

Association Between Residential Noise Pollution and Cardiovascular Disease

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ABSTRACT:

Background

Residential noise pollution is identified as a critical environmental factor with potential implications for cardiovascular health, driven by global urbanization and increased transportation activities. This review aims to address critical gaps in understanding the correlation between residential noise pollution and cardiovascular health by investigating existing evidence and highlighting the implications for public health. The objectives are outlined, focusing on the research question guiding the inquiry: how does chronic exposure to residential noise contribute to the development and progression of cardiovascular diseases?

Methods

PubMed and Google Scholar with specific search terms. Inclusion and exclusion criteria are established to ensure the relevance of the selected articles, focusing on clinical studies within the last five years that specifically address residential noise pollution and cardiovascular disease.

PubMed and Google Scholar were searched using the key terms: “Residential Noise Pollution”, “Cardiovascular Disease Risk”, “Traffic Noise”, and “CVD.” Inclusion criteria focused on clinical studies within the last five years that specifically address residential noise pollution and cardiovascular disease. Exclusion criteria was a study design of a systematic review or meta-analysis.

Results

Excessive noise is identified as a significant threat to mental, behavioral, and neurological well-being, contributing to global fatalities and the disease burden. The impact on heart health is highlighted, particularly among women facing high noise levels during both day and night. Prolonged exposure, especially in areas with louder road traffic noise, escalates cardiovascular risks, with aircraft noise above 45 dB emerging as an additional contributor.

Discussion

The key findings underscore a significant association between residential noise pollution and cardiovascular disease, emphasizing its multifaceted impact on overall health. The differential impact on men and women is highlighted, aligning with current literature, and emphasizing the global significance of noise as a health hazard. The unexpected decrease in risk among men during the day prompts exploration into potential protective factors or coping mechanisms.

Future applications may involve targeted interventions and public health campaigns to mitigate noise exposure, especially in vulnerable populations.

INTRODUCTION:

Significance of the Problem

Residential noise pollution has emerged as a critical environmental factor with potential implications for cardiovascular health. The growing urbanization and increased transportation activities worldwide have contributed to elevated levels of noise exposure in residential areas, prompting concerns about its impact on cardiovascular diseases (CVD) risk. Cardiovascular diseases, including stroke, myocardial infarction, and ischemic heart disease, represent significant contributors to global morbidity and mortality. The World Health Organization (WHO) states that CVD is the leading cause of mortality worldwide, accounting for approximately 17.9 million deaths annually [1]. As urbanization continues, understanding the intricate links between residential noise exposure and cardiovascular outcomes becomes crucial for developing effective preventive measures. Poor health outcomes associated with CVD, such as diminished quality of life, increased healthcare costs, and premature mortality emphasize the urgency of addressing the impact of residential noise pollution on public health. Despite growing awareness, existing data and scientific methodologies have proven insufficient in providing a clear correlation between residential noise and CVD outcomes.

Objectives

This literature review aims to investigate and synthesize existing evidence on the association between residential noise pollution and CVD, addressing critical gaps in understanding and highlighting the implications for public health. The overarching research question guiding this inquiry is: how does chronic exposure to residential noise contribute to the development and progression of cardiovascular diseases? It also aims to enhance the collective understanding of the implications of residential noise exposure to public health.

METHODS:

Search Strategy

The search engines used were PubMed and Google Scholar. The key search terms used were “Residential Noise Pollution”, “Cardiovascular Disease Risk”, “Traffic Noise”, and “CVD”.

Inclusion and Exclusion Criteria

The inclusion factors were if the article was a clinical study, written in the last 5 years (2018 - 2023), was about residential noise pollution and cardiovascular disease. All systematic reviews and meta-analyses were excluded.

RESULTS:

Excessive noise poses a significant threat to mental, behavioral, and neurological well-being, contributing to 3% of worldwide fatalities and comprising 10% of the global disease burden [2]. Particularly noteworthy is its impact on heart health, especially among women facing high noise levels during both day and night, showing an 8% higher risk of hospitalization for heart problems [2]. Further analysis reveals that women exposed to nighttime noise experienced a 0.5% higher risk, while daytime noise exhibited a 0.4% increase [2]. Intriguingly, during the day, men showed a non-statistically significant 6% decrease in risk [2].

Table 1: Risk Associations between Vehicular Traffic Noise Exposure and Cardiovascular Diseases

Noise Exposure Level	Mortality Risks	Hospitalization Risks
Medium-high and high levels	Excess risks for CVD (general pop.)	Increased risks for women (cerebrovascular, ischemic diseases)
High levels (women)	Excess risks for CVD	Increased risks for cerebrovascular, acute MI
High levels (men)	Decreased risks for certain conditions	Not specified

Drawing insights from the UK Biobank's extensive data involving over 370,000 participants, it was identified that residential road traffic noise exceeding 65 dB[A] was associated with subtle changes in blood pressure [3]. Notably, individuals not taking hypertension medication displayed a positive association between road traffic noise and self-reported hypertension, particularly in the 60-65 dB[A] range [3].

Table 2: Road Traffic Noise and Cardiovascular Disease Risk Factors in UK Biobank

Exposure Level (dB[A])	Change in Blood Pressure
>65	Slight changes
>65 (adjusted)	Significant associations
60-65	Positive association with self-reported hypertension (non-medicated individuals)

In Montreal, Canada, health data analysis from adults aged 45 and above unveiled a significant link between increased environmental noise levels and a heightened risk of ischemic stroke, with an 8% increase for every 10-decibel rise in the 24-hour equivalent noise level [4]. Additionally, there was an association found between higher levels of total environmental noise and increased myocardial infarction (MI) incidence, affecting 3.8% of the 1,065,414 individuals studied examining the entire adult population of Denmark from 1995 to 2017 [5,6].

Living in places with louder road traffic noise on one side of the building is associated with a higher risk of heart problems, including ischemic heart disease, heart attack, chest pain, and heart failure [6]. The risks escalate with a 10 dB higher noise level over a 10-year period [6]. Additionally, exposure to aircraft noise above 45 dB appears to increase the chances of heart attack and heart failure [6].

DISCUSSION:

The key findings of this research reveal a significant association between residential noise pollution and cardiovascular disease, underscoring the multifaceted impact of excessive noise on overall health. Notably, women exposed to high noise levels during both day and night exhibited an 8% higher risk of hospitalization for heart problems, with nighttime noise contributing to a 0.5% higher risk and daytime noise to a 0.4% increase [2]. Interestingly, men showed a non-statistically significant 6% decrease in risk during the day [2]. Moreover, the study, drawing insights from the UK Biobank and health data analysis in Montreal, Canada, supports the correlation between elevated noise levels and cardiovascular risks, including changes in blood pressure, self-reported hypertension, and an increased risk of ischemic stroke and myocardial infarction [5]. The risks further escalate with prolonged exposure, particularly in locations with louder road traffic noise, and aircraft noise above 45 dB emerges as an additional contributor [6].

It is evident that residential noise pollution constitutes a substantial risk factor for cardiovascular diseases, with the differential impact on men and women warranting further investigation. The results align with current literature, emphasizing the global significance of noise as a health

hazard. The unexpected decrease in risk among men during the day prompts exploration into potential protective factors or coping mechanisms. Future applications of this data may involve targeted interventions to mitigate noise exposure, especially in vulnerable populations. Understanding the nuances of noise-related health risks can inform public health policies aimed at minimizing these adverse effects and promoting cardiovascular well-being.

However, it is crucial to acknowledge certain limitations in this study. The observed gender differences and non-statistically significant findings among men during the day necessitate additional research to clarify the underlying mechanisms. Moreover, the study primarily relies on observational data, limiting the ability to establish causation definitively. Future studies could incorporate more extensive datasets, diverse populations, and experimental designs to enhance the robustness of our conclusions.

In light of these findings, implementing noise reduction strategies in residential areas, particularly those with high traffic density, and incorporating noise mitigation measures in urban planning is recommended. Public health campaigns to raise awareness about the cardiovascular risks associated with residential noise pollution, especially among women, could further contribute to preventive efforts. Additionally, targeted interventions addressing specific sources of noise, such as vehicular traffic and aircraft, may prove effective in reducing the burden of cardiovascular diseases linked to environmental noise exposure.

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