

Critical Review:

Do workers who are exposed to high levels of occupational noise increase the use of hearing protection devices after attending a hearing conservation program?

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This critical review examines whether workers who are exposed to loud levels of occupational noise increase the use of hearing protection devices after they receive training regarding hearing loss prevention and the benefits of using the devices. Research supports that most workers do increase the use of HPDs after an educational intervention. However, the literature contains some bias and contamination of the groups making it difficult to conclude that workers increased the use of the hearing protection devices due to the training only. The findings of these studies should inform audiologists and researchers about the need to develop and deliver effective training programs in order to influence workers' awareness regarding the use of hearing protection devices.

Introduction

According to the literature, noise induced hearing loss (NIHL) is a common occupational health hazard that affects more than 30 million workers in the United States. Some of the consequences of exposure to loud levels of occupational noise include not only NIHL but also tinnitus, anxiety, depression, and stress on the job. (Lusk et al, 2003). This condition is permanent and irreversible. However, it can be prevented by hearing conservation programs and by the use of hearing protection devices (HPDs).

There are some limitations of HPDs and the most important one is that a great number of workers do not use them, especially in some industries where workers are exposed to high levels of noise that are variable throughout the duration of a work shift (for example construction or farming). It is important that employers provide workers with education or training programs to promote the use of HPDs in order to prevent NIHL.

In the United States some studies have been done to prove the effectiveness of training programs or educational interventions to increase the usage of HPDs. Based on workers' beliefs and knowledge about NIHL and HPDs, some hearing conservation programs have been developed in order to modify workers' behaviors and to provide them with information that they are missing to fully understand what it means to live with a hearing loss and how to prevent it.

Objectives

The primary objective of this paper is to critically evaluate existing literature regarding the increase of HPD use by workers who are exposed to high levels of

occupational noise after they receive training about NIHL, its prevention, and the use of HPDs.

Methods

Search Strategy

The following computerized databases were used: SCOPUS, PubMed, audiology online, ProQuest Nursing Journals using the following key words: [(Hearing protection devices (HPD)) AND (workers) (Occupational noise) AND (Hearing protection) (Hearing conservation programs) AND (Workers) (Intervention to increase workers') AND (Hearing protection)]

Selection Criteria

Articles included in this review were required to have a randomized design, or pre and post-training data regarding hearing conservation programs and HPD use. They were required to include some form of intervention to encourage the use of HPDs, data from workers who were exposed to high levels of occupational noise (85 dBA or more), and measured the amount of use of hearing protection devices after training.

Data Collection

Results of the literature search yielded 3 studies: two randomized controlled designs and a single group pre-post test.

Results

Randomized Clinical Trial (1)

Knobloch and Broste (1998) examined the effects of a hearing conservation program that was delivered during the course of four school years to teenagers who worked

or lived in farms in the state of Wisconsin. The study included 753 participants grade 7th, 8th and 9th from 34 schools that were randomized into an intervention or control group.

Students in the intervention group (n=375) were involved in an educational program that included classes, demonstrations, assessments of noise levels with sound level meters, yearly hearing tests, and free HPDs throughout the program. Teenagers in the control group (n=378) did not receive the educational intervention or any information regarding NIHL, but they were given the yearly hearing tests.

Results indicated that at baseline, 23% of intervention group students and 24% of control group students used HPDs some of the time. After the educational program, the use of HPDs exceeded 80% beyond one year for the intervention group. Students in the control group also reported some increase in use.

When students were asked about intended use of HPDs in the future, intervention students reported 81% of intended use of HPDs. Participants in the control group reported 43% of intended future use. Some factors may have influenced the intervention students to increase the use of HPDs such as having different types of free HPDs, audiometric exams and educational mailings to their homes reminding them to wear the devices.

Results of the study were based on the teenagers' self-reported use of HPDs, which may lead to question the accuracy of the results. The study has some limitations that are explained by the researchers. Some of the limitations include the fact that 70% of the participants' parents were involved in the agricultural field, and 28% of the students had a parent or sibling with hearing loss. This factor might have encouraged teenagers to wear HPDs. Another limitation was that the control group might have been influenced by the yearly hearing tests, and also it was believed that some teachers may have informed control group students about the content of the educational program.

Knobloch and Broste concluded that the hearing conservation program could in fact modify participants' behaviour regarding the use of HPDs.

Randomized Clinical Trial (2)

Lusk, et al (2003) presented the results of a tailored, a non-tailored and a control intervention delivered to workers in a factory in the United States' Midwest. The study included 2831 participants for the pretest collection of data. The posttest was done with the workers who returned for their annual hearing test after 6 and 18 months following the baseline test. A large

percentage of workers dropped-out and therefore posttest data was available for 1325 workers only.

All participants were required to provide information about their current use of HPDs, and answered questions about predictors of HPD use. The next step was to assign the workers randomly by computer to the tailored, non-tailored or control interventions. The tailored intervention was based on the information provided by the workers, and the contents were designed using Pender's Health Promotion Model. The non-tailored intervention was not personalized and all the workers in that group received the same information. Workers in the control intervention were only shown a commercial video about HPDs.

Paired *t* tests showed that workers in the tailored intervention significantly increased their use of HPDs after the training (p=.001). Those in the control group also reported greater use; however, paired *t* tests showed that this change was not statistically significant (p=.138). Participants in the non-tailored intervention actually decreased the use of HPDs slightly after the training. In this study, some workers reported that they used HPDs 100% of the time even before the interventions; therefore, they could not increase the usage. Those workers also reported 100% usage after the training. A reanalysis was done and showed that the increase was still statistically significant. Results were based on workers' self-report use of HPDs; consequently, there could be some doubt regarding the precision of the data.

Lusk, et al concluded that the most effective intervention was the tailored one, which was personalized and had a major impact on workers' use of HPDs. They also compared their findings to other studies in the literature and stated that hearing conservation programs that train workers regarding the use of HPDs are not only important, but also needed.

Single Group Pre-Posttest (1)

Neitzel, et al developed a hearing conservation program and tested its effects on 33 construction workers. Pender's Health Promotion Model (HPM) was used to develop the training materials and to create a survey for the workers. The training was very thorough and included concepts like noise exposure, sources of noise in construction, NIHL and its prevention, tinnitus and HPDs among others. The program also included demonstrations about measuring levels of noise with sound level meters and a second demonstration that was particularly designed for workers to understand and obtain better knowledge of HPD and their proper use. Workers were trained to use HPDs whenever exposed to noise levels greater than 85 dBA.

Researchers used two different measures in order to assess the effects of the HPD training. One was a system of cards where workers reported noise levels, HPDs use, and the tools being use during the work shift among other events. The second measure consisted of a questionnaire in which workers reported use of HPDs. All the participants in the study filled in the activity cards and the pre and post training questionnaires. Some measurements were excluded due to missing data. The effects of the training were measured for 23 workers.

Results indicated that the percent of time where workers increased the use of HPDs when exposed to levels of noise greater than 85 dBA almost doubled after the training. This increase was shown to be statistically significant ($p=0.03$). Results of a paired Student's *t* test showed that after the program workers increased significantly their knowledge about the items that were taught in the training. In this study as in the previous two, some of the workers had received some training regarding HPD use before the delivery of the program; therefore they could not increase the usage of HPDs. Future intended use of HPDs increased after training; however, the change was not statistically significant.

Neitzel et al concluded that after a hearing conservation program it is possible to observe an increase in HPD use in workers. This was believed to be difficult to achieve in a population of workers that is exposed to variable levels of noise throughout a work shift. Worker's knowledge regarding NIHL and HPDs also increased significantly after the intervention.

Results

These three studies have some commonalities. Both Lusk, et al and Neitzel, et al used the same Health Promotion Model to develop surveys and to design the hearing conservation programs. This could mean that when the content of an intervention is based on workers' beliefs and perceptions of HPDs the results are positive and workers increase the use of the devices. Even when the results showed that workers did increase the use of HPDs after receiving training, there were

some factors that might lead to question the accuracy of the results, for at least two of the studies; like the fact that they relied on self-reported use of HPDs. Future studies could implement a more objective way to measure the increased usage of HPDs like Neitzel et al did, with direct observation of workers, and recording systems where there is documentation of the use of the devices throughout a work shift.

For a great number of workers future intent to wear HPDs was not a priority, which may lead to conclude that hearing conservation programs should be delivered on a regular basis in order to reinforce what was learned during the interventions.

Clinical Implications and Recommendations

Overall, evidence from the three studies showed that workers do increase the use of HPDs after training, when the training is specific, personalized or repeated over time. If possible, this is how hearing conservation programs should be delivered in order to have a greater impact on workers' perceptions of HPDs and NIHL.

References

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