Perception of Noisiness in Various Professionals Exposed to Occupational Noise

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Abstract

Introduction: To determine the exposed noise levels and perceptual noisiness scores of various professionals who are prone to develop occupational hearing loss. Further, the relationship between perceptual noisiness scores and measured noise levels was assessed in the study. **Methods:** Initially, the exposed noise levels of different professions were evaluated (traffic police, bus drivers, auto-rickshaw drivers, vendors, and office workers). The "Noise at Work Questionnaire" was used to assess the noise perception scores under five different domains. **Results:** SPSS (version 21) was used to analyze the data. Levene test showed homogeneity of variance maintained for noise exposure levels across professionals, following which MANOVA was used. Shapiro–Wilk test for perceptual noisiness scores showed nonnormal distribution, following which Kruskal–Wallis test and Mann–Whitney U-test were performed for group-wise and pairwise comparisons, respectively. Further, Spearman's correlation for noise exposure and noisiness scores was done. The results pertaining to exposed noise levels revealed that the bus drivers (80.42 dB A) were exposed to high noise levels, whereas the office workers (52.4 dB A) had the least. In terms of perceptual noisiness scores, the results revealed a significantly better difference between the groups in the following aspects: benefits (χ^2 [4] = 18.679), barriers (χ^2 [4] = 10.828), self-efficacy (χ^2 [4] = 21.318), attitude (χ^2 [4] = 16.233), susceptibility (χ^2 [4] = 25.006). Furthermore, there was a negative correlation between the noise exposure levels and the perceptual noisiness scores. **Conclusions:** In spite of the high noise levels being measured, the bus drivers had the least noisiness scores among the groups, indicating negative attitudes in terms of perceptions which pose as a barrier to preventive measures. The alarming observation made was that 100% of individuals in the study had the least knowledge on the use of Ear protective Devices (EPDs).

Keywords: Attitude, equivalent continuous level, noise levels, perceptual noisiness

Introduction

The worldwide estimate shows that as many as 50 million individuals are at risk of developing noise-induced hearing loss (NIHL).[1] Exposure to noise above the permissible limits may have nonauditory and auditory effects.[2] Nonauditory effects may be somatic and encompass anxiety, fatigue, impulsive behavior, depression, inability to concentrate on tasks, restlessness, stress, and sleep disturbances.[2,3] With respect to auditory system, noise exposure causes a temporary threshold shift, permanent threshold shift, and tinnitus.[4]

Various studies have probed into the effects of noise on different population of various working classes at their respective workplaces. Ingle *et al*.,[5] in a questionnaire-based study, reported that 84% of the sample reported having hearing loss and reported at least some difficulty in hearing by either one or both ears. Similarly, Sliman *et al*.[6] measured exposure of traffic police to noise levels in the city of Sudan and observed that at all points of measurement, the level of noise was more. Major effects of noise among traffic police officers include annoyance and tinnitus. Leong and Laortanakul[7] assessed the noise exposure of different categories of occupational people who are exposed to noise, namely, dwellers, drivers, street vendors, and traffic officers and to traffic noise levels in the city of Bangkok, and according to the audiometric investigation, in this study, it was revealed that hearing sensitivity of the daily noise exposure groups living in the urban sites was noticeably poorer than those who were living in suburban site. Varying

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degree of hearing loss was reported in participants in the study done by Siddiqui *et al*.[8] They studied the effect of road traffic noise in human beings who worked in busy places of Karachi. 17.6% of individuals had normal hearing sensitivity, 33.6% had mild hearing loss, 45.6% had moderate, and 3.2% had moderately severe hearing loss. 55.2% of participants were found to be bothered by traffic noise. The results of the study by Pettersson *et al*.[9] showed that working with vibrating machines in an environment with noise exposure increases the risk of hearing loss, thereby corroborating to a link between exposure to noise and hand-arm vibration. The investigation of 500 truck drivers by Karimi *et al*.[10] using pure tone audiometry (AC) in Iran and hearing impairment was observed. Nine percent of truck drivers had a hearing impairment in the left ear and 12.6% in the right ear. Majumder *et al*.[11] reported that hearing threshold of Indian professional drivers is elevated in comparison to office workers in the city of Kolkata. Sen *et al*.[12] in a questionnaire-based study studied the noise exposure levels of auto drivers in Kolkata, India, and compared the history of uneasiness obtained through questionnaire to different auto drivers in various routes of the city and the noise exposure for drivers of auto-rickshaws. It showed a significant effect due to noise exposure.

From the brief review, it is inevitable to mention that there is no dearth of literature to establish and corroborate to the fact that exposure to noise in various workplaces has deleterious effects not only on the auditory system but also on mental health, especially in the long run. Occupational NIHL still exists as a global health problem despite the relation between exposure to high level of occupational noise, and its adverse effects being recognized for decades.[13] Moreover, due to advancement in urbanization, there is a steady increase in environmental noise levels and noise has become a necessary part of urban soundscape. In India, occupational permissible noise level limit for 8-h time-weighted average is 90 dB (A).[14]

With the recent shift in the economy from a manufacturing base to a service base, especially in developing countries like India, there has been growing concern that NIHL affects not only the recognized noisy professions such as industrial work but also many workers in the service sector (such as traffic police, drivers, street vendors, and cafeteria employees). Studies have measured the noise levels in the workplace, across different job sets.[7]

Comprehensive studies which have relatively compared the noise levels across people of different professions, knowledge of EPDs, perceived noise due to their working ambiences with varying levels and types of noise exposures, consequently the relation between the former are limited. According to OSHA,[15] the permissible noise level is 90 dB (A) for 8 h. Although the limit to noise exposure has been called for by setting up certain standards, the levels of noise to which workers are exposed who are working in different setups remain alarmingly high; putting them at the risk of development of NIHL. There is a need to measure the noise level of persons who are exposed to high-level noise for a prolonged period and to find the amount of perceptual noisiness levels associated with this. Introspection and inspection are required to know the state and efficacy of hearing loss prevention program (HLPP) in response to the enormous evidence which asks for immediate prospective steps to be taken to alleviate the environment soundscape of workplaces. The "Noise at Work Questionnaire"[16] is a multifaceted questionnaire with five sections which is used as a tool to comprehend the perceptions and knowledge which people might have regarding noise exposure and its possible impact on hearing and whether they have the opinion that they can affect their noise exposure in their respective workplace. This questionnaire was mainly developed to assess the effectiveness of HLPP; however, it can provide some vital information about the attitudes and other perceptual domains as the baseline state of affairs. Various working classes were chosen for the administration of questionnaire to study if the perception and attitude vary across groups. This questionnaire probes into the perceptions of five domains in terms of (1) the benefits of reducing noise, (2) barriers to reduce the noise levels, (3) self-efficacy - the ability to reduce noise exposure, (4) attitude towards noise, and (5) awareness of susceptibility to NIHL. The aim of the study was to measure and compare the noise levels exposed to, by various professionals who include bus drivers, auto drivers, street vendors, traffic police, and office workers and to administer the "Noise at Work Questionnaire" to assess their perceptions in all the aforementioned domains in the questionnaire.

Subjects and Methods

Participants

Five groups of participants (n = 50) with ten participants in each group, namely, traffic police, bus drivers, auto-rickshaw drivers, vendors, and office workers (age range of 25–55 years) whose mean age and standard deviation (SD) are tabulated in Table 1 participated in the study. All the individuals were involved in their respective profession for at least 8 h a day with a minimum work experience of 5 years. None of the individuals reported any history of middle ear infections and psychological and neurological problems. Demographic history (Section B of Noise at Work Questionnaire) was taken followed by the administration of the "Noise at Work Questionnaire." The questionnaire consisted of twenty questions that were related to barriers, benefits, self-efficacy, attitude, and susceptibility to noise. The questions were explained to the participants by a qualified degree holder

Table 1: Mean age (years) and standard deviation of participants for the selected groups

Age range	Traffic police	Auto drivers	Vendors	Bus drivers	Office workers
Mean	46.4	39.1	34	43.3	32.4
SD	7.40	6.62	7.79	6.88	4.73

SD: Standard deviation

through direct interview. The questions on demographic data include (Q1) Do you feel you have a hearing loss? (Q2) Do you have any ringing in your ears? (Q3) Does an immediate family member feel that you have a hearing loss? (Q4) Do you find it very difficult to follow a conversation at home if there is a background noise? (Q5) Do you think nothing can be done about noise in your workplace? (fatalistic attitude). Written consent from each participant was taken before administering the questionnaire.

Noise measurement was carried out across each of work environments using a calibrated SLM (B and K model 2270) with windshield and mounted on a tripod stand. The microphone was placed at the ear level within 1 M diameter of the individual at work. All the measurements were done using the A-weighting network in the fast mode. The level equivalent, level maximum (L_{max}), and level minimum (L_{min}) were measured in the study. These measurements were done at a particular site for a duration of 5 min. Totally, two recordings in each of the work setting for all individuals were done and averaged to find out the level of noise exposure in the workplace across different professions [Table 1].

For measuring the amount of noise exposure of the auto-rickshaw and front engine bus drivers, the tripod stand was placed on the seat behind the driver's seat near the ear level at approximately 180° azimuths to the driver within distance of 1 M. For measurement in vendors, traffic police, and office workers' group, the tripod stand was placed behind the individual at ear level, approximately 180° azimuths to the individual within a distance of 1 M. The office workers who participated in this study had set ups with varying dimensions. In each cabin, the number of individuals varied from 1 to 4. The noise measured (equivalent continuous level [LAeq], L_{max}, L_{min}) for various groups were compared with the other groups. Similarly, the perceptual noisiness scores measured through questionnaire were compared between groups.

Scoring of questionnaire and interpretation

Scoring

The 20-item questionnaire in its original format used a 5-point Likert scale where 1 = strongly agree, 2 = agree, 3 = neither disagree nor agree, 4 = disagree, and 5 = strongly disagree. However, in this study, 16 questions were used and the other four questions (5, 8, 10, and 14) were eliminated because of its irrelevance in the present context. The scoring pattern was reversed for the questions 3, 6, 14, 18, and 19 as given in the questionnaire. The scores of the questionnaire are shown in percentage for each domain.

Interpretation

High mean scores for the attitude and susceptibility subscales indicate that they generally do not like high levels of noise and perceive their susceptibility to hearing loss as quite high, thereby high scores meant that they are annoyed by noise at their workplace, and therefore, it is a positive sign for implementing HLPP.

Results

Statistical Package for Social Sciences software version 21 (IBM corporation) was used for analyzing data. Levene test showed homogeneity of variance maintained for noise exposure levels across professionals, following which MANOVA (parametric test) was used. Shapiro–Wilk test for perceptual noisiness scores showed no normal distribution, following which Kruskal–Wallis test and Mann–Whitney U-test (nonparametric test) were performed for group-wise and pairwise comparisons, respectively. Then, Spearman's correlations for noise exposure and noisiness scores were done.

Exposed noise levels by different professions

Results in descriptive and inferential statistics showed normally distributed data in noise indices measured ($P > 0.05$). Levene test was carried out to assess homogeneity of variance and the results showed that there was no significant difference ($P > 0.05$), indicating that the assumption of homogeneity of variance is maintained. Hence, parametric statistics was chosen for analysis. Descriptive statistics revealed that higher level of noise in the workplace was noted for bus drivers (80.44 dB SPL), followed by auto drivers (77.82 dB SPL), traffic police (75.33 dB SPL), and street vendors (74.42 dB SPL). The least level of noise was recorded in office workers (control) group (52.77 dB SPL). MANOVA was carried out to study the effect of group on different noise indices. Results revealed a significant effect of group on LAeq (F [4, 45] = 214.46), L_{min} (F [4, 45] = 29.59), L_{max} (F [4, 45] = 35.52) with a significance of $P < 0.05$. *Post hoc* comparisons showed that the LAeq values of traffic police were significantly different from bus drivers and office workers. The noise exposures of auto drivers were significantly different from street vendors and office workers. The noise exposure of street vendors was significantly different from auto drivers, bus drivers, and office workers. The amounts of noise exposed by the bus drivers were significantly greater from traffic police, street vendors, and office workers. The office workers had significantly better differences from all other groups. The noise levels measured for each of the group are shown in Table 2 and represented in Figure 1.

Perceptual noisiness scores (part A)

The Shapiro–Wilk test was used to check the normality assumptions of data obtained under the noisiness scores. The Shapiro–Wilk test for normality revealed that the data did not

Table 2: Equivalent continuous level, level maximum, and level minimum values for each group

Group	LAeq (dB SPL)	L_{max} (dB SPL)	L_{min} (dB SPL)
Traffic police	75.77	93.06	62.71
Auto driver	77.32	94.98	62.22
Vendors	73.88	91.17	60.12
Bus drivers	80.42	93.05	68.08
Office workers	52.40	69.66	46.32

LAeq: Equivalent continuous level; L_{max}: Level maximum; L_{min}: Level minimum

follow a normal distribution; hence, nonparametric test was used. The mean and SD values of perceptual noisiness scores for various professions are shown in Figure 2.

The Kruskal–Wallis test was performed for comparing results obtained across each category of questions given in the questionnaire across groups. The results revealed that the groups showed a significant difference over benefits (χ^2 [4] = 18.679, $P < 0.05$), barriers (χ^2 [4] = 10.828, $P < 0.05$), self-efficacy (χ^2 [4] = 21.318, $P < 0.05$), attitude (χ^2 [4] = 16.233, $P < 0.05$), and susceptibility (χ^2 [4] = 25.006, $P < 0.05$).

Further, Mann–Whitney U-test was performed to check for significant difference across groups in a pairwise manner. The results of the same are shown in Table 3.

Perceptual noisiness scores (part B)

The results showed that traffic police had the highest scores for all the questions, except the one representing the fatalistic attitude (seen more in bus drivers). The results are shown in Figure 3.

The correlation between noise levels and perceptual noisiness scores

Spearman's correlation test was done to see the correlation between the level of noise exposed and the perception of noisiness scores for each group. LAeq values of traffic police when correlated with benefits ($\rho = -0.233$, $P > 0.05$), barriers ($\rho = -0.148$, $P > 0.05$), self-efficacy ($\rho = -0.593$, $P > 0.05$), attitude ($\rho = -0.104$, $P > 0.05$), susceptibility ($\rho = -0.187$, $P > 0.05$) showed a negative correlation; LAeq values of auto drivers when correlated with benefits ($\rho = 0.164$, $P > 0.05$), barriers ($\rho = 0.134$, $P > 0.05$), self-efficacy ($\rho = 0.185$, $P > 0.05$), attitude ($\rho = 0.241$, $P > 0.05$), susceptibility ($\rho = -0.278$, $P > 0.05$) showed a negative correlation; LAeq values of vendors when correlated with benefits ($\rho = -0.132$, $P > 0.05$), barriers ($\rho = 0.009$, $P > 0.05$), self-efficacy ($\rho = -0.208$, $P > 0.05$), attitude ($\rho = -0.133$, $P > 0.05$), susceptibility ($\rho = -0.218$, $P > 0.05$) showed a negative correlation; LAeq values of bus drivers when correlated with benefits ($\rho = -0.219$, $P > 0.05$), barriers ($\rho = -0.071$, $P > 0.05$), self-efficacy ($\rho = -0.007$, $P > 0.05$), attitude ($\rho = -0.297$, $P > 0.05$), susceptibility ($\rho = -0.059$, $P > 0.05$) showed a negative correlation; LAeq values of office workers when correlated with benefits ($\rho = -0.308$, $P > 0.05$), barriers ($\rho = -0.118$, $P > 0.05$), self-efficacy ($\rho = -0.090$, $P > 0.05$), attitude ($\rho = -0.691$, $P > 0.05$), susceptibility ($\rho = -0.034$, $P > 0.05$) showed a negative correlation. Hence, all groups showed a negative correlation indicating that there was decrease in perceptual noisiness scores as the level of noise exposure increased.

Discussion

The noise levels measured in the work environments are high as compared to that exposed by office workers which show that the traffic policemen, auto drivers, bus drivers, and vendors are at risk of developing NIHL. The exposed noise levels measured was highest for bus drivers (80.42 dB A), auto drivers (77.32 dB A), traffic police (75.77 dB A), vendors (73.88 dB A), followed by office workers which was 52.4 dB A. The increased noise levels in the three groups including traffic police, auto drivers, and bus drivers in uban area can

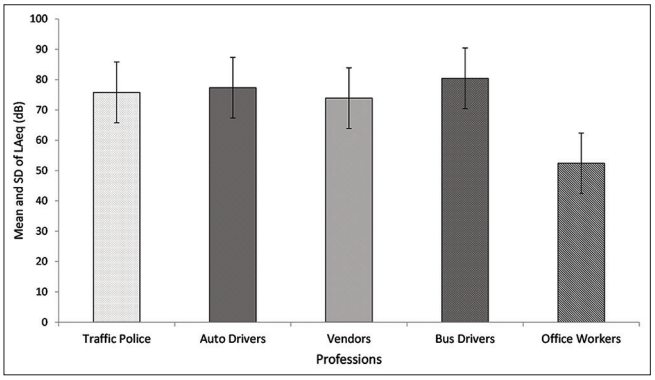

Figure 1: Noise levels measured across different work situations

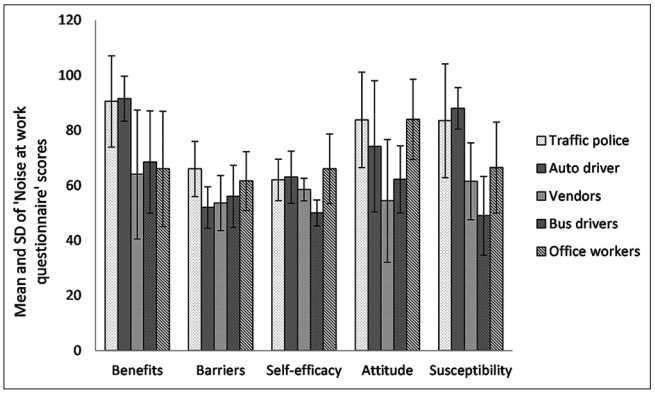

Figure 2: Mean and standard deviation values of the scores of "noise at work questionnaire" for each group

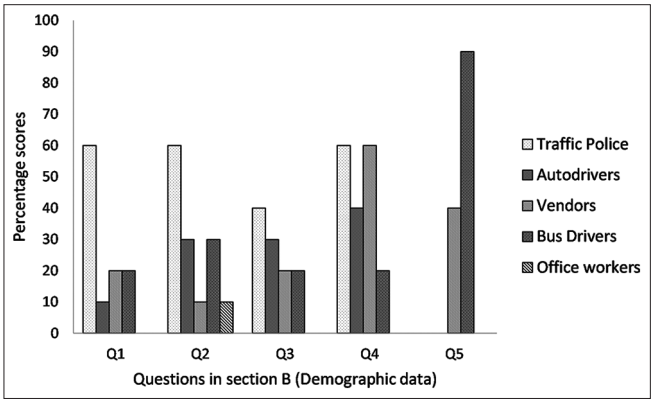

Figure 3: Questions scored under part B (self-reported problems: Q1 = Do you feel you have a hearing loss?, Q2 = Do you have any ringing in your ears?, Q3 = Does an immediate family member feel that you have a hearing loss?, Q4 = Do you find it very difficult to follow a conversation at home if there is background noise?; Q5= (fatalistic attitude) Do you think nothing can be done about noise at your workplace). Note: Values shown in percent

Table 3: Pairwise comparison of categories of different groups which showed significant difference in Mann-Whitney U-test ($P<0.05$)

Groups	Traffic police	Auto drivers	Vendors	Bus drivers	Office workers
Traffic police		Barriers |z|=2.752	Benefits |z|=2.59 Barriers |z|=2.35 Attitude |z|=2.78 Susceptibility |z|=2.36	Benefits |z|=2.654 Barriers |z|=2.019 Self-efficacy |z|=3.222 Attitude |z|=2.488 Susceptibility |z|=3.117	Benefits |z|=2.68
Auto drivers			Benefits |z|=2.63 Susceptibility |z|=3.59	Benefits |z|=2.904 Self-efficacy |z|=3.209 Susceptibility |z|=3.804	Benefits |z|=3.13 Barriers |z|=2.04 Susceptibility |z|=2.972
Vendors				Self-efficacy |z|=3.249	Attitude |z|=2.926
Bus drivers					Self-efficacy |z|=3.900 Attitude |z|=2.782 Susceptibility |z|=2.281
Office workers					

be attributed to increased acceleration and starting/re-starting the engine which could result in noise emissions up to 15 dB higher than the surrounding emission levels as stated by Singh and Davar.[17] Mondal *et al*.[18] reported that noise levels inside the cabin of buses were in the range of 88.6–102.4 dB (A). This indicates that many individuals are at risk of developing NIHL also evidenced by the self-reported problems regarding hearing given in the questionnaire. Similar findings were reported in bus drivers and traffic police.[5,19] Contradictory to what was expected, there was no positive correlation between the measurement of noise levels and the perceptual noisiness scores in the experimental group. All of the individuals in the noisy environment were aversive of noise which is a positive sign to implement HLPP. Among the occupational population in this study, bus drivers had the highest noise exposure. This finding is supported by Leong and Laortanakul,[7] who reported that drivers living in the urban sites were found to have the highest risk of NIHL due to traffic noise.

Surprisingly, bus drivers, though they had the highest exposure to noise, had relatively low scores in the questionnaire. Participants having high mean scores for the attitude and susceptibility subscales indicate that they generally do not like high levels of noise and perceive their susceptibility to hearing loss as quite high. High scores in barriers, benefits, and self-efficacy indicate that participants have positive perceptions about noise reduction and hearing loss prevention. Probably, due to their cavalier attitude toward noise evidenced by most of them opining that nothing can be done about this issue (question five in demographic data) and that it is a nature of the work. Since most of the participants were in the age range of 30–50, people who develop a hearing impairment due to noise are typically not aware that their hearing is affected until the loss is quite marked.[20]

Griffiths and Raw[21] stated that where an increase or decrease in noise occurs, the change in dissatisfaction of noise is considerably greater than would be predicted on the basis of findings in steady state conditions. The noise from a traffic stream is not a constant but varies from moment to moment. This could be the reason for the high annoyance scores (attitude, susceptibility) in traffic police and low scores in bus drivers as bus drivers have a steady state of noise and most of the traffic noise is attenuated by the engine noise, whereas in the case of traffic police, they are constantly being bombarded with loud honking noise, which is obviously not a steady noise. Bus drivers also had very low scores for the barriers, benefits, and self-efficacy subdomain comparatively, probably due to the adaptation effects as stated earlier.

Pitzer[22] stated that fatalism is the belief that accidents and/or illness are natural consequences of work which cannot be avoided. Fatalism which is an obstacle to achieve safety within the workplace could also be a reason to obtain low scores in the respective domains (which was observed from Q5 of demographic data). People with fatalistic attitudes will accept high injury and disease rates as unavoidable. As stated by Milhinch and Dineen,[23] individuals especially the traffic police were more worried about acute hazards such as pollution and were less concerned with more serious hazards such as noise exposure that may have future negative outcomes. Vendors had the least scores toward noise probably due to the fact that they are not always exposed to high levels of traffic noise.

The alarming observation was that neither the bus drivers nor the traffic police individuals were aware of EPDs. The questions in the questionnaire with respect to use of EPDs were irrelevant to all the groups due to this reason. Sanju and Kumar[19] reported the same findings that 100% of the participants who were traffic police and bus drivers were not aware of EPDs. Gupta *et al*.[24] also in a questionnaire-based study reported that 100% of traffic police had no knowledge of EPDs. All of the professionals working in the traffic atmosphere namely the traffic police, auto drivers, and bus drivers had the opinion that the honks caused the highest amount of distress. Widespread public education is required especially to the educated class of people with regards to this issue. It is also evident that HLPP should be implemented across various developing countries. Williams *et al*.[25] showed that significant effects are generated by very simple workshop sessions which lasted for 1 h and concluded that implementing such workshops has the potential

to increase individuals' awareness of noise as a workplace hazard. However, while certain countries are trying to better their HLPP, India and probably other developing countries need a head start in implementing the same.

Conclusions

The noise levels measured at various workplaces of workers, namely, bus drivers, traffic police, auto drivers, and vendors, had a higher noise level exposure as compared to office workers. From the questionnaire data, it was revealed that bus drivers and vendors had low scores, indicating that they have a negative attitude toward preventive measures. One more important observation is that 100% of the experimental population was absolutely ignorant about EPDs, which is a matter of concern which goes on to shed light on the poor state of affairs in preventive measures in these working population with respect to hearing. It is necessary for the audiological fraternity and the governing bodies to give a head start to HLPP to reduce the impact of noise on working population.

This study can be considered as a pilot study in noise and annoyance measurements in individuals exposed to occupational noise as the sample size considered is limited (ten individuals in each profession). Furthermore, the LAeq measurements can be done for a longer duration to make a sweeping statement on the amount of noise present at various work situations.

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Conflicts of interest

There are no conflicts of interest.

References

1. Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M. The global burden of occupational noise-induced hearing loss. Am J Ind Med 2005;48:446-58.
2. Kujawa SG, Liberman MC. Adding insult to injury: Cochlear nerve degeneration after "temporary" noise-induced hearing loss. J Neurosci 2009;29:14077-85.
3. Cohen S, Weinstein N. Nonauditory effects of noise on behavior and health. J Soc Issues 1981;37:36-70.
4. Goines L, Hagler L. Noise pollution: A modem plague. South Med J 2007;100:287-94.
5. Ingle ST, Pachpande BG, Wagh ND, Patel VS, Attarde SB. Exposure to vehicular pollution and respiratory impairment of traffic policemen in Jalgaon city, India. Ind Health 2005;43:656-62.
6. Sliman AA, Ibrahim OM, Ahmed AA. Noise exposure among traffic police officers in Khartoum locality, Sudan. Eur Sci J 2015;11:131-35.
7. Leong ST, Laortanakul P. Monitoring and assessment of daily exposure of roadside workers to traffic noise levels in an Asian city: A case study of Bangkok streets. Environ Monit Assess 2003;85:69-85.
8. Siddiqui IA, Nizami S, Chandio RR, Nizami S, Sikander N, Ashraf S. Consequences of traffic noise in residents of Karachi, Pakistan. Pak J Med Sci 2015;31:448-52.
9. Pettersson H, Burström L, Hagberg M, Lundström R, Nilsson T. Noise and hand-arm vibration exposure in relation to the risk of hearing loss. Noise Health 2012;14:159-65.
10. Karimi A, Nasiri S, Kazerooni FK, Oliaei M. Noise induced hearing loss risk assessment in truck drivers. Noise Health 2010;12:49-55.
11. Majumder J, Mehta C, Sen D. Excess risk estimates of hearing impairment of Indian professional drivers. Int J Ind Ergon 2009;39:234-8.
12. Sen T, Bhattacharjee PK, Banerjee D, Sarkar B. Running condition noise dose to auto drivers in Kolkata metropolitan city of India in different seasons. Int J Environ Sci Dev 2010;1:278.
13. Lao XQ, Yu IT, Au DK, Chiu YL, Wong CC, Wong TW. Noise exposure and hearing impairment among Chinese restaurant workers and entertainment employees in Hong Kong. PLoS One 2013;8:e70674.
14. Environmental Protection Agency. Noise Pollution Norms, Standards and Guidelines; 1986. Available from: http://www.moef.gov.in/citizen/specinfo/noise. [Last accessed on 2017 Jan 10].
15. Contaminants A, editor. Occupational Safety and Health Administration 29 CFR 1910: 1000, 1982. Documentation of the Threshold Limit Values. American Conference of Governmental Industrial Hygienists: Cincinnati, OH; 1980.
16. Purdy S, Williams W. Development of the noise at work questionnaire to assess perceptions of noise in the workplace. J Occup Health Saf Aust N Z 2002;18:77-84.
17. Singh N, Davar S. Noise pollution-sources, effects and control. J Hum Ecol 2004;16:181-7.
18. Mondal NK, Dey M, Datta JK. Vulnerability of bus and truck drivers affected from vehicle engine noise. Int J Sustain Built Environ 2014;3:199-206.
19. Sanju HK, Kumar P. Self-assessment of noise-induced hearing impairment in traffic police and bus drivers: Questionnaire-based study. Indian J Otol 2016;22:162.
20. Westbrook M, Hogan A, Pennay M, Legge V. Workers' reactions to their noise-induced hearing loss: Acknowledgement versus avoidance. J Occup Health Saf Aust N Z 1992;8:237-42.
21. Griffiths I, Raw G. Adaptation to changes in traffic noise exposure. J Sound Vib 1989;132:331-6.
22. Pitzer C. Safety Culture Survey Report: Australian Minerals Industry. Minerals Council of Australia & SAFEmap, Canberra; 1999.
23. Milhinch J, Dineen R. Noise and Hearing in the Construction Industry: A Study of workers' views on noise and risk on a Victorian site. Incolink; 1997.
24. Gupta S, Mittal S, Kumar A, Singh KD. Self assessment of hearing quality and noise-related attitudes among traffic policemen of Patiala, India. Int J Prev Med 2014;5:511-5.
25. Williams W, Purdy SC, Storey L, Nakhla M, Boon G. Towards more effective methods for changing perceptions of noise in the workplace. Saf Sci 2007;45:431-47.