

NOISE AND BLOOD PRESSURE: A CROSS SECTIONAL AND LONGITUDINAL STUDY OF THE EFFECTS OF EXPOSURE TO LOUD NOISE ON RESIDENTS OF CALABAR, NIGERIA

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1. INTRODUCTION

Effects on the systemic circulation, such as the constriction of blood vessels, have been observed under laboratory and field conditions. Many studies have shown blood pressure to be higher in noise exposed workers and in populations living in noisy areas around airports and on noisy streets than in control populations [1, 2]. Other investigations indicate no blood pressure effects. The overall evidence suggests that a weak correlation exists between long-term noise exposure and blood pressure elevation, or hypertension. In real life, community noise interferes with a number of activities, for example recreation, sleep, communication, and concentration [3, 4]. The risk of adverse effects on health must be considered in the light that noise as a stressor may operate through physiological responses modified in complex ways by individual psychological processes. To our knowledge, this is one of the few longitudinal studies of the effect of chronic noise on blood pressure.

1.1 Hypotheses

The following null hypotheses were used for the research:

- (i) there is no immediate relationship between exposure to loud noise and high blood pressure;
- (ii) there is no long-term relationship between exposure to loud noise and high blood pressure.

2. MATERIALS AND METHODS

Measurements were taken in sixteen zones-eight high noise zones (study group) and eight low noise zones (control group). The high noise zones had average A-weighted noise levels of 80 dB or above, a level which may be hazardous to the hearing of most people. The low noise zones had average A-weighted noise levels of 50 dB or below, a level above which most people complain.

2.1 Objective measurements

Physical measurements were taken between 7 a.m. and 9 a.m., and 2 p.m. and 4 p.m. on working days (Monday to Friday) by an accredited Acoustician. About fifty random readings were taken at different locations within each zone and the sound level of each zone was calculated. The materials used for this measurements are the sound level meter, (Bruel & Kjaer) type 2203 with octave band filter (Bruel & Kjaer) type 1613, for

measuring the sound level of the zones, a factory calibrated sphygmomanometer (SF 60502) for measuring blood pressure. During the noise level measurements, the sound level meter was held in such a way that the microphone was at least one meter from any reflecting surface and 1.2 m from the ground, corresponding to the ear level of an average person. Blood pressure measurements and the physical examination of respondents were done by an accredited Medical Doctor. Ambient temperature, atmospheric pressure, weight and height of respondents were also measured.

2.2 Subjective measurements

A 39-item questionnaire was used for subjective assessment of the respondents in all the sixteen zones. The respondents were given questionnaires which contained standard questions tailored toward getting their reactions about the effects of noise on them. The questionnaires were structured, among other things, to elicit information on general sociodemographic characteristics, viz: age, sex, educational level, medical and occupational history of diseases and conditions that could cause hearing impairment.

3. RESULTS

The effect of noise on blood pressure was assessed by comparing the blood pressure of respondents who had lived or worked/schooled in the high noise zones with that of respondents in the low noise zones. The respondents taken were those that have lived in these areas for at least three years, a period believed to be enough for adaptation to the noise environment by the respondents. The results of some of the measurements are shown in tables 1, 2 and 3.

Table 1. Blood pressure of respondents in the high noise zone (HNZ)

S/N	CODE	100/50- 140/90	141/91-180/140
1	HNZ1	70	61
2	HNZ2	49	52
3	HNZ3	112	93
4	HNZ4	115	116
5	HNZ5	68	54
6	HNZ6	32	55
7	HNZ7	45	70
8	HNZ8	45	55

Table 2. Blood pressure of respondents in low noise zone (LNZ)

S/N	CODE	100/50- 140/90	141/91-180/140
1	LNZ1	22	26
2	LNZ2	12	13
3	LNZ3	26	11
4	LNZ4	93	74
5	LNZ5	111	154
6	LNZ6	13	24
7	LNZ7	160	107
8	LNZ8	209	80

Table 3. Blood pressures of Respondents in Calabar Timber Market in July 2002 and July, 2006

S/N	Systolic/diastolic blood pressure, July, 2002 (mmHg)	Systolic/diastolic blood pressure, July, 2006 (mmHg)
1	120/80	140/80
2	110/80	120/80
3	120/80	120/80
4	120/80	130/80
5	120/80	130/80
6	120/80	120/90
7	140/90	140/90
8	110/80	120/80
9	130/90	130/90
10	120/80	140/80
11	120/90	130/90
12	120/80	130/80
13	100/70	120/70
14	130/100	160/100
15	130/90	140/90

First, the coefficients of correlation were calculated for the noise measurements to determine how related the subjective responses, assessed by the use of questionnaires as the study instrument were to the objective responses measured with the sound level meter. Thereafter, using regression analysis, figure 1 was obtained when distribution of blood pressures within range 100/50 to 140/90 (High 1) in the high noise zones were compared with that within the same range in the low noise zones (Low 1).

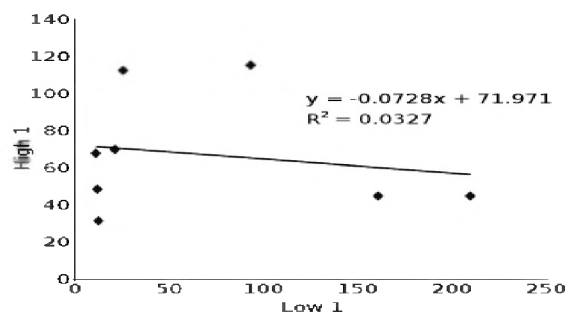


Figure 1. A graph of High 1 against Low 1.

In figure 2, comparison is made between systolic pressures of the same respondents measured in 2002 (sys 02) and 2006 (sys 06). A similar result was seen when the diastolic blood pressures were also compared.

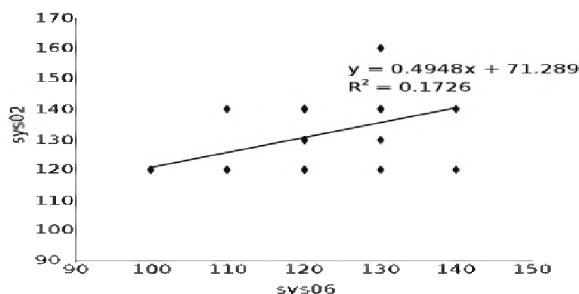


Figure 2. A graph of systolic blood pressure measured in 2002 against systolic

4. DISCUSSION AND CONCLUSIONS

The equation in figure 1 shows that a negative relationship exists between the blood pressures measured in the high noise zones and that measured in the low noise zones. Also, the level of association is low. This is shown by R2 which is only 3.3%. We therefore conclude that the null hypothesis that there is no immediate relationship between exposure to loud noise and high blood pressure should be accepted.

In figure 2, there is a positive relationship in the comparison of the systolic pressures measured in 2002 and 2006. Also, R2 = 17.3%. With the probability value (p-value) of 0.000 (< 0.05), we reject the null hypothesis that there is no long-term relationship between exposure to loud noise and high blood pressure. This finding replicates the positive results obtained in some retrospective longitudinal studies [5].

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