A SURVEY OF NOISE AND HEARING PATTERNS IN AN INDIAN INDUSTRY IN MYSORE CITY

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Introduction

Pollution has caused so much concern here and abroad that it is becoming a public nuisance. Among various pollutions, noise pollution has attracted a great deal of attention. As nation develops, as new industries are born, as consumer and transportation facilities increase, noise inevitably also spreads to more and more people. Rightly therefore more concern is being paid to the increasing occurrence of noise and its effects upon man.

An exposure to noise either of a short duration to intense noise or of a prolonged exposure to loud sounds is known to damage man's hearing, disturb his physiology and affect his productivity.

For many people in an industrial administrative set up, these problems and the solutions contain elements outside their previous training and experience.

The field of industrial audiology deals with the noise and its effects upon workers:

Hearing acuity
Safety
Communication and
Performance.

Noise is the price We pay for being civilized, therefore it is becoming increasingly important for us to know what noise is present in our society, so that preventive measures can be taken. Despite frequent conferences and even with an extensive literature on noise elsewhere not enough information about noise picture in our country and its effects are available.

Much Work has been done in this field in other countries, whereas in our country it is yet to be started.

To assess the effects of noise and to lay down the maximum permissible limits for such noises under different conditions have been arduous and are still unfinished tasks. The problem of noise, and in recent times that of aircraft and space craft noise have attracted investigators from different disciplines like, Biophysics, Engineering, Acoustics, Medicine, Physiology, Psychology and Audiology.

The present survey is perhaps the first survey in South India on industrial noise and its effects upon human hearing.

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It was an 'Analysis of industrial noise and hearing patterns in an Indian motor-cycle factory situated in a relatively non-industrialized city—Mysore'. The study consisted of two parts:

(i) Noise analysis in all the sections of the factory.

(ii) Hearing-evaluation of all the workers taken for the survey.

Importance of the study

1. It will emphasize the need for prevention of hearing-loss and also to make constructive suggestions for hearing-conservation in that factory.
2. It will add to the slowly growing understanding of noise problems in India.
3. It is also hoped that this study will augur more such studies in this part of the country.
4. Such studies will lead to legislation to help prevent noise induced hearing loss and other problems.
5. The results of the present survey will be an additional information to the existing literature on industrial noise and its effects upon hearing.

Methodology

There are 14 sections in the factory and a number of 379 workers were selected out of the total 610.

TABLE I. Number of workers taken from the different sections for the survey

SI. No.	Name of the Section	Total Number of workers in the Section	Number of workers taken for survey
		'X'	'Y'
1.	Assembly (Engine)	30	30
2.	Chamber section	50	30
3.	Degreasing	12	12
4.	Die-castingl	32	30
5.	Electro-plating	25	25
6.	Heat-treatment	28	28
7.	Machine shop	200	50
8.	Paint shop	25	25
9.	Press shop	50	30
10.	Polishing shop	22	22
11.	Press welding	34	30
12.	Testing and general repair	7	7
13.	Tool room	30	30
14.	Welding shop	65	30
	Total	610	379

Criteria for selection

1. *(a)* Where the number of workers is 30 and below, all the workers in that section are selected.

(b) Where the number of workers is above 30, a minimum of 30 workers or 25 per cent of the total number of workers in that section, whichever is more, is selected for the survey by random sampling.

2. The selected 379 was the representative of all the sections and who work with the machine.

3. The total number of workers selected, represented all the sections.

Noise evaluation

1. *Equipment:* SPL meter type 2203 with octave band filter set type 1613 and an extension cable with 1 microphone.

2. *Noise analysis:* Noise in all the sections has been measured in all the three weighting net works A, B and C. In addition to this, spectrum analysis of the noise was done using an octave set coupled to the SPL meter.

Noise measurements in each section were repeated thrice at different times during the work schedule and their means were plotted on the graph sheets.

Audiometric evaluation

(a) *Equipment:* Transistorized Madsen portable Audiometer Model TBN 60 calibrated to ISO standards.

(b) Room for testing: One of the rooms in the administrative block was selected and altered to the requirements specified for industrial screening purposes by Glorig (1964).

TABLE II. Comparison of noise pictures as given by Glorig and as obtained by the present investigator.

Octave Bands	150-300 Hz	300-600 Hz	600 H*-12K. Hz	1.2-2.4 K. Hz	2.4-4.8 K. Hz	4.8-9.6 K. Hz
Glorig	...	40	40	47	57	62
Present investigator		46	42	25	15	10

(c) Method of testing: A screening test was administered to all the workers at these levels:

A. C. testing 20 dB at low frequencies and 15 dB at high frequencies.

B. C. testing 20 dB at low frequencies and 10 dB at high frequencies.

Test frequencies 250—500—1K—2K—4K—6K—8K HZs.

(d) Criteria of failure: Those who failed to respond at more than two frequencies either in one ear or in both ears were considered to have railed in the test. For all those who have failed rn rreening were administered a detailed audiometric test.

TABLE III. Levels **for** p assing the **screening test**

Ear	250 Hz	500 Hz	1 K. Hz	2 K. Hz	4K. Hz	**6K Hz**	8K. Hz
Rt/Lt	20	20	15	15	15	**15**	15
B.C.	20	15	5		5		

Each worker was allowed to observe the testing situation before his turn, which facilitated an easy understanding about the testing situation.

With the cases having titinnitus pulsed tones were used.

As the study aimed at those workers who incurred the hearing loss due to noise, the following additional precautions were taken:

(i) Workers with apparent E. N. T abnormalities were excluded;

(ii) Testing was done only after the removal of wax;

(iii) Workers with congenital hearing loss were excluded;

(iv) Hinchcliffe's (1958) corrections *tor* presbyacusis were applied to the audiograms.

Audiometric analysis

Mean thresholds for each frequency or different sections were computed.

E. N. T. examination for each work: was done by an E. N T. specialist before hearing testing.

ANALYSIS

Hearing pattern.

When the mean of mean thresholdsof all the 14 audiograms were determined, following factors were observed:

(i) Bone conduction threshold rermined flat up to 2K.Hz and then had a dip at 4 K.Hz.

(ii) The industrial notch was observe at 6 K.Hz in most of the sections in both the ears (8 out of 14 sees sections).

(iv) Only in 3 out of 14 sections notches existed at 4 K.Hz.

Noise pattern

The common characteristic for all the sections was: 12 out of 14 sections had low frequency predominant noise spectrum.

DISCUSSION

1. A number of industrial surveys abroad have shown a notch at 4 K.Hz, but the present study showed notches at 6 K.Hz in most of the audiograms. (12 out of 14 sections)

2. AAOO (1957V, Baugh (1966) and Karl D. Kryter have suggested that 90 dB (A) as damage risk level, but the present study has showed that 85 dB (A) can be hazardous.

CONCLUSION

1. The noise levels seem to be higher in sections having intermittent type of noise than sections with continuous type of noise.

SI. No.	Name of the Section	Type of noise	Level of noise in dB (A]
1.	Machine shop	C*	70 decibels
2.	Electroplating	C	78 "
3.	Degreasing	C	80 "
4.	Engine assembly	I+	80 "
5.	Die-casting	I	81 "
6.	Chambers	C	83 "
7.	Tool room	C	83 "
8	Paint shop	C	84 "
9.	Heat treatment	C	85 "
10.	Polishing	I	86 "
11.	Testing and general repair	I	93 "
12.	Welding shop	I	95 "
13.	Press-welding	I	103 "
14.	Press-shop	I	104 "

*C=Continuous +I—Intermittent.

2. Noise above 85 dB (A) is hazardous.

3. The factors like long duration of exposure, more noise at dB (A) and more noise in octave bands (300-600 and 1200-2400 Hz) either individually or in consonance may have contributed to the hearing loss.

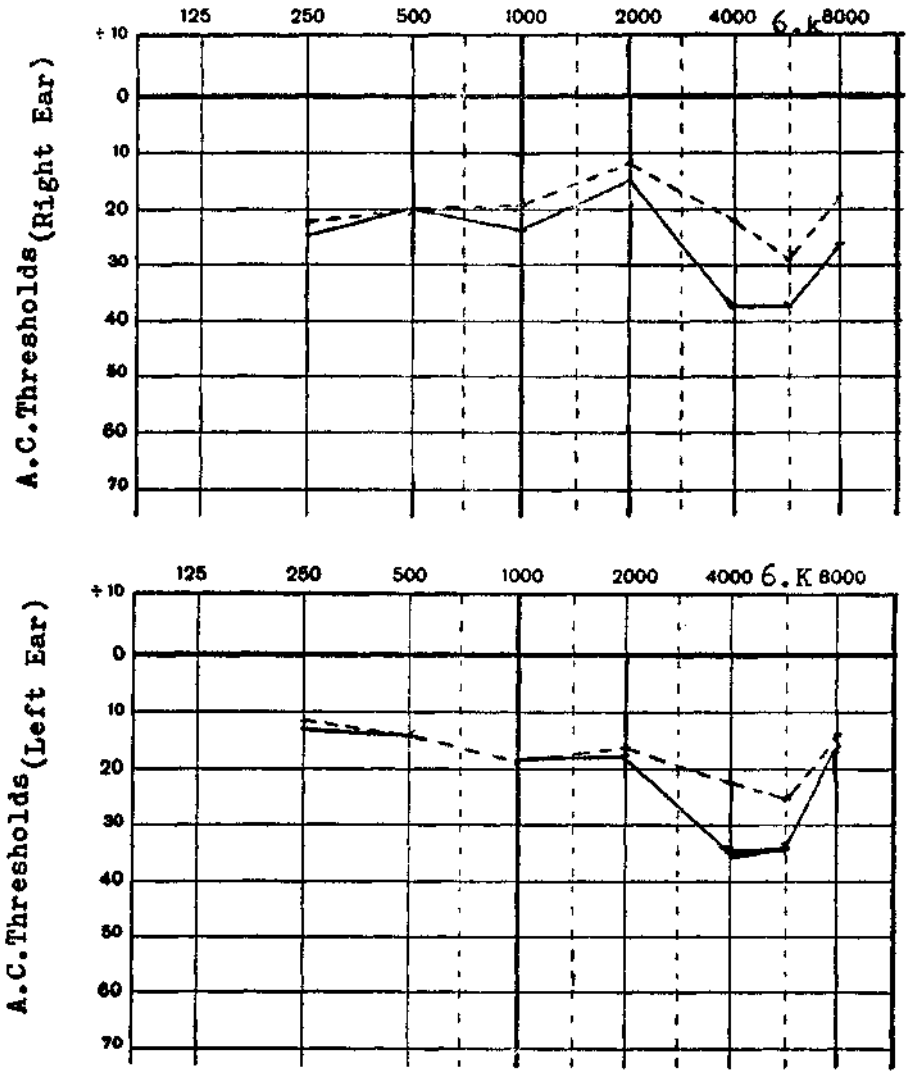
4. It was also seen that the factors other than the duration of exposure, age, type of noise and levels of noise, are also relevant.

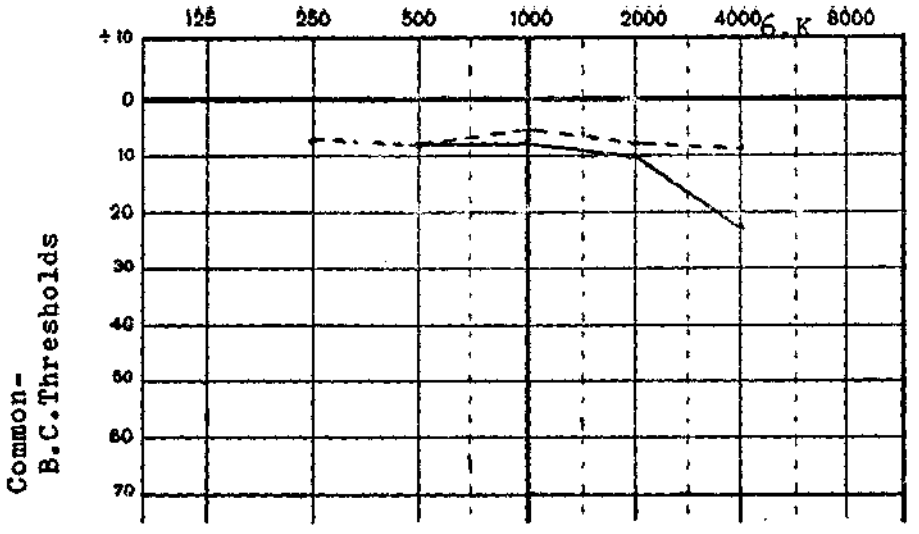
5. Noises below 82 dB may **not** be hazardous for a duration of eight years.

6. The factor of duration of exposure plays an important role in causing hearing loss. (Ref. Table No. V)

TABLE V

Comparison of Audiometric Patterns of Sections, Press-Shop (——) and Press-Welding (—)
Duration of Exposure (a) Press-Shop 5 yrs. (b) Press-Welding 9 yrs.
[Factors like the Level of Noise (I), type of Noise (T), and the Age (A), remains the same for these sections]
(Audiograms were corrected for the Presbycusis factor)—

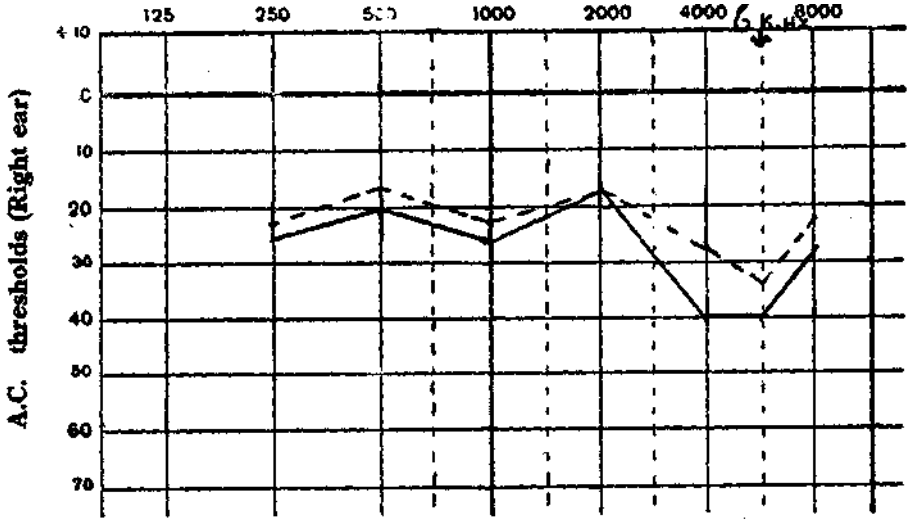


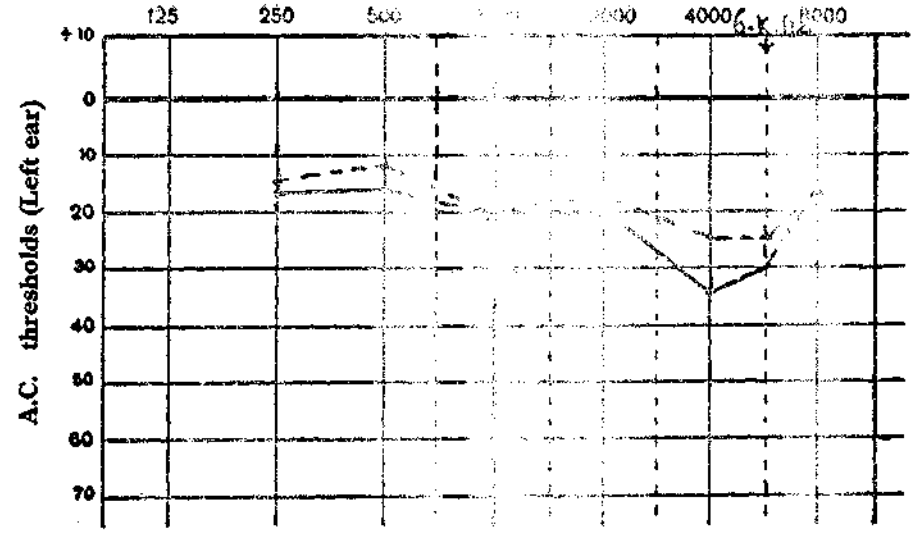


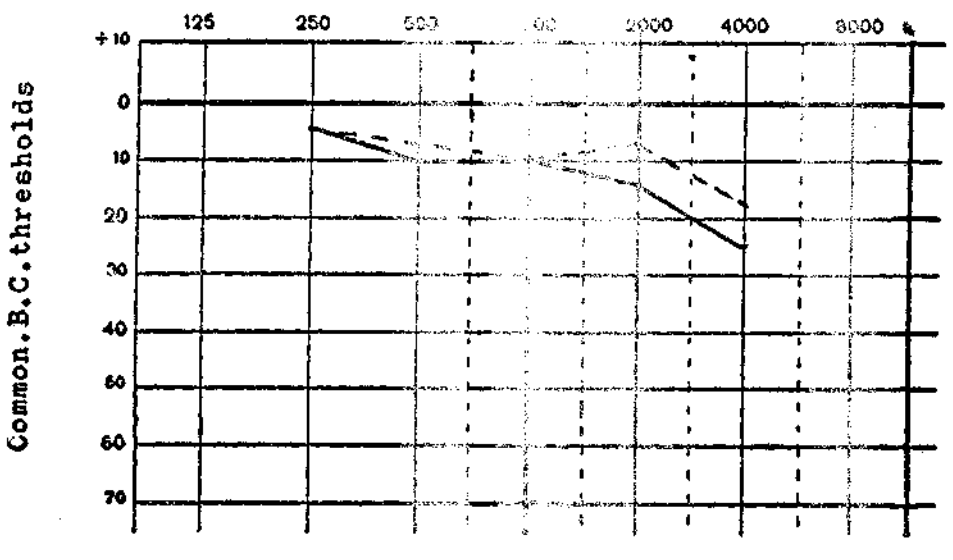
7. The factor of intensity of noise plays an important role in causing hearing loss. (Ref. Table No. VI)

TABLE VI

Comparison of Audiometric Patterns of Sections, Press Welding (—) and Polishing (——) Level of Noise (a) Press Welding 103 decibels. (b) Polishing 86 decibels. [Factors like the type of Noise (T), Age (A), and the Duration of exposure (D), remains the same to both of these sections] (Audiograms were corrected for the Presbycusis factor)







8. The Audiometric Patterns justify that the routine Pure-tone audiometry should include the testing at 6 K. *Hz,* which will be of clinical significance. (12 out of 14 audiometric patterns of all the sections showed notches at 6 K.Hz)

RECOMMENDATIONS TO THE FACTORY

1. Conservation of hearing should be an integral programme of the factory.
2. Those workers who work in the noise level of 85 dB(A) should wear ear protectors.
3. Those workers who have already incurred hearing loss due to noise, should be placed in sections having damage free levels.
4. Arrange for the periodic hearing check up for those who have incurred hearing loss.
5. The work schedule for those who have incurred hearing loss can be changed.
6. In case of new constructions, the new techniques in building industries should be followed.
7. Pre-employment audiograms are recommended.
8. An audiologist should be taken in the regular staff for the hearing conservation programme and to conduct research.

RECOMMENDATIONS FOR FURTHER RESEARCH

1. Intense research should be undertaken on the effects of noise on hearing among other industrial workers.
2. The present study can be repeated with a larger sample.
3. The same workers taken in this survey should be tested after a duration of one year to notice further changes in their audiometric patterns.
4. Studies should be done where testing schedule include testing after varied amount of rest.
5. Studies need to be made on workers who have left the factory for other professions to study whether any recovery takes place after a long period of exposure.
6. Studies need to be done concerning the temporary threshold shifts.

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