Journal of Netrokona Medical College
Frequency: Bi-Annual
Volume-2 | Issue-2 | July 2025
https://nmcj.org/jnmc
OPEN ACCESS
eISSN: 2664-738X
ORIGINAL ARTICLE
DOI: https://doi.org/10.70818/jnmc.v02i02.017

Investigating Sleep Disturbance Due to Environmental Noise Pollution in Urban Bangladesh

Abul Bashar*[1], Mohammad Abdul Gani[2]

[1] *Department of Community Medicine, Netrokona Medical College, Netrokona*
2 Department of Pharmacology & Therapeutics, Netrokona Medical College, Netrokona

ABSTRACT: ***Background:*** Environmental noise pollution in urban Bangladesh has become a major public health concern, leading to sleep disturbances among urban populations. Increased noise levels from traffic, industrial activities, and urbanization have exacerbated this issue. ***Objective:*** To investigate the impact of environmental noise pollution on sleep disturbances among urban residents of Netrokona, Bangladesh, and assess its relationship with various health parameters. ***Methods:*** A cross-sectional study was conducted from January 2023 to June 2024 at the Department of Community Medicine, Netrokona Medical College. A total of 108 patients were included, aged 18–65 years, selected through random sampling. Participants were assessed using a structured questionnaire based on the Pittsburgh Sleep Quality Index (PSQI) and environmental noise measurements using a calibrated sound level meter. Data was analyzed using SPSS version 25, with chi-square tests for categorical variables and independent t-tests for continuous variables. Descriptive statistics, including mean, standard deviation (SD), and p-value, were calculated to determine statistical significance. ***Results:*** The study revealed that 68% of participants reported moderate to severe sleep disturbances, with 45% experiencing frequent awakenings and 23% reporting difficulty falling asleep. Noise exposure levels ranged from 60 to 85 dB, with a mean of 73.4 dB (SD=5.6). The sleep disturbance index was significantly higher ($p<0.05$) in areas with noise levels exceeding 70 dB, as compared to those with lower noise exposure. A strong negative correlation ($r=-0.72$, $p<0.01$) was found between sleep quality and noise exposure. Additionally, a higher percentage of patients with elevated noise levels (78%) experienced poor sleep quality. ***Conclusion:*** Environmental noise pollution significantly contributes to sleep disturbances in urban Bangladesh, with noise levels above 70 dB correlating with poor sleep quality. Immediate intervention is needed to mitigate noise pollution and improve public health.

Keywords: Sleep Disturbance, Environmental Noise, Noise Exposure, Urban Bangladesh, Public Health.

***Correspondence:**
Dr. Abul Bashar

How to cite this article:
Bashar A & Gani MA; Investigating Sleep Disturbance Due to Environmental Noise Pollution in Urban Bangladesh. J Netr. Med Coll. 2025; 2 (2): 29-36

Article history:
Received: April 08, 2025
Accepted: June 12, 2025
Published: July 20, 2025

Peer Review Process:
The Journal abides by a double-blind peer review process such that the journal does not disclose the identity of the reviewer(s) to the author(s) and does not disclose the identity of the author(s) to the reviewer(s).

INTRODUCTION

Sleep disturbance, a pervasive issue in urbanized regions, has garnered increasing attention due to its direct links to physical health and psychological well-being.[1] Among the multitude of environmental factors influencing sleep, noise pollution has emerged as a significant disruptor, particularly in urban areas of developing countries like Bangladesh. Urbanization, characterized by rapid population growth, industrial expansion, and transportation infrastructure, has led to a significant rise in environmental noise levels. This, in turn, has exacerbated the prevalence of sleep disorders, with a profound impact on public health. Sleep disturbances, such as difficulty falling asleep, waking up frequently during the night, or experiencing non-restorative sleep, are often precipitated or exacerbated by chronic exposure to environmental noise. The scope of these disturbances is more pronounced in densely populated urban settings, where the sources of noise pollution are numerous and varied, including vehicular traffic, construction activities, industrial operations, and social gatherings.[2]

Research into the impact of noise pollution on sleep has steadily increased, owing to its far-reaching consequences on human health. Long-term exposure to noise pollution has been associated with a range of adverse health outcomes, including cardiovascular diseases, hypertension, and impaired cognitive function. Additionally, disrupted sleep due to environmental noise has been linked to heightened stress, mood disorders, and diminished quality of life. In particular, urban populations are at heightened risk, given the pervasive nature of noise in these settings. The city of Dhaka, Bangladesh's capital, epitomizes such urban conditions, where millions of residents are subjected to high noise levels from traffic, construction, and industrial activity. Studies on

environmental noise pollution have often focused on its physical effects on health, but limited attention has been given to the specific impact on sleep disturbances in cities like Dhaka.[3]

Environmental noise is classified by its source and intensity, with common sources including road traffic, railways, air traffic, and industrial operations. The frequency and intensity of noise exposure are crucial factors in determining its effect on sleep patterns. Noise-induced sleep disturbances (NISD) can manifest as difficulty falling asleep (sleep latency), frequent awakening during the night, and fragmented sleep. Over time, these disturbances contribute to cumulative sleep deprivation, which can have profound implications for both mental and physical health. The International Organization for Standardization (ISO) and the World Health Organization (WHO) have both identified noise pollution as a critical factor that compromises public health. According to the WHO, chronic exposure to noise levels above 55 decibels (dB) during the night significantly impairs sleep quality and duration, with detrimental effects on cardiovascular and metabolic health.[4] In the context of Bangladesh, there has been a notable rise in noise levels, particularly in urban centers. Dhaka, one of the most densely populated cities in the world, exhibits noise levels that frequently surpass recommended limits. According to a study by Chakraborty *et al.*, the average noise levels in residential areas of Dhaka can exceed 70 dB, far above the threshold deemed safe by international standards.[5] Such exposure is commonplace, with a significant portion of the population exposed to elevated noise levels during both day and night, leading to a heightened risk of sleep disturbances.[6]

The physiological mechanisms through which environmental noise impacts sleep are multifaceted. Noise-induced arousals during sleep are typically brief but frequent interruptions that prevent individuals from entering deeper, more restorative stages of sleep, particularly the rapid eye movement (REM) and slow-wave sleep (SWS) phases. Studies have demonstrated that noise exposure during the sleep cycle activates the sympathetic nervous system, increasing heart rate and blood pressure, which in turn disrupts the normal progression of sleep stages. This disruption impairs the restorative functions of sleep, leading to feelings of fatigue and cognitive impairment upon waking.[7] Furthermore, the chronic nature of noise exposure exacerbates the long-term effects of sleep disturbances. Continuous noise exposure, especially during critical sleep periods, can induce a hyper-arousal response, where individuals become more sensitive to external stimuli, thereby amplifying the negative effects of future noise events. This sensitivity to environmental stimuli has been identified as a key component in the development of chronic insomnia, a condition that significantly reduces quality of life. The link between noise and the dysregulation of sleep architecture underscores the importance of investigating noise pollution as a critical determinant of public health, particularly in urbanized areas like Bangladesh.[8]

The impact of sleep disturbance due to noise pollution extends beyond individual discomfort to encompass broader public health concerns. As sleep disturbances accumulate over time, they contribute to a range of chronic conditions, including cardiovascular diseases, obesity, and mental health disorders such as depression and anxiety. The economic burden of these health outcomes is substantial, with increased healthcare costs and reduced productivity in the workforce. In Bangladesh, where access to healthcare services remains limited in many urban areas, the consequences of noise-induced sleep disturbances are particularly concerning. The prevalence of noise pollution in Dhaka, combined with the growing burden of lifestyle-related diseases, presents a significant challenge to public health officials.[9] Furthermore, the psychosocial implications of sleep disturbances are particularly pronounced in low-income communities, where individuals may already be facing multiple stressors. The compounded effects of noise pollution, coupled with socio-economic hardships, can exacerbate mental health challenges, leading to a vicious cycle of poor health and limited access to care. As such, understanding the links between environmental noise and sleep disturbances in urban Bangladesh is not only crucial for improving public health outcomes but also for addressing the root causes of urban health inequalities.[10]

Aims and Objective

The aim of this study is to assess the impact of environmental noise pollution on sleep disturbances among urban residents in Netrokona, Bangladesh. The objective is to analyze the correlation between noise exposure levels and sleep quality, examining the prevalence of sleep disorders in relation to varying noise pollution intensities.

MATERIAL AND METHODS

Study Design

This was a cross-sectional study conducted at the Department of Community Medicine, Netrokona Medical College, from January 2023 to June 2024. The study aimed to investigate the relationship between environmental noise pollution and sleep disturbances in urban residents of Netrokona. A total of 108 participants, aged between 18 and 65 years, were randomly selected from both residential and commercial areas of the city. Noise exposure levels were measured using a calibrated sound level meter, and sleep disturbances were assessed using the Pittsburgh Sleep Quality Index (PSQI). The data were analyzed to identify correlations between noise pollution and sleep quality. This study adhered to standardized guidelines to ensure the reliability and accuracy of the collected data.

Inclusion Criteria

Participants aged 18-65 years, residing in urban areas of Netrokona, were included in the study. Individuals who reported consistent exposure to noise pollution (above 60 dB) for at least 6 months were considered eligible. Only those willing to participate and provide informed consent

were enrolled. The study aimed to include both men and women to ensure diversity in the sample.

Exclusion Criteria

Participants with pre-existing sleep disorders, psychiatric conditions, or those currently on medication affecting sleep were excluded from the study. Individuals with significant hearing impairments or those who had lived in the study area for less than six months were also excluded. Additionally, pregnant women, children, and those with chronic health issues that could confound the results were not considered eligible for participation in the study.

Data Collection

Data were collected through structured interviews, where participants were asked about their sleep patterns, general health, and exposure to environmental noise. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. Noise levels in residential and commercial areas were measured using a sound level meter at different times of the day. Informed consent was obtained from each participant before data collection, ensuring confidentiality and ethical compliance.

Data Analysis

Data analysis was performed using SPSS version 26.0. Descriptive statistics, including frequencies, percentages, mean, and standard deviation, were used to summarize the data. Chi-square tests were applied for categorical variables, while independent t-tests were used to compare continuous variables across different noise exposure groups. Correlation analysis was conducted to explore the relationship between noise levels and sleep disturbances. Statistical significance was set at $p<0.05$.

Procedure

The study was conducted in phases, beginning with obtaining ethical approval from the institutional review board. Participants were recruited via random sampling from urban areas, ensuring a mix of residential and commercial zones. Upon recruitment, informed consent was collected from each participant, emphasizing their voluntary participation and confidentiality of their responses. During the data collection phase, noise levels were measured using a sound level meter placed at participants' homes at various times, including morning, afternoon, and evening. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), which evaluates subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Additionally, interviews were conducted to gather demographic information and other health-related factors that could influence sleep patterns. Once data were collected, they were entered into SPSS for analysis. The results were categorized by noise exposure levels (below 60 dB, 60-70 dB, above 70 dB) to assess the prevalence of sleep disturbances. Participants who reported higher exposure to noise levels showed significantly worse sleep quality, corroborating the hypothesis of a direct relationship between noise pollution and sleep disturbances. The study was completed after six months, with continuous monitoring and feedback from participants to ensure accuracy and address any emerging concerns.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Netrokona Medical College. Informed consent was obtained from all participants, ensuring their voluntary participation. Confidentiality was maintained throughout the study, with all data anonymized to protect personal information. Participants were assured of their right to withdraw from the study at any time without repercussions.

RESULTS

The results indicated a significant relationship between environmental noise pollution and sleep disturbances in the urban population of Netrokona, Bangladesh. A total of 108 patients participated in the study, and comprehensive data was collected on their demographic characteristics, noise exposure levels, and sleep quality. The data were analyzed to identify the prevalence of sleep disturbances in relation to various levels of environmental noise. Below are the results, including descriptive statistics, p-values, and additional variables of interest.

Table 1: Demographic Characteristics of Study Participants

Demographic Variable	Frequency (n=108)	Percentage (%)	P-value
Age (years)			
18–30	25	23.1	
31–45	40	37.0	
46–60	30	27.8	
61+	13	12.0	
Gender			
Male	58	53.7	0.42
Female	50	46.3	
Marital Status			
Married	75	69.4	0.07
Unmarried	33	30.6	

Education Level			
No formal education	10	9.3	0.12
Primary/Secondary education	50	46.3	
Higher education	48	44.4	

The demographic characteristics of the study sample are as follows: 23.1% of the participants were between 18–30 years, 37.0% were aged 31–45, 27.8% were aged 46–60, and 12.0% were over 60 years old. A slightly higher proportion of males (53.7%) participated in the study compared to females (46.3%). Married individuals accounted for 69.4% of the study population, while those with primary or secondary education made up the largest educational group (46.3%).

Table 2: Noise Exposure Levels Among Participants

Noise Exposure Level (dB)	Frequency (n=108)	Percentage (%)	P-value
60–65	25	23.1	
66–70	45	41.7	0.03
71–75	20	18.5	
76–80	13	12.0	
81+	5	4.6	

Most participants were exposed to noise levels between 66–70 dB (41.7%), followed by 60–65 dB (23.1%). The data showed a significant association ($p<0.05$) between noise levels and the occurrence of sleep disturbances, especially in participants with exposure exceeding 70 dB.

Table 3: Sleep Quality Based on Pittsburgh Sleep Quality Index (PSQI)

Sleep Quality Category	Frequency (n=108)	Percentage (%)	P-value
Poor Sleep Quality (PSQI >5)	73	67.6	0.001
Good Sleep Quality (PSQI ≤5)	35	32.4	

The results indicated that 67.6% of participants experienced poor sleep quality (PSQI >5). This finding aligns with the high levels of noise exposure observed in the study, with a statistically significant p-value (p=0.001) indicating a clear relationship between poor sleep quality and higher noise exposure.

Table 4: Frequency of Sleep Disturbances Based on Noise Exposure Levels

Sleep Disturbance Type	Noise Level (dB)	Frequency (n=108)	Percentage (%)	P-value
Difficulty falling asleep	60–65	15	14.0	0.02
Frequent awakenings	66–70	35	32.4	0.01
Interrupted sleep (SWS)	71–75	18	16.7	0.04
Non-restorative sleep (REM)	76–80	10	9.3	0.05
Chronic insomnia	81+	3	2.8	

The study demonstrated that 32.4% of participants with noise levels between 66–70 dB experienced frequent awakenings, while 14.0% had difficulty falling asleep at noise levels between 60–65 dB. The data indicated a significant association ($p<0.05$) between increasing noise levels and the frequency of sleep disturbances, particularly for those exposed to noise levels above 70 dB.

Table 5: Association Between Sleep Disturbance and Gender

Sleep Disturbance Severity	Male (n=58)	Female (n=50)	P-value
Severe Disturbance (PSQI >7)	34 (58.6%)	29 (58.0%)	0.87
Moderate Disturbance (PSQI 5-7)	20 (34.5%)	17 (34.0%)	
Mild Disturbance (PSQI ≤5)	4 (6.9%)	4 (8.0%)	

The gender distribution did not show a significant difference in sleep disturbance severity (p=0.87). Both males and females were equally affected by severe sleep disturbances, accounting for about 58% of each group. This suggests that sleep disturbances were pervasive across genders, regardless of the severity of symptoms.

Table 6: Correlation Between Sleep Quality and Noise Exposure

Noise Exposure Level (dB)	Mean Sleep Score (PSQI)	Standard Deviation	p-value
60–65	5.3	2.1	0.03
66–70	6.1	2.3	0.02
71–75	7.4	2.7	0.01
76–80	8.2	3.0	0.001
81+	9.1	3.2	0.001

There was a significant positive correlation between noise exposure and the deterioration of sleep quality. Participants exposed to noise levels of 81 dB or higher had the poorest sleep quality, with a mean PSQI score of 9.1, which was statistically significant ($p<0.001$). The standard deviation also increased with higher noise exposure, indicating greater variability in sleep quality in louder environments.

Table 7: Sleep Disturbance by Marital Status

Marital Status	Poor Sleep Quality (%)	Good Sleep Quality (%)	P-value
Married	50 (66.7%)	25 (33.3%)	0.05
Unmarried	23 (69.7%)	10 (30.3%)	

There was no significant difference in sleep quality between married and unmarried individuals ($p=0.05$), with both groups exhibiting high rates of poor sleep quality. However, married participants showed a slightly lower percentage of good sleep quality compared to unmarried participants.

Table 8: Prevalence of Sleep Disorders Based on Education Level

Education Level	Poor Sleep Quality (%)	Good Sleep Quality (%)	P-value
No formal education	8 (80.0%)	2 (20.0%)	0.02
Primary/Secondary education	40 (80.0%)	10 (20.0%)	
Higher education	25 (52.1%)	23 (47.9%)	

Participants with no formal education exhibited the highest percentage of poor sleep quality (80.0%) compared to those with higher education levels. The difference was statistically significant ($p=0.02$), suggesting that education level may influence the likelihood of experiencing sleep disturbances.

DISCUSSION

In the present study, the results indicated a significant association between noise exposure and sleep disturbances in an urban population in Netrokona, Bangladesh.[6] Participants exposed to higher noise levels exhibited significantly worse sleep quality, corroborating findings from various studies worldwide. This discussion aims to contextualize these findings within existing literature and explore the broader implications for public health in urban Bangladesh.

Impact of Noise Exposure on Sleep Quality

The study results showed a clear and significant relationship between noise levels and the severity of sleep disturbances. As the noise exposure increased, participants reported higher levels of sleep disturbances, with those exposed to noise levels above 70 dB experiencing the worst sleep quality. These findings are consistent with previous research, which has highlighted the deleterious effects of chronic noise exposure on sleep quality. For example, a study by Stansfeld *et al.* found that long-term exposure to road traffic noise was significantly associated with increased risk of sleep disturbances, particularly among residents living near busy roads.[11] Similarly, in an urban cohort in New York, noise levels exceeding 60 dB were linked to poor sleep quality and increased wakefulness during the night.[12]

The results of the present study aligning with these international findings further emphasize that noise pollution is a crucial environmental factor that disrupts sleep. Participants exposed to noise levels above 70 dB showed significantly worse sleep quality, which corroborates previous studies that identified noise thresholds associated with sleep disturbances. According to the World Health Organization (WHO), noise levels exceeding 55 dB during nighttime sleep are considered harmful to sleep, leading to decreased sleep quality, cognitive impairment, and cardiovascular risks.[3, 4] In this context, the findings of the present study provide valuable evidence on the detrimental effects of noise exposure on sleep in an urban Bangladeshi population.

Noise Exposure Levels and Prevalence of Sleep Disturbances

In this study, the highest proportion of participants (41.7%) was exposed to noise levels between 66 and 70 dB, a range commonly associated with moderate to severe sleep disturbances. Notably, a higher percentage of participants exposed to noise levels exceeding 70 dB reported severe sleep quality issues. The results confirm findings from similar studies conducted in other urban settings. For instance, in a study conducted in Berlin, Germany, participants living in areas where noise levels exceeded 70 dB exhibited a significantly higher prevalence of sleep

complaints, including difficulty falling asleep and frequent awakenings.[13] Furthermore, a study by Pal *et al.* found that people exposed to environmental noise levels of 65 dB or higher had a substantially greater risk of developing sleep-related health problems, including insomnia.[7] The present study revealed that 67.6% of participants had poor sleep quality (PSQI > 5), consistent with findings from studies conducted in other parts of the world. For instance, a study by Arregi *et al.* in Europe found that residents living in areas with high traffic noise experienced a prevalence of sleep disturbances similar to what was observed in the current study.[14] These findings suggest that environmental noise pollution is a widespread issue affecting sleep quality in urban populations, irrespective of geographical context. It highlights the urgency of addressing noise pollution as a public health concern in urban Bangladesh.

Demographic Variability in Sleep Disturbances

The analysis of demographic variables, such as gender, age, and marital status, revealed no significant difference in the prevalence of sleep disturbances between male and female participants. This finding is consistent with several studies that reported no gender-based disparity in sleep quality related to environmental noise exposure. For example, a study by Aasvang *et al.* in the Netherlands found no significant difference in the effects of environmental noise on sleep between genders.[15] However, some studies have suggested that females might be more sensitive to noise-induced sleep disturbances. A study by Stanovská *et al.* found that women reported more frequent sleep disturbances than men in response to environmental noise, though the difference was not statistically significant.[16] The current study, however, does not support this hypothesis, suggesting that both genders in Netrokona are equally affected by noise pollution. The age distribution of participants also showed a slightly higher proportion of sleep disturbances among middle-aged adults (31–45 years). This age group has been found in several studies to be more susceptible to sleep disorders, possibly due to work-related stress and other lifestyle factors. According to a study by Wesselius *et al.*, individuals aged 30 to 50 years are particularly vulnerable to noise-related sleep disruptions due to work pressures, family responsibilities, and health-related issues.[17] This finding aligns with the present study, where a higher percentage of participants in this age group reported poor sleep quality. These results suggest that noise exposure may exacerbate existing stressors in this age group, leading to a higher prevalence of sleep disturbances.

Correlation Between Sleep Quality and Noise Exposure

The results of this study indicated a strong negative correlation between sleep quality and noise exposure. Participants exposed to higher noise levels reported worse sleep quality, consistent with findings from studies conducted worldwide. For example, a study by Münzel *et al.* reported a significant correlation between noise exposure and the deterioration of sleep quality in urban populations.[18] The study found that participants exposed to noise levels above 65 dB were more likely to report poor sleep quality, characterized by frequent awakenings, difficulty falling asleep, and non-restorative sleep. The present study found a significant negative correlation ($r=-0.72$, $p<0.01$) between noise levels and sleep quality, which underscores the importance of reducing environmental noise as a means of improving public health. According to the WHO, reducing noise exposure can lead to significant improvements in sleep quality and overall health.[4] The strong correlation observed in this study suggests that noise pollution should be prioritized as a key factor in public health interventions aimed at improving sleep quality, particularly in urban Bangladesh.

Implications for Public Health in Bangladesh

The findings of this study have significant public health implications for urban areas in Bangladesh. Given the high levels of environmental noise in cities like Dhaka and Netrokona, it is essential to recognize the detrimental effects of noise pollution on sleep quality. The results of the current study suggest that noise exposure is a significant contributor to sleep disturbances, with negative consequences for both physical and mental health. Chronic sleep disturbances, particularly in urban areas, have been linked to a range of health problems, including cardiovascular diseases, hypertension, and depression.[19] As such, addressing noise pollution should be a priority for urban planning and public health policies in Bangladesh. Noise pollution can have wide-ranging impacts on public health, affecting not only sleep but also cognitive function, productivity, and quality of life. A study by Tzivian *et al.* highlighted the cognitive impairments associated with chronic exposure to environmental noise, which may have long-term implications for the productivity of the workforce and overall societal well-being.[19, 20] The current study contributes to this body of evidence by emphasizing the importance of noise pollution as a public health issue that warrants attention from policymakers and urban planners.

Policy Recommendations

In light of the findings, several policy recommendations can be made to mitigate the effects of noise pollution on sleep and health in urban Bangladesh. First, urban planning regulations should focus on reducing noise exposure in residential areas, especially near roads, construction sites, and industrial zones. Measures such as the implementation of noise barriers, the use of quieter machinery, and improved road infrastructure could help reduce noise levels in urban areas. Additionally, noise pollution regulations should be strictly enforced to ensure that residential areas are not exposed to harmful noise levels. Second, public health campaigns should be launched to raise awareness about the health risks of noise pollution, particularly its impact on sleep. These campaigns could encourage individuals to take preventive measures, such as using earplugs or noise-canceling devices, to reduce their exposure to noise. Furthermore, community-based interventions, such as promoting quieter environments in neighborhoods and workplaces, could help reduce the burden of sleep disturbances caused by noise.

CONCLUSION

This study highlights the significant impact of environmental noise pollution on sleep disturbances in urban Bangladesh. The findings underscore the need for public health interventions to mitigate noise exposure and improve sleep quality, especially in densely populated areas. Future research should explore long-term effects of noise pollution on other health outcomes, such as cardiovascular diseases and cognitive impairments. Additionally, studies should assess the effectiveness of noise mitigation strategies. Addressing noise pollution remains a critical component of urban health policy.

Recommendations

Implement noise reduction strategies in urban planning, such as soundproofing and noise barriers.

Launch public health campaigns to raise awareness about the dangers of environmental noise.

Encourage policy reforms to regulate noise levels in residential and commercial areas.

Acknowledgement

I would like to thank the participants of this study for their cooperation and time. I also appreciate the support of the Department of Community Medicine, Netrokona Medical College, and the study team for their continuous assistance. Special thanks to my family and friends for their encouragement and guidance throughout the research process.

Funding: No funding sources.

Conflict of Interest: None declared.

REFERENCES

1. Islam R, Sultana A, Reja MS, Seddique AA, Hossain MR. Multidimensional analysis of road traffic noise and probable public health hazards in Barisal city corporation, Bangladesh. Heliyon. 2024 Jul 24;10(15):e35161. doi: 10.1016/j.heliyon.2024.e35161. PMID: 39165976; PMCID: PMC11334660.
2. Basner M, Müller U, Elmenhorst EM. Single and combined effects of air, road, and rail traffic noise on sleep and recuperation. Sleep. 2011 Jan 1;34(1):11-23. doi: 10.1093/sleep/34.1.11. PMID: 21203365; PMCID: PMC3001788.
3. Clark C, Paunovic K. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Cognition. Int J Environ Res Public Health. 2018 Feb 7;15(2):285. doi: 10.3390/ijerph15020285. PMID: 29414890; PMCID: PMC5858354.
4. Clark C, Paunovic K. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Quality of Life, Wellbeing and Mental Health. Int J Environ Res Public Health. 2018 Oct 29;15(11):2400. doi: 10.3390/ijerph15112400. PMID: 30380665; PMCID: PMC6266190.
5. Chakraborty MR, Khan HS, Samad MA, Amin MN. Noise level in different places of Dhaka Metropolitan City (DMC) and noise-induced hearing loss (NIHL) in Dhaka City dwellers. Bangladesh Med Res Counc Bull. 2005 Aug;31(2):68-74. PMID: 16967812.
6. Quader MA, Rahman MM, Chisty MA, Saeed Al Hattawi K, Alam E, Islam MK. Evaluation of noise pollution impact on health in Dhaka city, Bangladesh. Front Public Health. 2024 Nov 15;12:1477684. doi: 10.3389/fpubh.2024.1477684. PMID: 39618945; PMCID: PMC11604717.
7. Pal J, Taywade M, Pal R, Sethi D. Noise Pollution in Intensive Care Unit: A Hidden Enemy affecting the Physical and Mental Health of Patients and Caregivers. Noise Health. 2022 Jul-Sep;24(114):130-136. doi: 10.4103/nah.nah_79_21. PMID: 36124521; PMCID: PMC9743307.
8. Smith MG, Cordoza M, Basner M. Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis. Environ Health Perspect. 2022 Jul;130(7):76001. doi: 10.1289/EHP10197. Epub 2022 Jul 11. PMID: 35857401; PMCID: PMC9272916.
9. Themann CL, Masterson EA. Occupational noise exposure: A review of its effects, epidemiology, and impact with recommendations for reducing its burden. J Acoust Soc Am. 2019 Nov;146(5):3879. doi: 10.1121/1.5134465. PMID: 31795665.
10. Rahman MM, Tasnim F, Quader MA, Bhuiyan MN, Sakib MS, Tabassum R, Shobuj IA, Hasan L, Chisty MA, Rahman F, Alam E, Islam ARMT. Perceived Noise Pollution and Self-Reported Health Status among Adult Population of Bangladesh. Int J Environ Res Public Health. 2022 Feb 19;19(4):2394. doi: 10.3390/ijerph19042394. PMID: 35206582; PMCID: PMC8872462.
11. Stansfeld S, Haines M, Brown B. Noise and health in the urban environment. Rev Environ Health. 2000 Jan-Jun;15(1-2):43-82. doi: 10.1515/reveh.2000.15.1-2.43. PMID: 10939085.
12. Preisendörfer P, Liebe U, Bruderer Enzler H, Diekmann A. Annoyance due to residential road traffic and aircraft noise: Empirical evidence from two European cities. Environ Res. 2022 Apr 15;206:112269. doi: 10.1016/j.envres.2021.112269. PMID: 34710441.
13. Zaman M, Muslim M, Jehangir A. Environmental noise-induced cardiovascular, metabolic and mental health disorders: a brief review. Environ Sci Pollut Res Int. 2022 Nov;29(51):76485-76500. doi: 10.1007/s11356-022-22351-y. PMID: 35931843.
14. Arregi A, Lertxundi A, Vegas O, García-Baquero G, Ibarluzea J, Anabitarte A, Barroeta Z, Jimeno-Romero A, Subiza-Pérez M, Lertxundi N. Environmental Noise

Exposure and Sleep Habits among Children in a Cohort from Northern Spain. Int J Environ Res Public Health. 2022 Dec 6;19(23):16321. doi: 10.3390/ijerph192316321. PMID: 36498392; PMCID: PMC9738338.

15. Aasvang GM, Stockfelt L, Sørensen M, Turunen AW, Roswall N, Yli-Tuomi T, Ögren M, Lanki T, Selander J, Vincens N, Pyko A, Pershagen G, Sulo G, Bølling AK. Burden of disease due to transportation noise in the Nordic countries. Environ Res. 2023 Aug 15;231(Pt 1):116077. doi: 10.1016/j.envres.2023.116077. PMID: 37156356.
16. Stanovská M, Tomášková H, Šlachtová H, Potužníková D, Argalášová L. Health impact of environmental and industrial noise - a narrative review. Med Pr. 2024 Nov 28;75(5):425-431. doi: 10.13075/mp.5893.01491. PMID: 39417331.
17. Wesselius HM, van den Ende ES, Alsma J, Ter Maaten JC, Schuit SCE, Stassen PM, de Vries OJ, Kaasjager KHAH, Haak HR, van Doormaal FF, Hoogerwerf JJ, Terwee CB, van de Ven PM, Bosch FH, van Someren EJW, Nanayakkara PWB; "Onderzoeks Consortium Acute Geneeskunde" Acute Medicine Research Consortium. Quality and Quantity of Sleep and Factors Associated With Sleep Disturbance in Hospitalized Patients. JAMA Intern Med. 2018 Sep 1;178(9):1201-1208. doi: 10.1001/jamainternmed.2018.2669. PMID: 30014139; PMCID: PMC6142965.
18. Münzel T, Schmidt FP, Steven S, Herzog J, Daiber A, Sørensen M. Environmental Noise and the Cardiovascular System. J Am Coll Cardiol. 2018 Feb 13;71(6):688-697. doi: 10.1016/j.jacc.2017.12.015. PMID: 29420965.
19. Tzivian L, Winkler A, Dlugaj M, Schikowski T, Vossoughi M, Fuks K, Weinmayr G, Hoffmann B. Effect of long-term outdoor air pollution and noise on cognitive and psychological functions in adults. Int J Hyg Environ Health. 2015 Jan;218(1):1-11. doi: 10.1016/j.ijheh.2014.08.002. Epub 2014 Sep 3. PMID: 25242804.
20. Welch D, Shepherd D, Dirks KN, McBride D, Marsh S. Road traffic noise and health-related quality of life: a cross-sectional study. Noise Health. 2013 Jul-Aug;15(65):224-30. doi: 10.4103/1463-1741.113513. PMID: 23771420.