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Examination of Noise Hazards for Employees in Bar Environments

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Abstract

A noise sampling study was conducted in eight different bars in a small town. The study involved taking noise measurements using personal dosimeters worn by the researchers during peak operating hours. The results indicated that all the bars had average sound levels above 85 dBA (the OSHA recommended limit). Based on these results, a hearing conservation program should be implemented. This program should consist of hearing attenuation devices for current employees and hearing preservation awareness training.



Introduction

Bar patronage is an intermittent (most of the time) recreational activity. Reputable establishments are seen as safe and free from danger or harm to employees and patrons. For even the safest clubs and bars, the largest unforeseen danger for employees and patrons is noise, even though the usual definition of noise as unwanted sound may not be applicable in this context. The noise intensity in this environment can be so high that patrons may experience symptoms of temporary hearing loss. Since patrons experience this hearing loss, it can be assumed that employees (whose exposure is much greater than most patrons) may be more profound or at least have an accelerated onset.

The Occupational Safety and Health Administration (OSHA) has established standards for workplace noise limits to help prevent such hearing loss amongst employees. OSHA passed a hearing conservation amendment in 1983, which states that employees whose time weighted average noise exposure equaled or surpassed 85 dBA for eight hours must be included in a Hearing Conservation Program (Department of Labor, 1983). It is this time weighted average of 85 dBA that will be used to determine if a bar establishment is exposing its employees to hazardous noise levels. The maximum level of noise exposure allowed without the use of noise attenuating devices such as earplugs over eight hours is 90 dBA. The maximum exposure gradually increases with a decrease in time. Exposure to noise over 115 dBA is not allowed for any duration of time. For the purpose of this study, noise and sound are synonymous and generally imply sound pressure levels that are potentially in excess of what is deemed safe by current federal regulations.

The objective of this project was to determine if bar employees and patrons are exposed to hazardous sound levels. The levels were defined as an eight-hour time weighted average personal exposure level exceeding 85 dBA. Exposure was determined by two calibrated dosimeters worn by the experimenters through an entire shift at a selection of establishments in a single rural town.

Background Literature

Noise Exposure and Hearing Loss amongst Patrons

One of the earliest studies performed concerning club patrons noise exposure and potential for hearing loss was conducted in New Delhi discotheques during the 1970's. This study found noise levels of 79 to 95 dBA (Whitfield, 1998). Subsequently, the mean of all measured sound levels of 16 studies done from 1968 to 1986 concerning patron noise exposure was 103.4 dBA (Clark, 1991). More modern research has found sound levels in discotheques to be as high as 105 to 115 dBA (Axelsson, 1991).

A questionnaire study performed by Smith, Davis, Furguson, and Lutman in the United Kingdom in 2000 asked 6,883 individuals about their typical noise exposure during day-



to-day activities. Of these individuals, 23.1% said they were exposed to a significant amount of noise. Within this percentage it was stated that 18.8% were exposed to social noise (not related to job activities). The largest majority of this social noise was from nightclubs at 11.3%. Of those who attended nightclubs, 66.2% experienced temporary loss of hearing indicated by dullness of hearing, tinnitus or both. The results are practically identical to the survey conducted by the Medical Research Council Institute of Hearing Research which found that 66% of club goers reported temporary hearing problems after attending nightclubs (Bellis et al., 2002). Average nightclub attendance of individuals of this study was found to be about once a week. This agrees with other findings by the Royal National Institute for Deaf People (RNIDP, 2004) and Sadhra et al. (2002). It was also noted that males were found to have significantly more social noise exposure than females (Smith et al., 2000). This may be explained by Calvert and Clark who in 1983 hypothesized that high levels of noise prevents communication at distances greater than a few feet. Individuals that seek to meet members of the opposite sex may prefer a noisy environment where “they are not required to display their intelligence, wit or social skill” (Bray et al., 2004).

Noise Exposure and Hearing Loss amongst Employees

Nearly 28 million people in the United States have impaired hearing, with 10 million people having become hearing impaired due to exposure to loud noise. Of these 10 million people, 300,000 bartenders and 1.4 million waiters and waitresses employed in the United States were exposed to high sound levels (Gunderson et al., 1997). Studies conducted in which workers exposure in nightclubs and discotheques was evaluated, noise intensities ranged from 90 to 98 dBA with peak levels approaching 116 dBA (Gunderson et al., 1997; Sadhra et al., 2002). One study with nightclub employees in Hong Kong found exposures to loud noises up to 8.6 hours a day, six days a week. The patrons that attended those clubs were generally exposed on average 3.1 hours for 1.5 occasions per week (Sadhra et al., 2002), which is similar to previous exposure times mentioned.

Gunderson et al. conducted a study in 1997 that assessed Noise Induce Hearing Loss (NIHL) and occurrence of noise exposure on nightclub employees. Eight New York clubs featuring live bands were studied. Occupancies ranged from 105 to 2,000 people. Each club was visited three or four times between 09:00 PM and 02:00 AM, similar to the methods of RNIDP (2004) discussed previously. Rather than have a member of the bar staff wear a dosimeter, the investigator wore the dosimeter and stood near the midpoint of the bar to approximate the bartender’s exposure. To verify this action, on several occasions the bartender wore a dosimeter and results were compared to that of the investigator’s dosimeter. The results were found to be comparable, generally within 1 to 2 dB.

Interviews were conducted and questionnaires were made to see if there were relationships between noise exposure and tinnitus. As one would expect (and what Gunderson et al. found), employees who worked in louder clubs were found to have more



symptoms of tinnitus after work and were more likely to perceive a hearing deficit after work. It also showed that recently employed individuals perceived more hearing loss after work than did the individuals who were employed longer. This relationship was statistically significant amongst their findings. Similar findings by Taylor et al. in 1965 demonstrated that more recent employees with industrial noise exposure experienced more tinnitus (Gunderson et al., 1997). Long-term employees may have become desensitized to the perception of hearing loss or tinnitus after work or they may have experienced a permanent threshold shift in hearing. From those employees surveyed, 55% indicated they could not hear as well since becoming employed at their particular nightclub. This would lead the researcher to estimate that the same 55% of employees also reported rarely or never using hearing protection, although it was not implicitly stated. Approximately 29% of those surveyed reported using hearing protection “sometimes” and another 16% of those surveyed reported using hearing protection “often or always.”

The average personal exposure level for all the bars evaluated in the 1997 study exceeded 90 dBA and ranged from 94.9 to 106.7 dBA. Mean sound levels from the bartender and investigator were 94.3 and 95.6 dBA for ambient levels and 98.8 and 96.6 dBA for performance levels respectively. The highest peak sound levels exceeded 115 dBA during 67% of Hard Rock, 33% of Rock, and 25% of Blues performance measurements (Gunderson et al., 1997). Exposure times during performances ranged from four hours to less than one hour at the loudest nightclub. One surprising fact that emerged from this study was that there was no apparent relationship between distance from the noise source and the noise level exposure among bar staff, suggesting that club size was not a risk factor for NIHL. Ambient noise levels ranged from 83.7 to 97.1 dBA, suggesting that noise exposure may be excessive in music clubs during non-performance times. This may increase the number of workers in bar and restaurant establishments that are exposed to excessive noise and the risk for potential NIHL (Gunderson et al., 1997).

The 1997 study was fairly objective as to what the employees felt, rather than having a quantifiable method for determining what amount of hearing was actually lost. This objective data collection was replaced by quantifiable data in a study of 14 students working part time in music bars and discotheques at university venues in England (Sadhra et al., 2002). Noise monitoring took place from 06:00 PM to 12:45 AM in three different bar/dance/club type atmospheres. Average sound levels measured in these areas were 89 to 98 dBA with peak pressures recorded over three days being 113 to 124 dBA. In the United States, exposure of workers to sound greater than 115 dBA is not permitted for any duration of time (Department of Labor, 1983). Sadhra et al. carried out pre and post-work shift threshold shift audiograms to see what hearing loss occurred due to being exposed to noise on the job. Of the 14 students studied, 29% showed evidence of hearing loss of more than 30 dB as a temporary threshold shift (TTS). TTS values cannot be used to predict the extent of permanent threshold shifts (PTS) directly, but they do indicate that individuals are at risk of developing PTS if they are routinely exposed to these high sound levels. (Sadhra et al., 2002).



Methodology

Equipment

Two calibrated dosimeters were used to take noise samples. These dosimeters were designed to measure personal exposure levels, compliance assessments to noise standards (such as OSHA and ACGIH among others), and environmental analysis. The calibrator was preset at a 114 dB and was used to calibrate the dosimeters before and after each episode of data collection.

Data Collection Sites

Eight bars located in the downtown area of a small town were used in this study. Bars were selected that amplified music (live or recorded) was played and alcohol was served. The establishments varied in size but were generally one room consisting of a bar with, on average, 10 to 15 seats, a stage area where performers or disc jockeys were stationed with speakers generally to their sides, and a dance floor or standing area in the areas not occupied by bar seats or the stage.

Data Collection Methods

Noise samples were taken by the two researchers using personal noise dosimeters from 10:00 PM to 02:00 AM on Friday or Saturday nights. Sampling was done on average for four hours in each eight different bars. The dosimeters were worn on the belts of the researchers with the microphone being placed on the shirt collar near the ear. The sampling was conducted standing or sitting near or at the bar for the duration of the sample period. The dosimeters were set to measure personal exposure levels.

Results

The results of the data collection are shown in Table 1. Using “Bar 1” as an example, the average sound energy over the sample period was 86.3 dBA. If that figure were adjusted to an eight-hour period (all the sampling periods were less than eight hours), then the exposure would have been 91.7 dBA. Based on OSHA regulations (i.e., that an eight-hour TWA of 85 dBA may not be exceeded) the sample from Bar 1 indicated an exposure of 60.6% of the maximum allowable sound energy. When this allocation is adjusted for an eight-hour period, the exposure is 127.8% of the allowable exposure. The maximum sound energy level recorded was 107.5 dBA.



Table 1: Summary of the Data

	Bar 1	Bar 2	Bar 3	Bar 4	Bar 5	Bar 6	Bar 7	Bar 8	average
TWA	86.3	86.8	91.9	87.6	89.5	85.9	91.4	86.5	88.2
Projected TWA	91.7	92.1	96.9	92.5	94.9	91.2	96.6	91.6	93.4
% dose	60.6	64.5	131.3	72.3	94.5	57.1	122.5	61.6	83.1
% dose (projected)	127.8	135.3	262.8	143.3	198.1	119.0	250.1	126.4	170.4
Max	107.5	108.3	110.5	109.9	108.4	112.6	113.0	111.7	110.2

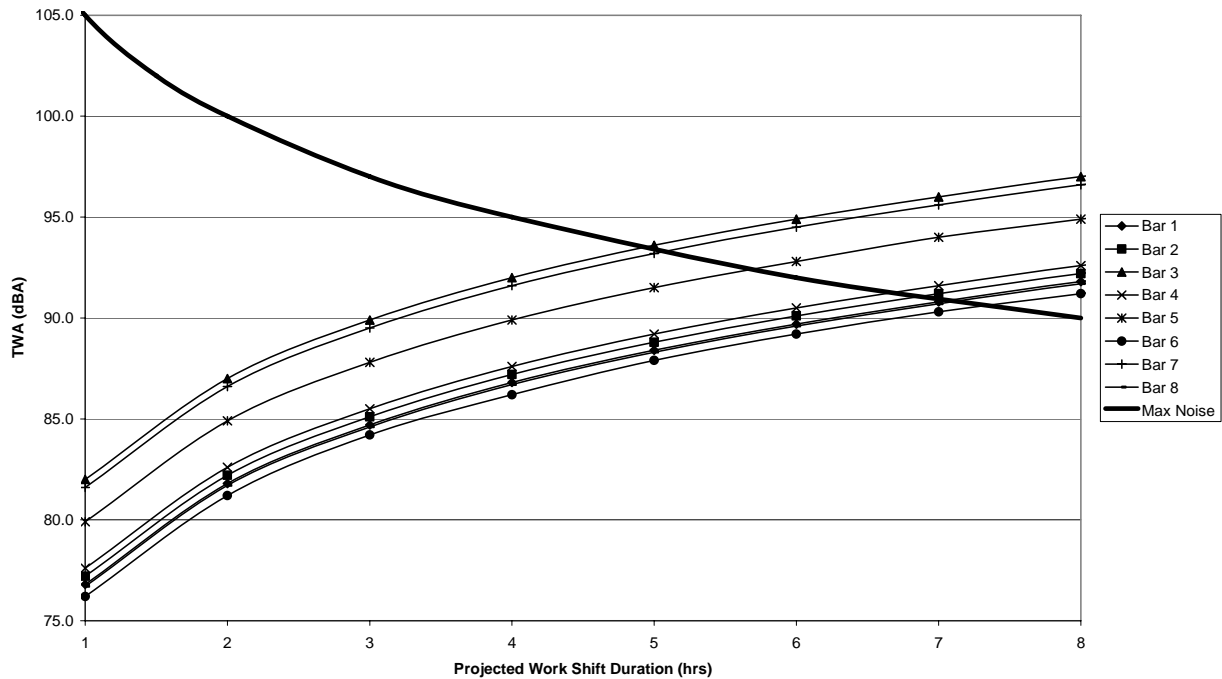
OSHA regulations require that exposures over 85 dBA for the projected eight-hour TWA be accompanied by a hearing conservation program and monitoring of the sound pressure levels. Hearing protection is not required, however, unless the projected TWA is over 90 dBA. Keeping this in mind, the following points are noteworthy.

- All the bars had readings over the 85 dBA projected eight-hour TWA limit.
- According to OSHA regulations, exposure to sounds of 115 dBA or greater is not allowed for any duration of time. It can be seen that Bar 7 approached 115 dBA but is still 2 dBA below the maximum allowable limit.
- Since 100 % dose is the maximum allowable exposure allowed for the sample period. Bar 3 and Bar 7 are the only two bars that exceed this figure. This indicates that hearing protection should be worn for these two bars during the sample duration.
- If the sound levels remained constant and were to be experienced during an entire eight-hour work shift, then all the projected doses would exceed 100%. This indicates that hearing protection is required at all seven bars for work shift duration of eight hours or more.

Figure 1 shows the relationship of the Projected Time Weighted Averages for all eight bars compared to the maximum allowable exposure. The figure demonstrates the point at which exposure at each of the bars exceeds the maximum allowable exposure.



Figure 1. Projected Time Weighted Averages for all eight bars in the study versus a line representing the maximum allowable exposure.



Recommendations and Conclusion

The research of this study indicates that individuals working in nighttime entertainment settings are exposed to hazardous noise levels. Although these data indicate that the noise levels are not sufficient to require hearing protection, the exposures are high enough to require a hearing conservation program and sound level monitoring since the eight-hour time weighted averages are over 85 dBA.

Since employees of bars do not always have eight-hour shifts, the TWA for the duration of actual work may be used to determine the implementation of a hearing program rather than the projected TWA.

The average TWA for all the bars was 88.2 dBA, which is nearly five to ten dBA lower than the noise exposures found in nightclubs and discotheques. The average eight hour TWA was 93.4 dBA, which approached 96.1 dBA, found by Bray et al. in 2004. All the bars sampled were above the 85 dBA criterion set forth in the beginning of this study as being the limit for safe noise exposure.



There are several recommendations that may be made based on these results.

- The owners of the bars should be made aware of the hazards to hearing that exist in their establishments. This information should be relayed to employees of those establishments. The owners would be required by OSHA regulations to provide hearing protection to employees.
- Controlling the intensity of noise found in a bar by lowering the volume is also recommended. This is not a practical solution, however, since most patrons are attracted by higher noise levels.
- Earplugs would be recommended in most industrial situations; however, this is not viable in this setting as it may interfere with employee-patron communication.

Therefore, a hearing conservation program is the most effective way to prevent hearing loss. Workers in bar environments should wear hearing attenuation devices (ear plugs, etc.) during the duration of their shift to protect. Newer employees should be made aware of the potential damage that may occur to their hearing from working in noisy environments and stress the need for hearing protection.



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