

Noise Pollution- Sources, Effects and Control

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ABSTRACT The study examines the problem of noise pollution in the wake of its ill effect on the life of the people. A cross-section survey of the population in Delhi State points out that main sources of noise pollution are loudspeakers and automobiles. However, female population is affected by religious noise a little more than male population. Major effects of noise pollution include interference with communication, sleeplessness, and reduced efficiency. The extreme effects e.g. deafness and mental breakdown neither is ruled out. Generally, a request to reduce or stop the noise is made out by the aggrieved party. However, complaints to the administration and police have also been accepted as a way of solving this menace. Public education appears to be the best method as suggested by the respondents. However, government and NGOs can play a significant role in this process.

Noise is derived from the Latin word "nausea" implying 'unwanted sound' or 'sound that is loud, unpleasant or unexpected'. The noise originates from human activities, especially the urbanization and the development of transport and industry. Though, the urban population is much more affected by such pollution, however, small town/villages along side roads or industries are also victim of this problem. Noise is becoming an increasingly omnipresent, yet unnoticed form of pollution even in developed countries. According to Birgitta and Lindvall (1995), road traffic, jet planes, garbage trucks, construction equipment, manufacturing processes, and lawn mowers are some of the major sources of this unwanted sounds that are routinely broadcasted into the air.

Though noise pollution is a slow and subtle killer, yet very little efforts have been made to ameliorate the same. It is, along with other types of pollution has become a hazard to quality of life. Kiernan (1997) finds that even relatively low levels of noise affects human health adversely. It may cause hypertension, disrupt sleep and/or hinder cognitive development in children. The effects of excessive noise could be so severe that either there is a permanent loss of memory or a psychiatric disorder (Bond, 1996). Thus, there are many an adverse effects of excessive noise or sudden exposure to noise.

In India, the problem of noise pollution is wide spread. Several studies report that noise level in metropolitan cities exceeds specified

standard limits. It is responsible for rising incidence of deafness among the inhabitants (Bhargawa, 2001). A study by Singh and Mahajan (1990) conducted in Delhi and Calcutta, found that the noise level is 95dB as against the ambient limit of 45dB. Even at the "calm" places, it does not fall below 60dB. Murli and Murthy (1983) also found that traffic noise in Vishakhapatnam exceeds 90dB even in morning hours that acts as a source of nuisance.

The noise pollution is not a unique problem for developing countries like India only. In China, till third century B.C., instead of hanging men for dangerous crimes, noise was used for their torturing. The worrisome effects of noise are dangerous enough that noise problem is considered next to crime by certain countries (Kapoor and Singh, 1995). Bond, (1996) reports that 16% of people in Europe are exposed to 40 dB or more of traffic noise in their bedrooms at night compare it with W.H.O.'s average estimates of 30 to 35 dB for undisturbed sleep.

Several initiatives have been taken by various countries to check the noise level. For example, USA has taken initiative to create sites where human-caused noise pollution will not be tolerated (Geary, 1996). Similarly, the European Union (with more than 250,000 inhabitants) requires that 'noise maps' of big cities are drawn up by 2002 (New Scientist, 1998). To safeguard against ill effects of noise, the laws of Netherlands do not permit building of houses in areas where 24-hour average noise levels exceed 50dB. And in Great Britain, the Noise Act empowers the local authorities to confiscate the noisy equipment and fine people who create excess noise at night. Recently, several countries are

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also investing in 'porous asphalt' technology, which can curtail traffic noise by up to 5dB.

The movement against noise pollution is weak in India. Most of the people do not consider it a pollutant, and take it as a part of routine life. Of late, it has been recognized as a pollutant (Negi et al., 1999). In India, the Noise Pollution (Regulation and Control) Rules, 2000 have been framed under the Environment (Protection) Act, 1986. These are a set of guidelines for regulation and control of noise. The ambient levels of noise for different areas/zones specified in the rules are indicated in chart 1.

Chart 1: Ambient noise standards

Area Code	Category of Area/ Zone	Limits in dB*	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

*The limit in dB denotes the time-weighted average of the level of sound in decibels on Scale A which is relatable to human hearing.

Source: Environment (Protection) Act, 1986 as amended in 2002.

A survey by Central Pollution Control Board (CPCB) survey shows that in Delhi, the noise level in most places exceeds the permissible limit. (The Times of India, New Delhi). Similarly, a study by NEERI has revealed that noise levels in residential, commercial and industrial areas and silent zones of Delhi and towns of National Capital Region (NCR) far exceed the prescribed standards. The average noise level in Delhi is 80 dB while the ambient limit is 55dB (The Business Line, New Delhi). Bombay too suffers from high levels of noise pollution. For example, Shetye et al. (1980) had estimated that noise level in crowded locations in Bombay was almost double that of residential standards adopted by most countries (45dB during day and 35dB at night). Evidently, noise pollution has assumed alarming proportions affecting adversely the efficiency of various populations, mental health and general quality of life. Moreover, it is becoming a problem of law and order with the growing number of complaints to police and administration. Unless and until, measures are taken to control the level of noise, the ongoing urbanization and industrialization may complicate the problem so much that it becomes incurable.

There are several methods that can be utilized for controlling the level of noise. First of all, the design and technology of machines/equipments could be altered resulting in low noise emission. Secondly, noise barriers may help us control noise. A third method is to protect receptors of sound by a shield e.g. building may be insulated against noise. Similarly, body and window planes may be made sound proof. Apart from technology, we may undertake various steps to modify or regulate the behaviour of users of machines and equipment. Though a legal framework could be enforced to regulate users of vehicles/equipment, but it requires huge resources and good governance. The public education appears to be a good option because it is a social problem. Sheer ignorance about the adverse effects of noise pollution appear to be a key factor in laying inadequate stress on controlling or reducing its levels. To make India a world-class destination for tourism, industry, and a place for healthy living, the development and implementation of a comprehensive noise control programme is a dire need of hour.

This study identifies the sources of noise that create noise pollution. Moreover, the study explores the effects of noise on publics and their reactions. Finally, various measures to control the pollution are contemplated. The empirical evidence gathered through this study can be employed for developing appropriate legal and public action programme.

METHODOLOGY

This empirical study is based on a sample survey of the State of Delhi. 150 respondents was interviewed personally. The sample represents a cross-section of different age groups, sex, geography, educational levels; income levels of respondents and therefore it could be treated as a representative sample for such an exploratory study. Delhi was chosen for the study because it is one of the most populous cities in India and reflects both the modern and traditional, infrastructure (roads, localities, buildings etc.) Moreover, its inhabitants represent a cross-section of Indian culture. The data was collected by using a structured questionnaire blended with suitable open-ended questions. The analysis has been carried out with the help of percentages and cross-classifications on sources of noise, effects of noise, reactions to noise, and

suggestions to control noise in terms of age as well as sex.

RESULTS

Sources of Noise: Sources of noise pollution include inter alia, vehicular traffic, neighbourhood, electrical appliances, TV and music system, public address systems, railway and air traffic, and generating sets. Even we fall prey to the noise generated by household equipments used by us. Most of the people inhabiting metropolitan cities or big towns and those working in factories are susceptible to the adverse effects of noise. Characteristically, it affects the rich and the poor alike. The problem of noise pollution is less in small towns and villages. But, those residing in villages/ towns along the national/ state highways or close to railway tracks do bear the burnt of excessive noise.

Indiscriminate use of horn by the vehicles and widespread use of loud speakers in Indian social and religious ceremonies cause several health hazards to the urban inhabitants. It may cause deafness, nervous breakdown, mental disorder, heart troubles and high blood pressure, head-aches, dizziness, inefficiency and insomnia (Bhargawa, 2001). The noise level and exposure area depends on its source and its strength.

Road noise, especially at some distance from the road can be described as a steady state noise that does not fluctuate much. But, rail and aircraft noise are acoustically characterized by high noise levels of relative short duration. Noise from industrial installations, construction sites and fixed recreation facilities radiates from a point source and the shape of the exposure area is generally a circle. The noise from various sources may either be steady for a long period or fluctuate over a specified period considerably.

Road traffic is a key source of noise in big cities. The speed and exhaust system determines

the noise released by road traffic. The contact between tyres and the road surface is dominant source of noise at speeds above 60km/h for light vehicles. In future, tyre to surface noise is likely to become an important issue to be addressed in noise abatement strategies. In urban areas, fast acceleration and re-starting the engine in traffic could result in emissions up to 15dB higher than the normal levels of emission resulting from smooth driving. Another major source of noise is public address system used by temples, mosques etc. Indian Constitution under Article 25-28 guarantees freedom of religion to all persons. But, this freedom of religion is not an absolute one. Freedom of religion is subject to public order, health and morality. In a recent decision, Supreme Court held that no religion prescribes that the prayers should be performed by using loudspeaker or by beating drums. Further, it was held that if religious people make use of such equipment, it should not affect the right of other people. The High Court of Tamil Nadu allowed a petition filed by the Welfare Association of KKR Nagar (Chennai) against Church, and directed the respondent that the noise level should not exceed the permissible decibels. Thus, the State can put a restriction on an institution for maintaining public health. Since the noise disturbs the living and leaves the bad impact on the health of the people, restriction imposed by a state on the noise level does not amount to violation of fundamental right.

The analysis (Table 1) indicates that a very large proportion of respondents in each age group is being affected by noise emanating from the loudspeakers. The range is 71% to 86% with overall %age of 83%. However, % of such people in age group of 20-40 years is marginally lower. Similar is the situation with automobiles. Majority of respondents across different age groups feel that automobile noise affects their activities. A relatively small proportion of res-

Table 1: Sources of noise in terms of age groups

Source of Noise	Age groups				Total
	Upto 20	20-40	40-60	Above 60	
Loud speaker	29 (85)	35 (71)	37 (86)	20 (83)	121 (83)
Automobiles	23 (67)	31 (63)	32 (74)	18 (75)	104 (75)
Neighborhoods	17 (50)	23 (47)	20 (46)	13 (54)	73 (54)
Religious functions	21 (62)	29 (59)	25 (58)	14 (58)	89 (58)
Total respondents	34 (100)	49 (100)	43 (100)	24 (100)	150 (100)

Figure in parenthesis are percentages

pondents (54% across various age groups) acknowledge adverse effect of noise generated by neighborhoods. An almost equal proportion of respondents (58%) across different age-groups claim that noise originating from religious functions affects them.

In general, apart from the loudspeakers and automobiles, religious functions, as well neighborhood act as significant sources of noise pollution. Thus, metropolitan cities are becoming a victim of new class of pollution i.e. noise. Further, we examine whether sources of noise pollution act upon male population and female population differently.

Table 2 presents figures and % age of male and female respondents affected by different sources of noise. There is marked differences in population affected by noise from religious func-

Table 2: Sources of noise affecting male and female respondents

Noise Sources	Male	Female
Loudspeaker	64 (82)	57 (79)
Automobiles	52 (67)	52 (67)
Neighborhoods	38 (49)	35 (49)
Religious functions	42 (54)	47 (65)
Total respondents	78 (100)	72 (100)

Figure in parenthesis are percentages

tion and surprisingly, women are more affected by it over the men population. In terms of remaining sources, there is no marked difference in % of male population and female population. It means that other sources of noise (Loudspeaker, automobiles, neighborhoods) affect equal proportion of male population as well as female population.

Effects of Noise: There is no doubt that the noise affects human health adversely. The noise may result in loss of hearing, stress, high-blood pressure, loss of sleep, distraction affecting productivity, and a general reduction in the quality of life. The effects of noise are difficult to quantify because tolerance levels among different populace and types of noise vary considerably. There is a large amount of scientific literature assessing the effects of noise on human beings. Indiscriminate use of horn by the vehicles and wide spread use of loudspeakers in Indian social and religious ceremonies caused several health hazards to the urban inhabitants. It may cause deafness, nervous breakdown, mental disorder, heart troubles, high blood pressure, dizziness and

insomnia (Bhargawa, 2001).

Exposure to noise pollution exceeding 75 decibels for more than eight hours daily for a long period of time can cause loss of hearing. The hazards increase with the intensity of the noise and the period of exposure. The sound produced by a bursting cracker, exceeding 150dB, can cause a ringing sensation called 'tinnitus' and can impair hearing permanently. In general about 1 percent of the population suffers from noise-induced pollution.

Nagi et al. (1993) found that the noise level produced by household equipment and appliances sometimes reaches up to 97 dB which is more than double the acceptable (45dB) noise level. This excessive noise could carry several ill-effects viz. annoyance, speech interference, sleep disturbance, mental stress, headache, and lack of concentration. Similarly Singh (1984) noted that the workers exposed to high noise levels have a higher incidence of circulatory problems, cardiac diseases, hypertension, peptic ulcers, and neurosensory and motor impairment. The adverse effects of noise have not even spare the birds (Robins, sparrows, wrens and black-birds). Those living near busy roads could not hear each other and thus unable to contact for propagation (Deutsche Presse-Agentur, 2003).

We can visualize (Table 3) that noise interferes with communication, disturbs the sleep and reduces the efficiency of individuals under its umbrella. Majority of sample respondents exposed to noise pollution report occurrence of annoyance and hearing problem. As many as 35% reported the deafness and almost equal number reported mental breakdown. The survey data shows that the effect of noise is not similar among various age groups. Generally, growing age bears the burnt of excessive noise pollution. For example, the rising proportion of sample respondents in higher age groups acknowledges depression, sleeplessness and deafening effect. A very large proportion of respondents feel that noise interferes with inter-personal communication and causes annoyance. Extreme effects (i.e. mental breakdown and deafness) are acknowledged by one third of survey population. However, there is a much higher incidence of deafness effects on old people (above 60 years of age). Further, a general perusal of table shows that psychosomatic (e.g. depression, sleep) and physiological (deafness) disorders are acknowledged by a smaller proportion of respondents

Table 3: Effect of noise on different age groups

<i>Effect of noise</i>	<i>Age Groups</i>				<i>Total</i>
	<i>0-20</i>	<i>20-40</i>	<i>40-60</i>	<i>Above 60</i>	
Effect on hearing	23 (68)	28 (57)	34 (79)	22 (92)	107 (71)
Interfere with communication	33 (97)	47 (96)	41 (95)	20 (83)	141 (94)
Cause annoyance	25 (73)	38 (78)	35 (81)	18 (75)	116 (77)
Disturb sleep	33 (68)	46 (94)	41 (95)	22 (92)	132 (88)
Result in deafness	9 (26)	15 (31)	15 (35)	13 (54)	52 (35)
Mental breakdown	8 (23)	17 (35)	17 (40)	8 (32)	50 (32)
Total	34 (100)	49 (100)	43 (100)	24 (100)	150 (100)

Figures in parentheses are percentages to the total of the respective columns.

in young age groups vis-à-vis older populations.

Table 4 shows that perception of male and female populations about the effect of noise varies. A significantly higher proportion of male population feels the adverse effects of noise on hearing, efficiency, and breeding of annoyance. Differences in terms of physiological (depression, sleep, mental breakdown) and interference with communication are not marked i.e. almost equal proportion of male and female population is susceptible to such effects of noise.

Table 4: Sex-based differences in perception of effects of noise

<i>Effect of noise</i>	<i>Male group</i>	<i>Female group</i>	<i>Total</i>
Effect on hearing	60 (77)	47 (65)	107 (71)
Interfere with communication	72 (92)	69 (96)	141 (94)
Cause annoyance	62 (81)	54 (75)	116 (77)
Reduce efficiency	71 (91)	61 (84)	132 (88)
Cause depression	48 (62)	47 (65)	95 (63)
Disturb sleep	70 (90)	62 (86)	132 (88)
Result in deafness	27 (35)	25 (35)	52 (35)
Mental breakdown	28 (36)	22 (31)	50 (32)
Total	78 (100)	72 (100)	150 (100)

Figure in parentheses are percentages to the total of the respective columns.

Table 5: Reactions to noise by different age groups

<i>Reactions</i>	<i>Age groups</i>				<i>Total</i>
	<i>0-20</i>	<i>20-40</i>	<i>40-60</i>	<i>Above 60</i>	
Request the source	26 (77)	24 (49)	28 (65)	19 (79)	97 (65)
Complain to the authorities	10 (29)	09 (18)	13 (30)	11 (46)	43 (29)
Complain police	4 (12)	1 (2)	5 (12)	2 (8)	12 (8)
Quarrel with people	11 (32)	4 (8)	11 (26)	4 (17)	30 (20)
Total	34 (100)	49 (100)	43 (100)	24 (100)	150 (100)

Figure in parentheses are percentages to the total of the respective columns.

We have analyzed the data on reactions of age-groups (Table 5) with a view to ascertain the differences in groups, if any. Popular reactions across various age-groups include 'request the perpetrator to stop/reduce the noise'. A significant proportion of people affected by noise seek redressal through administrative procedure or quarrel-the latter is popular with youngsters (up to 20 years) as well as with "mature people" (40-60 years). People falling in 20-40 years do not indulge in administrative, legal remedies and/or quarreling. Even in terms of requesting the source, they lag other age groups. Though a small percentage, the recourse to legal remedy (police) probably indicates serious violations of noise-controlling laws or community ethics.

Table 6 shows that there is no major difference in proportions of male and female populations with regard to the set of probable reactions toward excessive noise. Major reactions to excess noise are similar to what we have seen in case of different age groups i.e. request and seek administrative remedy. It is heartening to note that the fair sex is found to indulge in an aggressive reaction (quarrelling) even more than their masculine counterpart. It may be a result

of modern education, nurturing, and a changing concept of womanhood.

Table 6: Reactions to noise among sex groups

<i>Mode of Reaction</i>	<i>Male</i>	<i>Female</i>	<i>Total</i>
Request the source	50 (64)	47 (65)	97 (65)
Complain to the authorities	22 (28)	21 (29)	43 (29)
Complain to police	7 (09)	5 (07)	12 (8)
Quarrel with people	14 (18)	16 (22)	30 (20)
Total	78 (100)	72 (100)	150 (100)

Figure in parentheses are percentages to the total of the respective columns.

Suggestions for Controlling Noise: The figures in Table 7 indicate responses of individuals to a set of probable solutions. In general, a set of a significant proportion of respondents feel that public education programmes and government can help us control the noise-level. The police and civil administration, if empowered, could also facilitate checking of noise-levels. However, the data suggests need for a multi-dimensional approach i.e. a single measure cannot achieve the goal of noise-reduction. In terms of age, a significant proportion persons between 20-40 years and 40-60 years feel that civil authorities should be empowered along with other measures. It strengthens the belief that public education is needed direly because people are not aware of legislation/rules of environment ministry of Delhi. The younger (< 20 years) and older generation (above 60 years) appears to emphasize *inter alia*, need for empowering the police. Each of age groups feels that a combination model could work better for a public cause.

Male and female groups do not seem to differ regarding alternative methods of controlling the noise-level. Predominantly, male as well as

female respondents advocate public education. Empowering the police is rated as a tool for control of noise by smaller proportion of people in total sample. Thus, change in public attitude by programmes of government/NGO's and civil measures (fines etc.) could help us reduce or prevent the noise pollution ab initio.

Table 8: Suggestions by different sex groups to control noise

<i>Methods</i>	<i>Sex groups</i>		
	<i>Male</i>	<i>Female</i>	<i>Total</i>
Education	28 (36)	22 (31)	50 (33)
Government efforts	17 (22)	16 (22)	33 (22)
Involving NGO's	14 (18)	12 (17)	26 (17)
Empowering police	8 (10)	10 (14)	18 (12)
Empowering Civil Authorities	11 (14)	12 (17)	23 (15)
Total	78 (100)	72 (100)	150 (100)

Figure in parentheses are percentages to the total of the respective columns.

CONCLUSION

This research paper explores the sources, effects, reactions and suggestions for controlling the excessive noise. Automobiles and public address system (loudspeakers) turns out to be major sources of noise pollution. It appears that loudspeakers are frequently used for religious functions (and temple prayers). Disturbance by loudspeakers and automobiles is felt by age groups of 20-40 years somewhat lesser than other groups. Across various age groups, there is almost an equal proportions of respondent reporting neighborhood, music and religions functions as sources of noise. There are no variations among male and female population. Proportion of female population vis-à-vis

Table 7: Suggestions by different age groups to control noise

<i>Suggestion</i>	<i>Age groups</i>				<i>Total</i>
	<i>Upto 20</i>	<i>20-40</i>	<i>40-60</i>	<i>Above 60</i>	
Education	7 (21)	18 (37)	14 (33)	11 (46)	50 (33)
Government efforts	8 (23)	11 (22)	12 (28)	2 (08)	33 (22)
Involving NGO's	8 (23)	6 (12)	8 (19)	4 (17)	26 (17)
Empowering police	8 (23)	4 (04)	2 (05)	4 (17)	18 (12)
Empowering Civil authorities	3 (09)	10 (20)	7 (16)	3 (12)	23 (15)
Total	34 (100)	49 (100)	43 (100)	24 (100)	150 (100)

Figure in parentheses are percentages to the total of the respective columns.

proportion of males' population is same for each of sources of noise.

The survey indicates that noise affects individuals in several ways. It results in improper communication, sleeplessness and reduced efficiency. Though the psycho-somatic effects (annoyance and depression) are also common yet the extreme effects e.g. deafness and mental breakdown are not ruled out. In a majority of cases, the affected party tenders a request to stop noise. A substantial proportion of respondents among various age-groups complain to administration. Interestingly, about one-third of young people (below 20 yrs) prefer to quarrel with the erring party. Public education, appears to be the best methods as suggested by the respondents. However, government and NGOs can play a significant role in the process.

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