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Original Article

Noise levels at traffic intersections and awareness of noise pollution among traffic policemen and automobile drivers

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ABSTRACT

Introduction: Noise pollution is an important health hazard in modern times and traffic policemen and automobile drivers are exposed to unregulated vehicular noise. This study aims to estimate the exposure levels from traffic noise for traffic policemen and automobile drivers and assess their awareness regarding noise pollution and the use of noise prevention measures.

Methods: An analytical cross-sectional study was carried out comprising the exposed and the control group with 121 people in each group. Sound level estimation was carried out across 20 traffic intersections in the city at various times to assess the noise levels. All the participants were administered a pretested questionnaire to assess their awareness regarding noise pollution and as well as the use of noise prevention strategies. The chi-square test was used to estimate the difference between the two groups. P <0.05 was considered statistically significant.

Results: The noise levels at traffic intersections are above the permitted and acceptable limits. The mean ±SD of sound levels at traffic points range from 76.8±5.8 dB to 83.4±6.3 dB across various traffic intersections. The mean noise level at the traffic intersection was in the high-risk category (81-86dB) in 25% of traffic points while 75% of traffic points had noise levels in the moderate risk (76 - 81dB) category. 88% of the exposed group and 95% of the control group considered noise to be a form of pollution even though they were not aware of all the harmful effects. In practice, only 34% of study participants used some form of hearing protection measures, even though the majority were aware of the need to do so.

Conclusion: The noise levels at traffic intersections are high. This is coupled with a lack of adequate use of hearing protective devices which can be detrimental to the inner ear. Frequent awareness programs are necessary to educate the occupationally exposed personnel on proper noise prevention strategies. At the same, time it is necessary to take decisive measures to curb the ever-increasing menace of occupational noise exposure.

Keywords: Awareness, Hearing protection device, Noise pollution; Traffic noise

Introduction

Noise is an unpleasant and unwanted loud sound that causes disturbance and irritation[1]. Noise pollution is an important health hazard that can affect people across all age groups. It is estimated that 12.5% of children and 17% of adults have suffered permanent hearing loss due to noise exposure[2]. The detrimental effect of noise exposure is not just limited to hearing loss but also can present a multitude of problems affecting the general well-being of the person. Sources of noise are manifold and vehicular noise contributes to most of the environmental noise. The effect of excessive vehicular noise is borne by the traffic police personnel most of the time. The prevalence of noise-induced hearing loss among the police force is high and is estimated to be 34% in studies.[3,4] It has been seen that nearly 26.8% of automobile drivers are also affected by noise-induced hearing loss[5]. It is well known that awareness of any problem is necessary to take any preventive and remedial measures. Noise pollution has always been a neglected entity and noise levels from vehicular traffic remain unregulated. The study aims to estimate the exposure levels from traffic noise for traffic policemen and automobile drivers and assess their awareness regarding noise pollution and the use of noise prevention measures.

Methods

The study was an analytical cross-sectional design consisting of the exposed group and the control group and was conducted for a period of 2 years from June 2020-2022. Expecting that 50% of the study group will be aware of noise pollution and the use of noise prevention measures and a minimum of 20% difference in the control group with a 95% confidence interval, 80% power with two-sided hypotheses, the sample size was estimated to 105 in each group. Adding a 15% non-response rate, the final sample size was calculated to 121 in each group using Open Epi software version 3.01. The exposed group comprised 121 people (traffic policemen – 66; automobile drivers – 55) who had a history of noise exposure for approximately 8 hours/day for at least 5 years or more. The control or the nonexposed group had 121 participants and comprised healthy volunteers who did not have any history of any prolonged or chronic noise exposure. Any history of ear discharge, vertigo, chronic diseases like diabetes, hypertension, kidney diseases, or thyroid dysfunction was excluded from the study. All the study participants were administered a pretested questionnaire and their responses were recorded. The questionnaire consisted of questions that recorded the basic socio-demographic and employment details of the participants. The questionnaire had questions that recorded the details and duration of noise exposure and the type of exposure that the participants are exposed to. It consisted of closed, semi-closed and open-ended questions to assess the awareness regarding noise pollution and knowledge and use of hearing protection devices by the participants. The chi-square test was used to estimate the difference between the two groups. $P < 0.05$ was considered statistically significant.

Sound level estimation was carried out across 20 traffic intersections in the city with high traffic load. The sound level recording was done with a Class I sound level meter(Lutron SL-4033D model, Lutron Electronic Enterprise Ltd, Taiwan), having a condenser type of microphone and measuring range of 30-130 dB with a resolution of 0.1 dB. The recording was carried out by fixing the sound level meter on a tripod perpendicular to the ground and at a height of 120cm from the ground level. Three sessions of recording were conducted each day at three different times, (9 AM to 10 AM, 2PM to 3 PM and, 5 PM to 6 PM). Each session lasted for one hour and each traffic intersection was mapped for two consecutive days. The recording was done only on the weekdays and was avoided on any holidays. Analysis of data was done with MS Excel 2010 (Microsoft Windows). Mean ± SD was calculated and maximum and minimum sound pressure levels were noted.

Results

The mean ± standard deviation (SD) of sound levels at traffic points range from 76.8±5.8 dB to 83.4±6.3 dB across various traffic intersections with a minimum sound level (L_{min}) of 60.8 dB and maximum sound level (L_{max}) of 117.4 dB are shown below [Table 2].

Based on the mean noise level 25% of traffic points had noise levels more than high risk (81-86dB) and the remaining 75% of traffic points had Moderate risk (76 - 81dB). There was no significant variation in traffic noise levels recorded at different times of the day.

Table 1: Risk stratification based on the sound level at various traffic points.[6]

Sound level (dB)	Risk
Less than 66	Safe
66 – 71	Tolerable
71 - 76	Low risk
76 – 81	Moderate risk
81 – 86	High risk
More than 86	Extremely high risk

Table 2: Distribution of noise levels at various traffic points

SL. No.	Traffic Point	Mean± SD Noise level dB	L_{max}	L_{min}
1	Anjaneya Swamy Temple Ramvarapadu	79.7±6.3	110.4	66.8
2	Auto Nagar	81.7±5.6	108.1	69.5
3	Benz Circle	83.3±5.8	108.4	69.8
4	BRTS Road	76.8±5.8	107	64
5	Chittinagar One Town	80.7±6.1	108.6	68.8
6	IG Stadium	78.8±5.3	105.4	64.2
7	Mahanadu Junction	80.8±5.7	107.7	67.3
8	Netaji Point	83.4±6.3	107	70.2
9	Nirmala Junction	80.8±5.4	107.5	67.9
10	NTR Circle	80.4±6.0	107	67.6
11	Old Bus Stand	81.7±5.2	116.9	69.1
12	Police Control Room	78.7±6.2	106.1	63.1
13	Prakasam Barrage	78.6±6.3	117.4	63.9
14	Pushpa Hotel Point	79.4±5.9	106.3	66.6
15	PWD Ground Signal	79.2±5.3	109.2	60.8
16	Raghavaya Park	79.1±4.9	110.5	67.9
17	Ramesh Hospital Point	81.0±5.5	109	69.9
18	Ramvarapadu Ring Rd	80.7±5.1	109.3	69.2
19	Sitarampura	80.9±5.4	110.6	64.4
20	Vinayaka Temple One Town	80.5±5.8	108	68

In the present study, 88% of the noise-exposed group were aware that prolonged noise exposure was harmful compared to 95 % of the control group. When asked about the effects of noise pollution, symptoms like hearing loss and headache were attributed to noise exposure by a majority of all participants [Table 3]. The majority of the exposed group and the unexposed group did not consider hypertension, sleep disturbance, psychiatric disorders and tinnitus to be harmful effects of prolonged noise exposure [Table 3]. Interestingly, the awareness regarding the symptoms of prolonged noise exposure was more among the control group as compared to the exposure group (P< 0.05) [Table 3]. In the exposed group, awareness levels were better among the traffic policemen than among the automobile drivers [Table 4].

It was also noticed that, compared to the 71% of the exposed group, almost 88.4% of the control group felt the need for using noise prevention strategies (P< 0.001). Nearly 90.9% of traffic policemen felt the need for using noise prevention strategies as compared to 47.3% of automobile drivers (P<0.001). In practice, it was seen that only 34.7% of the exposed group and 77.7% of the control group used some form of noise prevention measures (P <0.01). Both groups considered cotton plugs to be a useful noise prevention strategy and the majority were unaware of the use of ear plugs, ear muffs and noise cancellation headphones as protective noise

prevention measures. There were no awareness programs on noise pollution and nearly 93% of the exposed group had never attended any such program at their workplace [Table 3].

Table 3: Awareness regarding noise pollution and use of noise protection measures**.**

		Exposed n =121	Control n =121	Total	p-value*
Awareness of the harmful effects of noise	Present	107(88.4)	115(95.0)	222(91.7)	0.062
	Absent	14(11.6)	6(5.0)	20(8.3)	
Consider the following symptoms as harmful effects of prolonged noise exposure: -					
1. Dizziness	Yes	1(0.8)	12(9.9)	13(5.4)	0.002
	No	120(99.2)	109(90.1)	229(94.6)	
2. Hearing Loss	Yes	95(78.5)	112(92.6)	207(85.5)	0.002
	No	26(21.5)	9(7.4)	35(14.5)	
3. Hypertension	Yes	9(7.4)	13(10.7)	22(9.1)	0.371
	No	112(92.6)	108(89.3)	220(90.9)	
4. Psychiatry disorder	Yes	11(9.1)	24(19.8)	35(14.5)	0.018
	No	110(90.9)	97(80.2)	207(85.5)	
5. Heart ailment	Yes	23(19.0)	30(24.8)	53(21.9)	0.277
	No	98(81.0)	91(75.2)	189(78.1)	
6. Tinnitus	Yes	10(8.3)	30(24.8)	40(16.5)	0.001
	No	111(91.7)	91(75.2)	202(83.5)	
7. Sleep disturbance	Yes	3(2.5)	15(12.4)	18(7.4)	0.003
	No	118(97.5)	106(87.6)	224(92.6)	
8. Mood swing	Yes	47(38.8)	49(40.5)	96(39.7)	0.793
	No	74(61.2)	72(59.5)	146(60.3)	
9. Headache	Yes	76(62.8)	99(81.8)	175(72.3)	0.001
	No	45(37.2)	22(18.2)	67(27.7)	
Feel the need for protection against noise pollution	Yes	86(71.1)	107(88.4)	193(79.8)	0.001
	No	35(28.9)	14(11.6)	49(20.2)	
Take measures to protect from noise	Yes	42(34.7)	94(77.7)	136(56.2)	<0.001
	No	79(65.3)	27(22.3)	106(43.8)	
Ear plugs	Yes	9(7.4)	17(14.0)	26(10.7)	0.97
	No	112(92.6)	104(86.0)	216(89.3)	
Cotton balls	Yes	40(33.1)	86(71.1)	126(52.1)	<0.001
	No	81(66.9)	35(28.9)	116(47.9)	
Ear muffs	Yes	1(0.8)	5(4.1)	6(2.5)	0.98
	No	120(99.2)	116(95.9)	236(97.5)	
Noise – Cancelling headphones	Yes	0(0)	2(1.7)	2(0.8)	0.156
	No	121(100)	119(98.3)	240(99.2)	
Whether any awareness program was carried out in the workplace on noise pollution	Yes	9(7.4)	5(4.1)	14(5.8)	0.271
	No	112(92.6)	116(95.9)	228(94.2)	

Table 4: Breakup of awareness regarding noise pollution and use of noise protection measures between traffic policemen and automobile drivers.

		Traffic police (n = 66)	**Automobile drivers** (n = 55)	**p-value***
Awareness of the harmful effects of noise	Yes	65(98.5)	42(76.4)	<0.001
	No	1(1.5)	13(23.6)	
Feel the need for protection against noise pollution	Yes	60(90.9)	26(47.3)	<0.001
	No	6(9.1)	29(52.7)	
Take measures to protect from noise	Yes	24(36.4)	18(32.7)	0.675
	No	42(63.6)	37(67.3)	

*Chi-square test was used

Discussion

Vehicular traffic contributes to 80% of the environmental noise.[7] The rising population of the cities along with congested city roads has increased traffic noise levels. The noise levels detected in the present study are above the permissible noise limits set by Central Pollution Control Board which set the maximum permissible noise in industrial, commercial, and residential areas during day time to 75dB, 65 dB, and 55 dB respectively.[8] The effects of chronic noise exposure on health are already established. It is well known that chronic noise exposure has a detrimental effect on the auditory threshold and causes a threefold increase in the risk of developing hearing loss[9]. Approximately 12% of the global population is at risk from noise-induced hearing loss and approximately 68% of traffic policemen are affected by some degree of hearing loss due to prolonged exposure to noise experienced at traffic points.[4,10]Automobile drivers are also exposed to vehicular engine noise which can range from 88dB to 103dB depending on the type of vehicle.[11] The sources of noise exposure in automobile drivers are manifold and include the engine sound, and noise emanating from the exhaust system and the tires. Apart from the auditory effects, chronic noise exposure is associated with hypertension.[12] It is estimated that a 1dB reduction in noise level can avoid 284 premature cardiovascular and 184 premature respiratory deaths.[13] The cognitive functions are affected by noise and there is an increase in the average errors and reaction times while performing difficult tasks.[14] Annoyance is considered to be one of the first and most widespread reactions to environmental noise.[15] Noise has been associated with chronic headaches, sleep disturbance and immune alterations. [16,17,18] It is known that many non-communicable diseases like diabetes, obesity, and cardiovascular diseases are on the rise and many of them owe to lifestyle changes as an etiological factor. There is enough evidence to suggest road traffic noise is associated with diabetes and obesity. [19,20] Chronic exposure to environmental noise has also been associated with male infertility.[21]

Awareness regarding the hazards of noise exposure is necessary for taking any preventive measures. We have seen in this study that even though the participants had some awareness regarding the harmful effects of noise and the need to take preventive measures, fewer adopted the preventive measures. Various studies have also reported low compliance toward the use of hearing protective devices.[22,23] Many factors may be responsible for such non-compliance. Availability of the devices and associated costs along with hygiene, difficulty in communication, and discomfort from the use of such devices may be some factors that are barriers to the proper use of hearing protective devices.[22] Increased cognitive effort to hearing and loss of situational awareness arising from the use of hearing protective devices have also been seen and may contribute to poor acceptance or usage among the noise-exposed group.[24] It is important to use an appropriate protective device depending on the sound level exposure. Cotton plugs even though widely used are not recommended as standard hearing protective measures because of the very low levels of attenuation provided. Ear muffs provide better attenuation at low frequencies while ear plugs provide attenuation at both high and low frequencies.[25] It has been seen that ear muffs can provide attenuation up to 40 dB at 2kHz and beyond that frequency it provides an attenuation of around 35 dB. Ear plugs on the other hand attenuate around 25dB up to 1kHz and around 40dB at higher frequencies.[25] Ear plugs need proper fitting for optimal sound attenuation and pre-molded ear plugs may not provide necessary attenuation in practical scenario.[26,27]

Occupational noise exposure is often a neglected entity. There is a lack of awareness about this form of pollution among the stakeholders.[23,28] Awareness and educational programs regarding noise pollution and noise prevention strategies are necessary to bring about behavioral modifications and the adoption of noise reduction strategies. This will help in reducing the long-term effects of noise pollution. At the same time, it is important to take decisive measures to curb the nuisance of traffic noise. This may be achieved by implementing legislation for regulating noise levels. Proper planning and designing of city roads and traffic intersections can

go a long way in reducing the impact of vehicular noise. Enclosed traffic booths can be a practical solution to protect traffic policemen from chronic noise exposure. Mandatory regular maintenance of vehicles can go a long way to mitigate the noise output of vehicles. It is important to create a noise barrier by plantation of trees surrounding the high noise zones which can help in attenuation of sound energy.[29] It is also necessary to identify and demarcate silence zones and bring in automation in traffic intersections thereby reducing the exposure among the traffic personnel and automobile drivers.

Conclusions

The noise level across various traffic points is above acceptable limits and should act as a warning for the ever-increasing noise pollution that cities are witnessing. A lack of awareness regarding noise pollution can act as a hurdle to the adoption of noise prevention strategies. It is necessary to educate traffic policemen, automobile drivers and others with occupational noise exposure on the harmful effects of noise and carry out frequent sensitization on proper noise prevention strategies, particularly in the settings of occupational noise exposure. It is also imperative to adopt a concerted approach by the citizens and the administration which will help towards reducing the traffic noise levels in cities.

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