly contacting with sounds and noises, long term encountering with noises can lead into serious hearing losses even if a lower than average is defined [13]. Thus, conducting engineering and managerial controlling initiatives such as providing dentists with needed instructions and using protective headset are necessary to reduce and control noises among dentists. The findings from workplace intensity evaluation indicated 4.34% of male dentists have reported encountering with higher than average noises (score 6) while 10% of female dentists have reported encountering with average noises (score 5).

Most dentists have experienced encountering with noise intensity with score 3 which can cause problems for them in long term. The findings on evaluating workplace noise harassing rate

indicate that 21.73% of male and 20% of female dentists have evaluated workplace noise as harassing, respectively. Likewise, 39.13% of male and 60% of female dentists have reported workplace noise as relatively harassing, respectively. Overall, considering the results, all surveyed individuals are in the range of workplace harassing in a way which can be an alarm for the health of people working in this field in long term, threaten their health chronically and yield into different disorders among them. To study noise harassing rate in different aspects with gender (male and female), T- Test was used and its results suggested that such people with any gender are statistically suffering from hazards of noise harassing in an equal manner. To determine the relationship between workplace noise intensity and workplace noise harassing rate, Spearman correlation coefficient is used; the findings indicated that there is a strong and significant correlation between both parameters.

## Conclusion

Overall, considering the results from this study, it seems necessary to execute a plan to protect audition and to take engineering and managerial controlling initiatives and techniques. By this way, one may mitigate dentists' suffering from produced noises and can prevent probable mistakes and damages against patients' health.

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