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Original Research Article

Traffic Noise Pollution and Community Awareness of Cardiovascular Risks a Community-Based Cross-Sectional Study in Peshawar

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Abstract: This community-based cross-sectional study investigated Peshawar people' attitudes of traffic noise as a cardiovascular risk factor. A total of 384 respondents, chosen via stratified random sampling, completed a validated questionnaire given to them in person. Descriptive statistics, chi-square tests, and t-tests were employed to evaluate demographic data and awareness levels. Bloom's cut-off criterion revealed that overall awareness was shockingly low, with only 1% of respondents displaying "good" knowledge, 18.8% having "neutral" knowledge, and 80.2% having "poor" knowledge. Residents in low-traffic areas demonstrated higher levels of awareness than those in high-traffic zones (50.8% vs. 42.1%, $p < 0.001$). High-traffic populations were at a significantly higher risk of cardiovascular morbidity (28.6% reported hypertension or heart disease vs. 10.4% in low-traffic zones, $p < 0.001$). These findings show a large knowledge gap about noise-related cardiovascular risks, especially among the most exposed individuals. The study underlines the urgent need for targeted public health campaigns, the integration of environmental health into cardiovascular preventative strategies, and stricter noise control policies to eliminate this underestimated but manageable risk factor in urban Pakistan.

Keywords: Community-based study, cross-sectional study, public health campaigns, environmental health, public awareness, health education.

INTRODUCTION

Chronic exposure to road traffic noise has been linked to an increased risk of cardiovascular disease, particularly ischemia and coronary heart disease [1]. According to the WHO Environmental Noise Guidelines, each 10 dB(A) increase in road traffic noise raises the risk of ischemic heart disease by 1.08 (95% confidence interval: 1.01-1.15) [2], and According to a 2025 umbrella meta-analysis, every 10 decibel rise raises the risk of coronary heart disease by around 8% [1]. Recent research suggests that increasing road noise is moderately connected with heart failure and hypertension. For example, one meta-review discovered that every 10 dB (A) increase raised the risk of cardiac failure by about 4-5% [2]. These epidemiological studies suggest that recurrent noise exposure might lead to vascular dysfunction and blood pressure increase, increasing long-term CHD risk (pooled cardiovascular risk is

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approximately 3.2% greater every 10 dB of road noise) [2].

Traffic noise is a serious urban problem with well-documented health implications. Environmental assessments in Europe, for example, show that over 106 million people (more than 20% of the population) are exposed to chronic transportation noise exceeding 55 decibels [3], and globally roughly 30% of people exceed the WHO-recommended noise levels for avoiding cardiovascular harm [4]. Chronic exposure to excessive traffic noise has been linked to an increase in the risk of hypertension and ischemic heart disease [5]. Cardiovascular disease is the largest cause of death worldwide, accounting for around 17.9 million deaths annually [5]. Pakistan has a disproportionately high CVD burden, with an age-adjusted CVD death rate of more than 350 per 100,000 in 2019, which is significantly higher than global averages and has not declined in recent years [6]. Pakistan's cities have frighteningly high urban noise levels. The average road traffic noise levels in Lahore and the Islamabad-Rawalpindi area have been measured to be between 70 and 120 dB [7]. Significantly exceeded national safe limits. 90% of Lahore's important junctions reported daytime noise levels exceeding 85 dB (peaking at 104 decibels) [8]. These findings show that a sizable proportion of the metropolitan population is exposed to hazardous traffic noise, emphasizing the significance of raising community knowledge of the cardiovascular dangers.

Despite the identified risks, nothing is known regarding traffic noise's involvement as a cardiovascular risk factor. Peshawar, a densely populated city with substantial vehicle traffic, is likely to have high noise levels; nevertheless, it is unclear whether inhabitants link road noise to heart disease. To close this gap, a community-based cross-sectional survey is recommended. This study will look into people's noise exposure and awareness of noise-related cardiovascular risk in Peshawar. The findings will serve as a crucial baseline for Pakistan's public health policymakers, allowing them to develop targeted campaigns and educate the public about this modifiable environmental danger.

METHODOLGY

Objectives

1. To assess public awareness of the cardiovascular risks linked with traffic noise pollution in Peshawar.
2. To compare public awareness levels in Peshawar's high and low-traffic zones.

Standard Procedures of the Study

A cross-sectional survey design was used. A validated questionnaire was used which was changed accordingly to my population. The researchers employed convenience sampling, which targeted people who were readily available to participate. The data were collected by the face-to-face administration of written questionnaires on paper. Student researchers served as survey administrators, handing out questionnaires to consenting individuals and collecting completed forms. This strategy allowed for quick and economical data collection.

Surveys were performed in several areas to get a varied set of respondent profiles. Survey sites were put up in both high and low-traffic locations. The study aims to avoid bias in its findings by selecting both high and local venues.

The questionnaire had questions that tested relevant knowledge. Each right solution was worth one point. The total scores for each respondent were tallied and translated to percentages. Bloom's cut-off criteria identified knowledge levels as "good" (80-100%), "neutral" (60-79%), or "poor" (<60%). Answering ≥80% of questions correctly is regarded "good knowledge," while scores below 60% are categorized as "poor."

Sample Size

A stratified random sampling technique was used. The sample size was calculated using OpenEpi software. The following parameters were used.

1. Population size= 1000000; as population size was considered large, so this value was used as per OpenEpi guidance.
2. Anticipated frequency (p) = 50% since the true frequency was unknown
3. Confidence limits as + - percent of 100 = 5%
4. Design effect = 1%

So, based on these parameters, the calculated sample size for a 95% confidence level was 384.

Data Analysis

Following data collection, questionnaire responses will be entered into statistical software and analyzed. The demographics and knowledge levels of respondents will be reported using descriptive statistics like means and frequencies. Inferential tests (such as chi-square or t-tests) will be used to look at differences in knowledge levels between groups, if applicable. The full analysis plan will be developed based on the obtained data and the study's requirements.

Scoring and Catogrization

Each awareness question in Section 2 was evaluated for accuracy (one point for a correct response, zero for wrong or "don't know"), and the total scores were converted to percentages. Using Bloom's cut-off criterion, we classed knowledge

levels as Good (≥80% right), Neutral (60-79%), and Poor (<60%). This approach is widely used in health KAP surveys to categorize knowledge.

Statistical Analysis

Descriptive statistics (frequency, percentage, and mean) were employed to summarize respondents' demographics and levels of awareness. The mean knowledge scores for each respondent were determined. Inferential studies used chi-square tests for categorical comparisons (for example, knowledge level vs. location) and independent-sample t-tests for continuous variables. Significance was determined at $p < 0.05$. All analyses were conducted using statistical methods.

RESULTS

Demographics

Table 1 describes the samples. Among the 384 respondents, 229 (59.6%) were men and 155 (40.4%) were women. The age range was primarily 18-35 (60.4%), with the remainder being older: 84 (21.9%) were 18-25, 148 (38.5%) 26-35, 88 (22.9%) 36-45, and 64 (16.7%) 46 and over. Half (192, 50.0%) lived in high-traffic areas (near major roads or highways), whereas the other half (192, 50.0%) resided in low-traffic zones.

Table 1:

Characteristic	Category	n (%)
Gender	Male	229 (59.6%)
	female	155 (40.4%)
Age Group	18–25	84 (21.9%)
	26–35	148 (38.5%)
	36–45	88 (22.9%)
	46+	64 (16.7%)
Residence Location	High traffic area	192 (50.0%)
	Low traffic area	192 (50.0%)

Awareness of Noise Related Cardiovascular Risk

Overall, there was a lack of understanding about traffic noise as a cardiovascular risk. Based on Bloom's cut-off, only 4 respondents (1.0%) scored "Good" (≥80% right), 72 (18.8%) scored "Neutral" (60-79%), and 308 (80.2%) scored "Poor" (<60%). In fact, just around 20% of the responses to the heart-health impact questions were right on average. For example, less than half of the respondents correctly responded that road noise can cause high blood pressure and heart disease. Few people had ever heard a public warning regarding loud noises and heart health. The results point to a "negative" conclusion for Objective 1: low public knowledge and an inaccurate understanding of noise-related cardiovascular risks.

Comparative Analysis by Traffic Exposure

Knowledge levels varied substantially depending on home traffic exposure. Table 2 shows that 85.4% of high-traffic respondents evaluated their performance as "poor," with no rating of "good." In comparison, low-traffic households received 2.1% "Good" and 75.0% "Poor," showing a higher level of awareness. The chi-square test found a significant connection between knowledge category and location ($\chi^2(2)=8.85$, $p=0.012$). The high-traffic group scored considerably lower on knowledge (42.1%) compared to the low-traffic group (50.8%; $t(350)\approx-5.69$, $p < 0.001$).

Table 2: Knowledge of traffic noise–heart risk by residential area (n and %). Bloom's cut-offs used for classification. High-traffic residents had significantly poorer knowledge ($\chi^2=8.85$, $p=0.012$).

Knowledge	High Traffic Area	Low Traffic Area	Total
Good (≥80%)	0 (0.0%)	4 (2.1%)	4 (1.0%)
Neutral (60–79%)	28 (14.6%)	44 (22.9%)	72 (18.8%)
Poor (<60%)	164 (85.4%)	144 (75.0%)	308 (80.2%)
Total (N=384)	**192 (100%)**	**192 (100%)**	**384 (100%)**

Health outcomes also differed by location. Overall, 75 (19.5%) of respondents mentioned a personal or familial history of cardiovascular disease. Self-reported diagnoses were significantly higher in the high-traffic group, with 55 of 192 (28.6%) reporting hypertension or heart disease compared to 20 of 192 (10.4%) in the low-traffic group. The chi-square test found a significant difference ($\chi^2(1)=19.15$, $p<0.001$), indicating a higher risk for those living near heavy traffic.

Table 3:

Cardiovascular	High traffic area	Low traffic area	χ^2, p-value
Yes (diagnosed)	55 (28.6%)	20 (10.4%)	χ^2=19.15, p<0.001
No	137 (71.4%)	172 (89.6%)	

Additional inference tests, such as comparing individual question responses, produced comparable results. To summarize, people who lived near major roads were not only less conscious of noise-related cardiac hazards, but also reported higher cardiovascular morbidity, which aligned with our comparative objective.

DISCUSSION

Our findings show an alarming lack of public awareness of traffic noise as a cardiovascular risk. Using Bloom's taxonomy thresholds (at least 80% accuracy for strong knowledge). The majority of respondents had "poor" knowledge. Gilani and Mir discovered that most locals had "no/little awareness" of noise's health implications, which was consistent with previous area study [9)] Similarly, studies in Karachi have revealed widespread misunderstanding of noise issues, with Wasiullah Khan *et al*., asserting that residents were "totally ignorant of the hazards of noise" despite exceptionally high ambient levels [10]. In contrast to stated risks like smoking or hypertension (which more than 75% of our sample recognized [11]. Traffic noise remains frequently underestimated as a problem. The male-dominated sample (about 60%) is consistent with previous findings, such as one on traffic noise in Karachi, in which 84% of participants were male [12]. This disparity may indicate disparities in occupational or cultural exposure and should be viewed as a constraint.

We identified significant area-based disparities. Residents in high-traffic regions exhibited poorer awareness and reported increased CVD prevalence compared to quieter areas (p<0.05, chi-squared/T-test). This adds to biological plausibility, as extended noise exposure has been linked to increased blood pressure and stress hormone levels. For example, UK Biobank data showed that road traffic noise was linked to moderate but significant increases in systolic/diastolic blood pressure and metabolic indicators [13]. Similarly, meta-analyses show a strong exposure-response relationship, with each 10 dB (A) increase in noise linked to an 81% greater risk of hypertension [14]. There is also an increased risk of coronary heart disease and arrhythmia. Pershagen *et al*., (2025) discovered that long-term exposure to traffic noise considerably raises the risk of ischemic heart disease, myocardial infarction, and stroke [15]. Recent assessments have underlined the risks: Trends in Cardiology provided studies demonstrating that increased road noise greatly increases the incidence of stroke and CAD mortality [16]. Our findings of a higher CVD incidence in high-noise situations are consistent with global research. Those who were most exposed were less aware of the link between noise and CVD, showing that chronic exposure may result in resignation or a focus on immediate inconveniences (annoyance, hearing loss) rather than long-term health implications.

These findings add to the limited understanding about noise perception. A detailed review of low/middle-income nations revealed that noise research focuses mostly on discomfort, with scant evidence on cardiovascular effects [17]. Our findings close a gap by correlating awareness, exposure, and disease. We observed statistically significant differences (p<0.05) that may represent actual trends. For cross-sectional research, we adhered to STROBE reporting criteria and used validated knowledge assessments (Bloom's cut-offs) and appropriate statistical tests. The study's weaknesses include a cross-sectional design with no causal inference, possible sampling bias (more men), and dependence on self-reported diagnoses. Although similar gender disparities have been seen in environmental surveys (12), our significant chi-square and t-test results corroborate the group differences.

The public health implications are enormous. Although traffic noise is a known cause of cardiovascular stress, it is frequently neglected by the general public. Peshawar's development and traffic have resulted in noise levels that exceed permitted limits [18]. Our findings on low awareness reflect calls from local experts: Karachi researchers urge authorities to "wake up" to traffic noise and implement awareness campaigns [9]. Noise reduction, which involves urban design, automotive legislation, and traffic control, must be combined with education. Health experts and the media should acknowledge that noise can cause hypertension, heart disease, and stroke (e.g. Farooqi *et al*., discovered that 74% of survey respondents linked noise to higher blood pressure and hypertension [19]. Integrating noise into CVD prevention strategies could help counteract this harmful risk. On a policy level, stricter noise regulations (as supported in Karachi 20), and regular noise monitoring could improve cardiovascular health.

CONCLUSION

The current investigation demonstrates a serious lack of public awareness of traffic noise as a cardiovascular risk in Peshawar. Given the overwhelming evidence that long-term traffic noise increases the risk of hypertension and heart disease, this knowledge gap is most certainly contributing to preventable morbidity. These findings highlight the importance of immediate public health action, such as targeted education campaigns, integrating environmental health into primary care, and implementing noise-reduction regulations. Raising community knowledge is critical to reducing the cardiovascular burden of traffic noise and improving urban health in Pakistan.

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