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Original

Increasing the Use of Hearing Protection Devices by Delegating the Right to the Workers

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Abstract

Background: Noise-induced hearing loss (NIHL) is one of the most common but absolutely preventable occupational diseases. One of the measures to prevent and control noise's harmful effects in the workplaces is the use of hearing protection devices (HPDs) that workers do not often accept to use or do not use throughout the entire work shift. Therefore, the aim of this study is to investigate the effectiveness of delegating the right to choose HPD to workers on the increase of the duration of using them. **Methods:** This interventional study was conducted on 60 male workers divided into two groups, intervention (n: 30) and control (n: 30), who were exposed to non-permissible sound levels during sampling. A questionnaire including BASNEF constructs was completed by both groups in two stages, ie, before intervention and 3 months after completion of the intervention delegating the right to choose HPD to workers. Durations of using HPD were recorded in two stages in intervention and control groups and compared. Data analysis was conducted by SPSS 22. **Results:** In intervention group, the number of workers who used HPDs full time was 0 (0%) before intervention and 16 (53.33%) after intervention. The duration of using HPDs significantly increased after intervention in intervention group than in control group. **Conclusion:** The intervention based on providing HPDs that are appropriate for the needs and wishes of workers and available as well as promoting their use in the work environment can persuade them to use such devices continuously.

Keywords: Hearing protection device; Delegating the right to choose; Hearing loss

Introduction

Noise-induced hearing loss (NIHL) is one of the most common occupational diseases. It is estimated that 16-24% of the causes of hearing loss worldwide are related to work. [1, 2] However, NIHL is absolutely preventable, and the most important way to prevent it is to eliminate the harmful agents. Sound engineering and management controls are the preferred method of preventing NIHL ;[3] But under certain circumstances, including high cost, lack of compulsion and inappropriate management, it is difficult to use them. Under such circumstances, the use of hearing protection devices (HPDs) is the only method to protect workers' hearing.[4]

In order to ensure the effectiveness of the hearing conservation program (HCP), the duration of using HPDs is an important and effective parameter for their efficiency.[5] The best HPDs are those that are

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used throughout the entire period of noise exposure. According to studies, hearing loss is reduced by continuous use of protective ear muffs.[6, 7] However, studies show that most employees do not use these devices properly and constantly.[8] A study by Sevenson et al. (2004) on the knowledge and attitude of Swedish employees about the risk of hearing loss showed that 95% of employees knew about noise-induced harm, 90% considered the risk of hearing loss as serious, and 85% of them believed HPDs were effective in protecting hearing, but only a small percentage of those who were exposed to noise used HPDs.[9]

So far, various interventions have been designed to increase the use of HPDs in the workplace. Many of these programs are based on the viewpoints of experts on health and industry as well as reliable scientific evidence, but the key element, ie, audience orientation, has been neglected.[10] In other words, the lack of paying adequate attention to the audience orientation principle as a key element can be observed in designing effective behavioral interventions to change individual and social behaviors throughout the stages of designing these types of programs.[11] The purpose of this study was to investigate the increase of the duration of using HPDs by delegating the right to choose them to workers.

Methods

The present study is an interventional study carried out in Lorestan Glass Company in(2016). The participants in this study were 60 workers (30 in intervention group and 30 in control group) of the factory who were exposed to non-permissible sound levels (above 85 dB). The sample size was determined given 95% confidence interval and 80% test power according to the formula below:

$$n = \left(\frac{z_1 - \frac{\alpha}{2} + z_2 - \beta}{d}\right)^2$$

Participants were not significantly different in terms of work experience, age, and noise exposure. Observations were performed before intervention and 3 months after completion of intervention in both groups. The intervention included the preparation of a brochure Figure 1. to introduce a number of protective ear muffs models and their features including the nominal noise reduction, model, material, weight, price, color, standard, and comfort and health. Then, the intervention group were separately allowed to choose protective ear muffs from several models based on their own criteria.

The selected model and the criteria that the person took into account in selecting it were recorded and the same model with the same features was bought for and provided to him. But the control group were delegated no right to choose the protective ear muffs for themselves and used the protective ear muffs provided by the company. Before the intervention, a questionnaire based on the constructs of the BASNEF model was filled out for both groups. The questionnaire consisted of 12 items regarding knowledge rated on a 2-point Likert scale (0: wrong answer; 1: correct answer) scale, 7 items on attitude, 7 items on subjective norms, 7 items on enabling factors, and 8 items on behavioral intention rated on a 5-point Likert (from Absolutely agree to Absolutely disagree) scale and 8 items on practice rated on a 3-point Likert (Absolutely agree, Partially agree, and Absolutely disagree scored 1, 2, and 3, respectively) scale.[12]

Three months after completion of the intervention, the questionnaire was again filled out for both groups to determine the effect of the intervention on the increase of the duration of using protective ear muffs by them. In order to record the durations of using the protective ear muffs before and after the intervention in the control and intervention groups, the participants were observationally monitored without prior notice and intangibly with the help of an expert on professional health and supervisors working in the industry. In this study, attempt was made to improve workers' attitudes toward HPDs by using the

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intervention delegating the right to choose protective ear muffs to them, taking into account their needs and wishes and reducing their barriers to access to HPDs.

To observe ethical standards, the research objectives were explained to the participants and they were assured that they could withdraw from the study during the study whenever they wished and that participation in the study would be completely voluntary. Data analysis was performed using the SPSS version 22. First, normality of data distribution was investigated by Kolmogorov-Smironov test, and then to compare the duration of using the ear muffs before and after the intervention, paired T test and independent T test were used. *P*-value≤0.05 was considered significance level.

Results

The frequency distribution of the demographic characteristics of the studied workers is presented in Table 1.

According to Table 1, participants in the two groups are almost matched and not significantly different with respect to work experience, age, marital status and education level (*P*-value> 0.05). Participants were selected from different work shifts. In order to record the durations of using the protective ear muffs before and after the intervention in the control and intervention groups, the participants were observationally monitored without prior notice and intangibly with the help of an expert on professional health and supervisors working in the industry. The results of these observations are presented in Table 2. Additionally, the results of measurements of the durations of using protective ear muffs are shown in Table 3.

The results of the above table show that before the intervention, the number of workers who used the protective ear muffs is almost the same in the intervention and control groups, but the number of these workers increases in the intervention group but does not change in the control group after the intervention Table 3.

The results of Table 3 show that the duration of using the ear muffs in the intervention group is significantly higher after the intervention compared to before the intervention (*P*-value≤0.001). In the control group where no intervention was implemented, the mean duration of using the ear muffs did not change after the intervention compared to before the intervention.

Features :

- Nominal volume reduction: 20 dB
- Color: red
- Body Material: Plastic
- Headband type: leather
- Floor pads: PVC
- Weight: 114 g
- Price: 400,000 Rials
- Under European CE standard
- Non-allergenic pads fitted to the ear shape
- Superb comfort
- It is not possible to replace the cushions on the ear

It is not possible to use (vertically) with a helmet

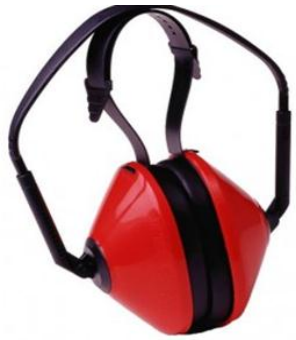

Figure 1. An example of a brochure for protective ear muffs

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Table 1. Frequency distribution of demographic characteristics of workers in two groups of intervention and control

demographic information	Variable	Intervention group Number (%)	Control group Number (%)	Significance level
Age group (yr)	25-30 30-35 35-40 Over 40	4(13.3%) 11(36.7%) 11(36.7%) 4(13.3%)	6(20.1%) 7(23.3%) 8(26.7%) 9(29.9%)	0.47*
Work experience (yr)	Less than 5 5-10 15-10 Over 15	5(16.7%) 12(40%) 9(30%) 4(13.3%)	7(23.3%) 9(30%) 6(20%) 8(26.7%)	0.40*
Marital status	Married Single	28(93.3%) 2(6.7%)	29(96.7%) 1(3.3%)	0.56**
Education level	Illiterate, elementary education Secondary education High school diploma Associate's degr Bachelor's degree	0(0%) 13(43.3%) 16(53.4%) 1(3.3%)	0(0%) 6(20.1%) 22(73.3%) 2(6.6%)	0.11**

* Paired T test ** Independent T test
Significance level P <0/05

Table 2. Frequency distribution of workers' status of using protective ear muffs

Duration of using ear muffs	Intervention group		Control group	
	Before intervention	After intervention	Before intervention	After intervention
Never	24(80.00%)	5(16.66%)	26(86.66%)	25(88.33%)
Sometimes	6(20.00%)	9(30.00%)	4(13.33%)	5(16.66%)
Full time	0(0.00%)	16(53.33%)	0(0.00%)	0(0.00%)
Total	30(100.00%)	30(100.00%)	30(100.00%)	30(100.00%)

Table 3. The results of mean duration (h) of using protective ear muffs in intervention and control groups before and after intervention

Duration of using the HPD group	Number	Before intervention Mean	Before intervention Standard deviation	After intervention Mean	After intervention Standard deviation	Paired T test
Intervention	30	0.5	1.04	6.00	2.90	T= -10.199 Sig.(2-tailed)=<0.001
Control	30	0.5	1.31	0.53	1.31	T= -0.191 Sig.(2-tailed)=0.850
Independent T test		T=-0.106 *P*-value=0.916		T=-9.278 *P*-value=<0.001		

Significance level P<0.05

As the results of Table 4 show, there is no significant difference in the BASNEF model constructs between the intervention and control groups before the intervention delegating the right to choose the ear muffs. In intervention group a significant difference was observed in the mean scores of the BASNEF constructs except for knowledge after implementation of the intervention delegating the right to choose protective ear muffs to the workers. However in the control group where no intervention was implemented, no change was observed in the mean scores of the BASNEF constructs.

Discussion and conclusion

The purpose of this study was to investigate the effect of the intervention delegating the right to choose the HPDs to workers so that the target population would accept the benefits of using HPDs and therefore use them more frequently. The significant difference in the duration of using the HPDs after the intervention in the intervention group compared to before the intervention and the control group, indicated the effect of the intervention in achieving the desired goals.

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Table 4. Comparison of mean (standard deviation) values of the BASNEF constructs before and after intervention in two groups of intervention and control

BASNEF model constructs	group	Before intervention		After intervention		Paired T test	
		Mean	Standard deviation	Mean	Standard deviation	T	Sig.(2-tailed)
Knowledge	Intervention	5.50	1.77	5.80	1.86	-0.742	0.464
		5.20	1.64				
	Control	Mann-Whitney test Z=-0.625 Sig=0.532		5.26	1.52	-0.273	0.787
Attitude	Intervention	26.46	4.00	28.90	3.41	-2.535	0.017
		26.00	3.04				
	Control	Independent T test T=-0.523 Sig=0.603		25.36	3.20	-1.35	0.177
Influential people	Intervention	26.40	5.40	28.33	3.67	-2.276	0.03
		24.40	7.78				
	Control	Mann-Whitney test Z=-0.657 Sig=0.511		23.96	7.09	1.538	0.135
Enabling factors	Intervention	23.56	6.00	29.76	2.97	-5.377	000
		22.10	7.64				
	Control	Mann-Whitney test Z=-0.415 Sig=0.678		21.96	6.35	0.872	0.390
Behavioral intention	Intervention	33.26	4.75	36.46	3.37	-2.339	0.026
		32.63	6.00				
	Control	Independent T test T=-0.954 Sig=0.344		31.90	5.70	0.959	0.345
Practice	Intervention	18.63	3.81	21.60	2.34	-3.643	0.001
		18	4.19				
	Control	Mann-Whitney test Z=-0.423 Sig=0.672		17.33	3.13	1.52	0.138

Significance level P <0/05

Although several interventions have been carried out to increase the use of HPDs in recent years, various studies have shown that the percentage of workers who use protective ear muffs in exposure to harmful noises varies from 20% to 50%.[13-16] The establishment of strict and preventative laws for employers and employees, as well as the development and implementation of educational programs aimed at raising knowledge, correcting attitudes and beliefs, and improving skills, including the programs implemented during recent years, have not culminated in desirable results.

In the field of health, there are different approaches to behavior change the most important of which include training and legal compulsions. However, education and compulsion cannot be always effective. In fact, many of these programs are based on the viewpoints of experts on health and industry as well as reliable scientific evidence, but the key element, ie, audience orientation, has been neglected. In other words, most of these interventions have been developed and implemented without paying due attention to the needs and wishes of the audience and the factors influencing their behaviors.[10, 11]

In this study, attempt was made to give employees the right to choose the type of protective ear muffs to motivate them to act or behave effectively using a precise program that was based on their needs, wishes, interests, and tastes. Lusk et al. have also argued that the best HPDs are those that workers choose to use in all conditions and constantly.[7] In our study, various models of protective ear muffs were chosen by the workers, which in turn greatly improved their adherence to using this device.

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The study of Arezes et al. showed that when a few number of HPDs are available to choose, unfavorable attitudes could be created toward the use of HPDs in workers. These factors can cause dissatisfaction and frustration with protective ear muffs, which in turn will reduce hearing protection as a result of inappropriate and incorrect use of HPDs.[17] The study of Arezes et al. showed that HPD selection should be collaboratively accomplished by workers, managers and the staff of the health and safety department.

Given that a variety of HPDs are currently available in various sizes and settings, workers can select a more personal and appropriate HPD, and, ultimately the role of workers and their attitudes toward HPDs should not be ignored because this will determine the general success of any HCP.[3] The delegation of the right to choose the protective ear muffs to the workers, the use of quality devices, direction of due attention to the workers' viewpoints and reactions, and the consideration of their interests, tastes and ideas represent their value and importance of their personalities for employers, which increases the efficacy of the HCP and workers' compliance level. In this study the rate of full-time use of protective ear muffs was(55.33%) after the intervention.

The results of the current study showed that the implementation of this type of intervention was effective in improving the attitude, subjective norms, enabling factors, behavioral intention and practice. One limitation of this study was that all participants were male, necessitating it to include female samples in future studies. It is suggested that, for choosing HPDs, a brochure be included in the package to state the features of the device and a sample of the same type of the device be also provided so that the consumer can touch it easily and examine it for user-friendliness,ect. to make a better choice. Given the effectiveness of this intervention in the field of occupational health and particularly on the increase of HPDs use, it is hoped that the intervention will pave the way to develop and implement such interventions to reduce other unsafe behaviors in the workplace.

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