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Noise Pollution in Urban Transport: A Systematic Review of Health Impacts from Buses, Trains, and Motorcycles

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Abstract: Transportation noise pollution is a critical environmental and public health concern, particularly in urban areas where increasing traffic density contributes to elevated noise levels. Prolonged exposure to excessive transport noise has been associated with adverse health effects, including hearing impairment, sleep disturbances, increased stress levels, and an elevated risk of cardiovascular diseases. This systematic review examines noise pollution across various transport modes—including buses, cars, trucks, motorcycles, subways, and aircraft—and compares recorded noise levels to the World Health Organization (WHO) standard limits. The findings indicate that several transport modes exceed recommended thresholds, with motorcycles (88.9 dBA), heavy trucks (87.5 dBA), and auto-rickshaws (85.5 dBA) surpassing their respective limits of 85 dBA, 85 dBA, and 82 dBA. Among public transport options, buses exhibit an average noise level of 81.91 dBA, exceeding the standard of 80 dBA, while subways (79.8 dBA) and streetcars (71.5 dBA) remain within acceptable limits. The highest recorded noise level was for commercial passenger aircraft at 135.0 dBA, whereas the lowest was for bicycles at 69.65 dBA, remaining below the 70 dBA threshold. The most frequently reported sources of excessive noise in urban transport, including engine vibrations, exhaust systems, tire-road interactions, and sudden vehicle movements. Furthermore, this review evaluates various mitigation strategies, emphasizing the role of advancements in vehicle technology, infrastructure modifications, traffic management, and policy enforcement in reducing transportation noise. The adoption of electric and hybrid vehicles, noise-absorbing road surfaces, urban green spaces, and stricter noise regulations are identified as effective strategies; however, persistent high noise exposure suggests that current measures require more robust implementation and enforcement. By providing a comprehensive assessment of urban transportation noise levels and their health implications, this study highlights the necessity for enhanced noise regulation and mitigation efforts. Its findings offer valuable insights for policymakers, urban planners, and public health officials in developing evidence-based strategies to minimize noise pollution and its associated health risks. Given the increasing reliance on public and private transportation, addressing transport noise pollution is imperative to fostering healthier and more sustainable urban environments.

Keywords: *Environmental Noise, Noise-Induced Health Effects, Public Health, Traffic Noise Exposure, Transportation Noise.*

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I. INTRODUCTION

Urban noise pollution has become a major environmental and public health concern worldwide, particularly in densely populated cities where transportation systems play a crucial role in daily mobility. Among the key contributors to urban noise are buses, trains, and motorcycles, which generate significant sound levels due to engine operations, braking systems, and frequent horn usage (WHO, 2018). In major cities across the world, from New York to London, Tokyo to Mumbai, public transportation noise has been identified as a persistent problem affecting millions of commuters and residents. According to a study by Basner et al. (2014), the WHO has classified noise pollution as the second-largest environmental contributor to health problems, after air pollution, highlighting its critical impact on global public health. Despite this, transport noise pollution often remains underregulated and underestimated in urban development policies, leaving populations exposed to harmful noise levels daily.

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The effects of transport noise pollution extend beyond being a mere nuisance. Prolonged exposure to elevated noise levels has been linked to a range of health issues, including hearing impairment, increased stress levels, sleep disturbances, and a heightened risk of cardiovascular diseases. A study conducted by Brown & Müller (2019), noise levels exceeding 70 decibels (dB) for extended periods can result in permanent hearing damage, while even moderate noise exposure has been associated with chronic stress and physiological changes such as increased blood pressure and heart rate. In many global cities, daily commuters, roadside vendors, transport workers, and residents living near major roads and railways are among the most vulnerable, as they experience prolonged exposure to transport noise. Given the rapid expansion of urban areas and increasing reliance on public transportation, understanding the full scope of transport noise pollution and its health consequences is critical for developing effective noise mitigation policies (Smith et al., 2021).

Despite the well-documented risks, efforts to regulate and mitigate transport noise pollution remain inconsistent across different regions. According to a study by Goines & Hagler (2007), while some cities have implemented noise control measures such as sound barriers, vehicle noise regulations, and urban planning adjustments, their effectiveness varies based on factors such as population density, infrastructure, and government enforcement. In many developing nations, noise pollution regulations are either weak or poorly enforced, leading to widespread exposure and health risks. Without proper assessment and data-driven strategies, transport noise pollution will continue to be an overlooked but serious public health issue.

Given these concerns, this systematic review aims to assess the noise levels produced by buses, trains, and motorcycles by analyzing recorded decibel (dB) levels and identifying key noise sources such as engine operations, braking, and horn usage. It will also evaluate the health impacts of transport noise exposure on affected populations, including risks such as hearing loss, stress, and cardiovascular issues. Finally, it seeks to examine and assess the effectiveness of existing noise mitigation strategies implemented for urban transport systems. By synthesizing current research and data, this review aims to provide evidence-based insights that can guide policymakers, urban planners, and public health officials in addressing noise pollution and its associated health risks.

II. METHODOLOGY

This systematic review followed a structured approach to identify, screen, and analyze relevant studies on noise pollution in urban transport and its associated health effects. The research process was guided by the conceptual framework, ensuring a rigorous selection and evaluation of data.

A. Data Sources

This systematic review utilized a comprehensive search strategy to identify relevant studies on the health impacts of noise pollution from urban transport, specifically focusing on buses, trains, and motorcycles. We systematically searched electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar, to ensure the inclusion of peer-reviewed articles and relevant grey literature.

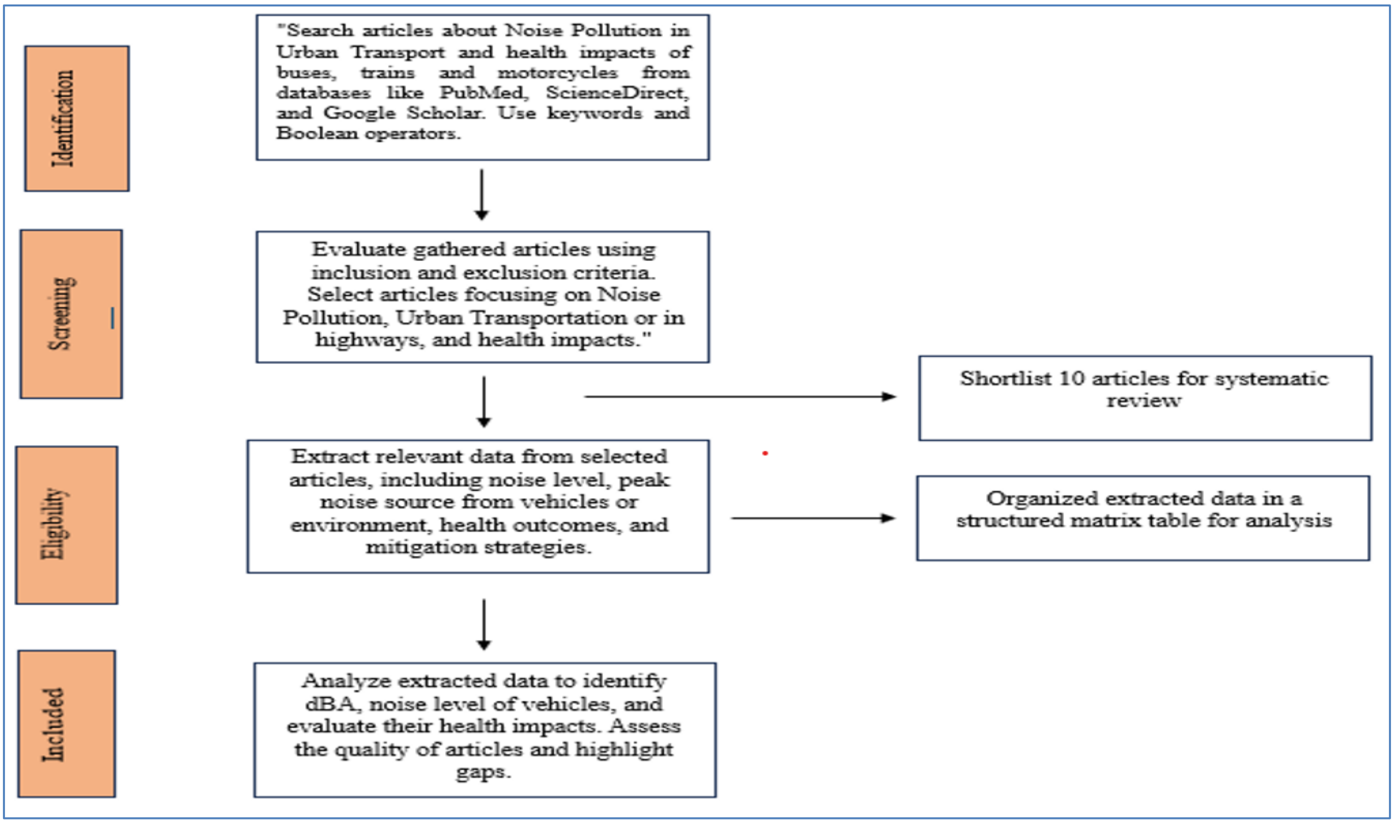

Fig 1 Framework of the Study using PRISMA Guidelines

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B. Literature Search

A comprehensive literature search was performed across multiple academic databases, including the National Institute of Health (NIH), ScienceDirect, ResearchGate, Acta Pharmaceutica Sciencia, De Gruyter, World Scientific Connect, and Google Scholar. The search strategy utilized specific keywords and Boolean operators (e.g., "urban transport noise" AND "health effects" OR "bus, train, motorcycle noise pollution") to maximize relevant findings. Studies published between 2014 and 2024 that examined noise pollution from urban transportation modes and their associated health impacts were considered.

C. Inclusion and Exclusion

The extracted data were analyzed to identify noise exposure levels, the specific transport modes contributing to noise pollution, and their associated health impacts. Studies were also assessed for methodological quality, highlighting research gaps and inconsistencies. Trends in mitigation strategies were examined to evaluate their effectiveness.

This methodology ensures a systematic and transparent process, enabling a comprehensive understanding of urban transport noise pollution.

D. Search Results

The gathered articles were assessed using predefined inclusion and exclusion criteria. Studies focusing on noise pollution in urban transportation settings and their effects on public health were selected. Articles that primarily discussed industrial noise, air pollution, or unrelated environmental stressors were excluded. At this stage, 10 relevant studies were shortlisted for systematic review.

E. Data Extraction

Relevant data from the selected studies were extracted systematically. Key information such as noise levels (dBA), primary noise sources (vehicles or environment), health outcomes (hearing loss, cardiovascular diseases, sleep disturbances, psychological stress), and mitigation strategies were collected. The extracted data were then organized into a structured matrix table for further analysis.

F. Statistical Analysis

The 10 studies were assessed by its comprehensive summary of noise levels, sources, health impacts, and mitigation strategies related to urban transport systems, as reported across various studies. These studies cover a range of geographical locations, including Iran, Canada, Greece, India, Turkey, Kenya, and the United States, and assess a diverse array of transport modes, such as buses, motorcycles, cars, trains, and bicycles. The noise levels, measured in decibels (dBA), vary by transport mode and region, with some studies identifying particularly high noise levels originating from engine operations, vibrations, and interactions between vehicles and road surfaces.

III. RESULTS AND DISCUSSION

A. Overview of Noise Pollution in Urban Transport

Noise pollution in urban transport has emerged as a significant environmental and public health concern, primarily due to the increasing volume of traffic and urbanization. The findings indicate that road transport, particularly from motor vehicles such as cars, buses, and motorcycles, is the dominant source of noise pollution in urban areas. Factors contributing to elevated noise levels include vehicle speed, engine type, road conditions, and traffic congestion. High noise levels in densely populated areas negatively impact residents by causing stress, sleep disturbances, and reduced productivity.

The health impacts associated with these noise exposures are considerable, encompassing hearing impairment, cardiovascular diseases, stress, sleep disturbances, cognitive decline, and various other physical and psychological effects. These health outcomes are frequently aggravated by prolonged or repeated exposure to elevated noise levels.

To mitigate the detrimental effects of transport-related noise, a variety of strategies have been proposed and implemented. These include infrastructure improvements, such as the installation of noise barriers and soundproofing measures; advancements in vehicle technology, including the adoption of electric or hybrid vehicles; traffic management techniques designed to alleviate peak-hour congestion; and urban planning initiatives that integrate green spaces and buffer zones. Furthermore, public awareness campaigns and regulatory frameworks are instrumental in reducing noise pollution and fostering healthier urban environments.

Table 1 consolidates the key findings from these studies, offering an overview of the noise levels, sources, associated health impacts, and proposed mitigation strategies across different locations and transport modes.

Table 1 Summary of Noise Levels, Sources, Health Impacts, and Mitigation Strategies in Urban Transport Studies

Study No. and Author	**Location**	**Vehicle**	**Noise Level (dBA)**	**Peak Noise Source**	**Analysis Testings**	**Health Impact**	**Mitigation Strategies**
Karimi, A., Nasiri, S., Kazerooni, F., & Oliaei, M. (2010).	Iran	Bus , Cars, Trucks, Auto-rickshaw	**Bus**: 84.5 dBA **Cars**: 76 dBA **Trucks**: 86.5 dBA **Auto-rickshaw**:	Engine and Vibrations	Pure Tone Audiometry (PTA)	Hearing Impairment Noise-Induced Hearing Loss (NIHL)	**Vehicle and Infrastructure Improvements** **Operational and Behavioral Measures** **Health and**

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			88.5 dBA				**Educational Intervention**
Yao, C. M., K, A., MA, Cushing, S. L., & Lin, V. Y. (2017).	Toronto, Canada	Subways, Streetcars, Buses, Car Bicycle	**Subway**: 79.8 dBA **Bus**: 78.1 dBA **Car**: 67.6 dBA **Bicycle**: 81.8 dBA	Vehicle velocity Traffic Condition Engine	Noise dosimetry	Noise-Induced Hearing Loss (NIHL) Stress Annoyance Discomfort, Sleep Disturbances Hypertension Heart attacks Strokes.	**Engineering and Infrastructure Improvements** **Vehicle Technology Enhancements Traffic & Urban Planning Solutions** **Public Awareness & Policy Implementation**
M Paviotti, K Vogiatzis (2012)	Athens, Greece	Scooter, Motorbikes and Car	**Scooter** - 73.5 dbA **Motorbikes** - 69.7 dbA **Cars** - 73.3 dbA	Engine Exhaust Systems	Sound level meter	Hearing Impairment Sleep Disturbances Cardiovascular Problems Hypertension Ischemic Heart Disease Increased Stress Levels Faster Cognitive Decline Reduced Memory Development	**Urban Planning, Policy Enforcement, and Public Awareness** **Integration of Noise Barriers and Green Spaces** **Traffic Management Measures** **Regular Vehicle Maintenance Public Awareness Campaigns**
Kamineni, A., Duda, S. K., Chowdary, V., & Prasad, C. (2019).	Andhra Pradesh and Telangana, India	Buses, Motorcycles, Scooters, Bicycles, Auto rickshaws, Small cars, Big cars,	**Buses**: 90 dBA **Motorcycles**: 95 dBA **Scooters**: 90 dBA **Bicycles**: 57.5 dBA **Auto Rickshaws**: 82.5 dBA **Small Cars**: 77.5 dBA	Tyre/road interaction noise Engine Vehicle Maneuvering	Sound Level Meter	Hearing Loss Cardiovascular Diseases Sleep Disturbances Stress Mental Health Issues Hypertension Increased Heart Rate Cognitive Impairment Increased Stress Levels Reduced Overall Well-being	**Traffic Management** **Infrastructure Improvements** **Technological Advancements** **Urban Planning** **Public Awareness Campaigns**

Yavuz, A., Hazar-Yavuz, A. N., & Hacıbektaşoğlu, S. E. (2024).	Turkey	Cars, Trucks, Motorcycles, Trains, Airplanes, Ships	**Cars**: 69 dBA **Heavy Trucks**: 87.5 dBA **High-Speed Trains**: >100 dBA **Commercial Passenger Aircraft**: 135 dBA **Ships**: 95 dBA	Engine Horn Use	Noise modeling and simulation Dosimeter	Hearing Loss Hypertension Heart Disease Cognitive Decline Stress-Related Hormonal Imbalances Digestive Disorders DNA Damage Vestibular Dysfunction in Animals Increased Heart Rate Cognitive Impairment Increased Stress Levels Reduced Overall Well-Being	**Quieter Vehicle Technologies** **Road Modifications** **Public Awareness Campaigns** **Urban Planning Strategies**
Supriya Kumari , Anjali Sharma and Ashok Kumar Ghosh (2024)	Kenya	Bus	Bus - 98.65 dbA	Engine	Noise descriptors Noise mapping and modeling	Annoyance Diminished Work Capacity Hearing Loss Insomnia Irritability Elevated Blood Pressure	**Infrastructure and Urban Planning** **Road and Traffic Management** **Vehicle Technology Advancements**
Yazhong Lu*, Lingguang Chen and Sean F. Wu	USA	Motorcycle	Motorcycle - 102 dbA	Engine	Passive sonic detection and ranging (SODAR)	Sleep Disturbance Annoyance Cardiovascular Effects Hypertension and Ischemic Heart Disease Blood Pressure Loud Noise Difficulty Speaking Discomfort Lack of Sleep Decreased Productivity ReducedCognitive Increased Risk of Cardiovascular Diseases	**Regulatory Frameworks** **Noise Assessment and Monitoring**
Adriana Lacerda, Angela Ribas, Jair Mendes, and Paulo Andrade	Brazil	Bus	Bus - 69.5 dBA.	Engine Combustion Noise	Sound pressure level (SPL) Survey-based perception	Irritability Headache Tinnitus Lack of Concentration	**Infrastructure Modifications** **Traffic Management**

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(2015)					analysis		**Vehicle and Driving Adjustments**
Betül Kasagici, Nuray Ates*	Turkey	Bus	Bus - 67 dBA.	Engine Propulsion Noise	Sound Level Meter	Headache Frustration Stress Sleep Disorder Mental Problems Hearing Impairment Social Behavior Disorders	**Building and Structural Modifications** **Regulatory Measures**
Supriya Kumari, Anjali Sharma and Ashok Kumar Ghosh (2023)	India	Bus	85.61 dBA.	Vehicle Maneuvering	Noise Descriptors and Survey	Headache Depression Nervousness Difficulty in Hearing Difficulty in Falling Asleep Fatigue Pain in the Ear Tinnitus	**Traffic and Passenger Management** **Vehicle Operation Guidelines** **Infrastructure and Noise Control Measures** **Technology Integration**

Table 1 presents an extensive compilation of transportation noise pollution studies conducted across various global locations, highlighted the recorded noise levels, primary noise sources, associated health impacts, and proposed mitigation strategy (Jaskowski et al., 2025). It provides a comparative perspective on how different transportation modes such as buses, trains, motorcycles, trucks, and airplanes contribute to urban noise pollution and how these levels vary geographically (Farooqi et al., 2020).

Findings reveal that noise levels in several transport modes frequently exceed recommended thresholds, with motorcycles in the USA reaching as high as 102 dBA and commercial passenger aircraft in Turkey exceeds 135 dBA. In India, bus noise levels were recorded at 85.61 dBA, while in Kenya, buses produced an exceptionally high 98.65 dBA (Ouas, 2011). These noise levels pose severe health risks, including noise-induced hearing loss (NIHL), cardiovascular diseases, cognitive decline, sleep disturbances, and increased stress levels. Additionally, the studies underscore the role of traffic conditions, engine vibrations, horn use, and tire-road interactions as primary noise contributors (Mehrotra et al., 2024).

Mitigation strategies focus on four key areas: technological advancements, urban planning, traffic management, and public awareness. Vehicle improvements, such as the adoption of electric and hybrid vehicles, the use of quieter braking systems, and regular maintenance, have been emphasized(Perkins et al., 2023). Infrastructure modifications, including the installation of noise barriers, soundproofed waiting areas, and noise-absorbing road surfaces, play a crucial role in reducing exposure (EU, 2022). Moreover, policy enforcement, such as stricter noise regulations and reduced vehicle operation during peak hours, is highlighted as an essential intervention. Public awareness campaigns aim to educate citizens on responsible horn use and the broader impact of transport noise on health and well-being (Philippines & Philippines, 2021).

Infrastructure modifications are also emphasized as critical strategies to reduce noise exposure. The installation of noise barriers, green buffer zones, and soundproof measures in high-traffic areas can significantly lower noise levels (Jacyna et al., 2017). Several studies highlight the effectiveness of noise-absorbing road surfaces and low-noise pavements that mitigates sound pollution, particularly in areas where vehicular traffic is heavy (Ejsmont et al., 2016 ; Dev, 2025). Urban planning strategies, such as integrating noise reduction measures into city development plans, further enhance long-term noise management efforts (Zhang, Y., Wang, J., & Li, X. 2023). However, these measures often require policy-driven initiatives and multi-sector collaboration to be successfully implemented.

Traffic management strategies focus on regulating vehicle flow and reducing congestion-related noise pollution. Speed control policies, restrictions on heavy vehicles in residential areas, and optimized traffic flow planning are commonly proposed interventions (Eisaeia, Maridpour, and Tay, 2017 ; Penny, 2023). Additionally, designated noise-reduced zones and regulations to minimize excessive horn usage can contribute to lower noise levels in urban environments. Enforcing these measures requires

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government commitment, proper monitoring, and collaboration with local authorities to ensure adherence to noise control policies (Brown 2024 ; Api 2024).

Public awareness campaigns and regulatory frameworks also play a crucial role in transport noise reduction. Several studies highlight the importance of educating the public on responsible horn use, the health risks of prolonged noise exposure, and the benefits of quieter transport alternatives. (Aletta et al., 2016 ; Eichwald & Scinicariello, 2020). Governments and policymakers are urged to enforce stricter noise regulations, implement noise assessment and monitoring programs, and provide incentives for the adoption of low-noise transport solutions (Respicio, 2024). Strengthening legal frameworks and increasing penalties for excessive noise pollution can serve as deterrents to non-compliance and drive long-term behavioral change (APHA, 2021).

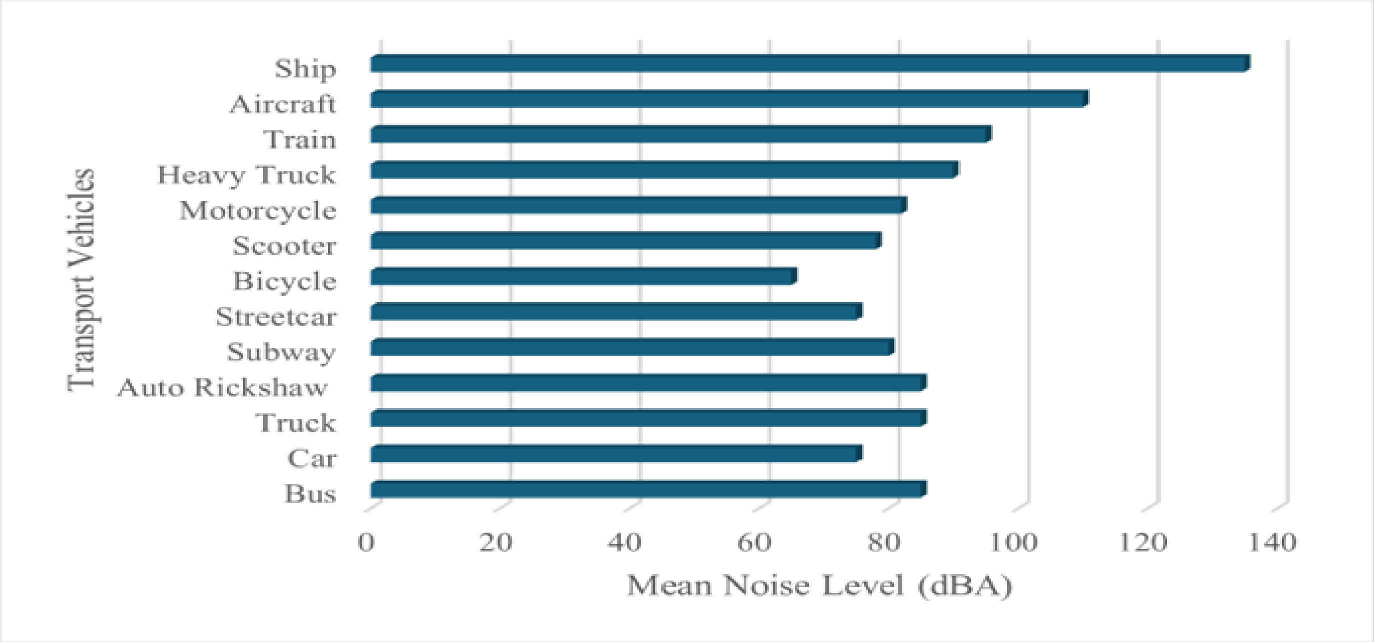

Fig 2 Mean Noise Levels of Different Vehicles

B. Recorded Mean Noise Level of Vehicles

The data presented in Figure 2 illustrates the mean noise levels (dBA) associated with various transport vehicle categories, and provides valuable insights into the relative contributions of different modes of transportation to urban noise pollution. Several key observations can be drawn from this graph, which are important for understanding the environmental and health implications of transport-related noise (Babisch et al., 2014).

Commercial aircraft emerge as the primary contributors to high noise levels, with noise measurements reaching approximately 130 dBA (FDA, 2019). This finding is consistent with prior research, which identifies aircraft noise as one of the most significant sources of environmental noise pollution, particularly due to the high engine power and speed involved during takeoff and landing (Miedema & Oudshoorn, 2001). The impact of such noise extends to both individuals living near airports and passengers within the aircraft, resulting in substantial disturbances and potential health risks.

In comparison, road-based vehicles, includes buses and cars generate lower noise levels, typically range from 80 to 90 dBA. These levels, while lower than those of aircraft, still exceed the threshold of 70 dBA, which has been linked to increased risks of cardiovascular diseases and other adverse health effects from prolonged exposure (Stansfeld & Matheson, 2003). Heavy trucks, motorcycles, and high-speed trains also contribute significantly to noise pollution in urban areas, highlighting the need for effective noise reduction strategies in these transport categories (Garg, N., & Maji, S. 2014).

On the other hand, modes such as bicycles and streetcars produce relatively minimal noise, with average levels falling around 60 dBA or lower (WHO 2018). This is indicative of the much lower environmental impact of these transport options in terms of noise pollution. The quieter operation of bicycles, in particular, is well-documented as an environmentally sustainable and noise-reducing mode of transport, offering clear benefits for urban health and well-being (Gidlöf-Gunnarsson & Öhrström, 2007).

The data presented in this figure 2 underscores the significant variation in noise emissions across different transport modes, highlighting the need for targeted interventions to mitigate the negative health impacts associated with high-noise vehicles (Barros, Kampen, and Vuye, 2024 ; Eren et al., 2024). Strategies such as the adoption of electric vehicles, improvements in rail technology to reduce engine noise, and urban planning initiatives that promote quieter modes of transport are essential to addressing the public health concerns raised by elevated noise levels in urban environments (Niu et al., 2019).

Table 2 Comparison of Recorded Noise Levels with WHO Standard Limits for Various Transportation Modes

Transportation Type	Location	Noise Level (dBA)	WHO Standard Limit (dBA)	Within Limits?
Bus	Iran	84.5	80	Exceeds
	Canada	78.1		Within Limit
	India	90		Exceeds
	Kenya	98.65		Exceeds
	Brazil	69.5		Within Limit
	Turkey	67		Within Limit
Cars	Iran	76	74	Within Limit
	Canada	67.6		Within Limit
	Greece	73.3		Within Limit
	India	77.5		Exceeds
	Turkey	69		Within Limit
Truck	Iran	86.5	85	Exceeds
	Turkey	87.5		Exceeds
Auto-rickshaws	Iran	88.5	82	Exceeds
	India	82.5		Exceeds
Train	Canada	79.8	80	Within Limit
	Turkey	100		Exceeds
Motorbikes	Greece	69.7	85	Within Limit
	India	95		Exceeds
Scooter	Greece	73.5	77	Within Limit
	India	90		Exceeds
Ships	Turkey	95	90	Exceeds

C. Recorded Noise Levels Compared to WHO Standard Limits

The data presented in Table 2 compares the noise levels of various transportation types across different countries, evaluating their compliance with the World Health Organization (WHO) standard limits. The findings highlight that buses, trucks, auto-rickshaws, trains, motorcycles, scooters, and ships frequently exceed the recommended noise levels that contribute to heightened urban noise pollution (Wrótny & Bohatkiewicz, 2021). Notably, buses in Iran (84.5 dBA), India (90 dBA), and Kenya (98.65 dBA) exceed the WHO limit of 80 dBA, pose significant risks of noise-induced health impacts. However, some locations, such as Canada (78.1 dBA), Brazil (69.5 dBA), and Turkey (67 dBA), report bus noise levels within acceptable limits, reflecting variations in vehicle regulation, road conditions, and enforcement of noise policies (Jameel, 2024 ; Nyaranga et al., 2018).

For cars, most locations remain within the WHO noise limit of 74 dBA, except for India (77.5 dBA), indicating that personal vehicles contribute less to excessive noise pollution than larger transport modes (Manar et al., 2024). Similarly, trains in Canada (79.8 dBA) meet the threshold, but those in Turkey (100 dBA) significantly exceed the limit, emphasizing the need for stricter railway noise control measures (Paiva et al., 2019). Heavy vehicles like trucks and

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auto-rickshaws consistently exceed noise standards, particularly in Iran (86.5 dBA for trucks, 88.5 dBA for auto-rickshaws) and Turkey (87.5 dBA for trucks).Motorbikes and scooters show mixed results, while motorbikes in Greece (69.7 dBA) and scooters in Greece (73.5 dBA) comply with noise limits, those in India (95 dBA for motorbikes and 90 dBA for scooters) exceed WHO guidelines, indicating regional differences in vehicle models, maintenance, and regulatory enforcement (Parsipour 2011 ; Gökdag 2012). Additionally, ships in Turkey (95 dBA) surpass the WHO standard of 90 dBA, demonstrating that maritime transport is also a significant noise source (IMO, 2014).

These findings underscore the urgent need for enhanced noise mitigation strategies, particularly for public transport, heavy vehicles, and high-speed transport systems. Implementing quieter vehicle technologies, stricter noise regulations, and improved infrastructure, such as noise barriers and urban zoning policies, could significantly reduce noise pollution and its associated health risks (Harris, 2024). The data also emphasize the importance of localized noise control measures, as compliance varies widely across countries.

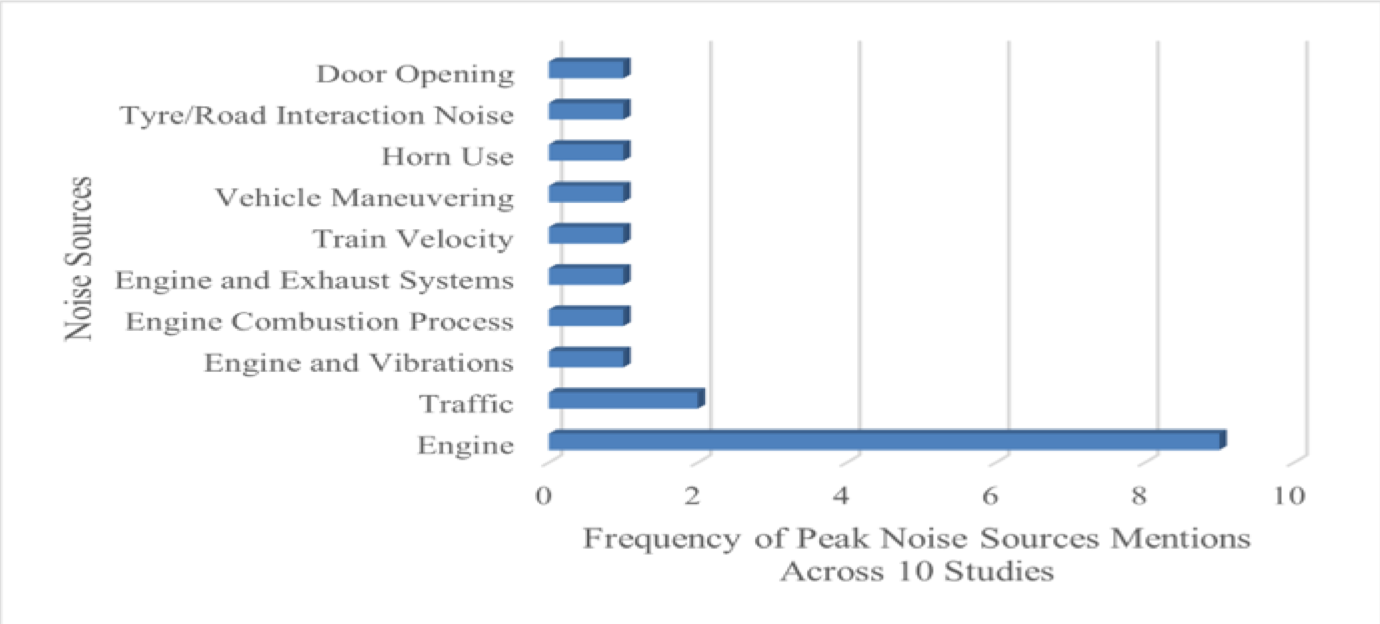

Fig 3 Peak Noise Source

D. Peak Noise Sources

Figure 3 highlights engine noise as the most frequently engine noise as the most frequently cited source of noise pollution. The compiled data from multiple studies reveal that engine noise is identified as a primary noise source in at least nine instances, making it the most dominant factor in urban noise pollution. This is consistent with findings from Karimi et al. (2010) and Yao et al. (2017), who highlighted that internal combustion engines, particularly those in heavy-duty vehicles such as buses, trucks, and motorcycles, generate high decibel levels due to engine vibrations, combustion processes, and propulsion mechanisms.

Another critical contributor to urban noise pollution is traffic conditions (merged with heavy traffic), which frequently interacts with other noise sources such as engine operations, vehicle maneuvering, and road infrastructure. Traffic congestion intensifies noise pollution as vehicles operate inefficiently, leading to frequent acceleration, braking, and honking (Paviotti & Vogiatzis, 2012).

Studies have shown that road traffic noise can lead to increased stress levels, sleep disturbances, cardiovascular diseases, and cognitive impairments (Kamineni et al., 2019). This aligns with previous research highlighting the link between prolonged exposure to traffic noise and long-term health impacts, including hypertension and an increased risk of heart disease (Yavuz et al., 2024).

Apart from engine noise and traffic-related disturbances, engine vibrations and combustion processes also rank high among peak noise sources. These sources contribute significantly to the overall noise exposure in urban transport environments, particularly in cases where vehicle maintenance is inadequate. Older or poorly maintained vehicles tend to produce more noise due to inefficient fuel combustion and excessive mechanical friction, further worsening urban noise levels (Kumari et al., 2024).

Interestingly, horn use, vehicle maneuvering, and tyre/road interaction noise are also identified as contributors, albeit in fewer studies. Horn use, while not as frequently reported as engine noise, remains a persistent issue in urban settings, particularly in countries where excessive honking is common due to poor traffic discipline (Kumari et al., 2023). Research has shown that prolonged exposure to horn noise can lead to mental fatigue, heightened stress levels, and even auditory damage over time (Lacerda et al., 2015). Similarly, tyre and road interaction noise is especially relevant for high-speed vehicles and heavy trucks, where friction between tyres and road surfaces generates significant levels of noise pollution (Kasagici & Ates, 2023).

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Another notable observation is the presence of lesser noise contributors such as door opening, which was mentioned in at least one study. Although minor, it suggests that even small mechanical actions within vehicles can contribute to the overall noise environment, particularly in transport hubs such as bus terminals and train stations (Lacerda et al., 2015)

E. Health Impacts

The analysis of noise pollution's health impacts highlights a range of adverse effects, with hypertension, hearing impairment, and stress-related disorders being the most frequently cited concerns. As shown in Figure 4, hypertension appears in nearly all reviewed studies, suggests a strong link between chronic noise exposure and cardiovascular diseases (De Souza et al., 2015 ; Dutchen, 2025). Transportation noise, particularly from road and rail traffic, triggers physiological stress responses, leading to elevated blood pressure and an increased risk of heart disease and strokes (Münzel et al., 2021).

Hearing impairment, includes Noise-Induced Hearing Loss (NIHL), is another major health effect caused by prolonged exposure to high noise levels (CDC, 2024). Transport workers, drivers, and individuals living near high-traffic zones are particularly vulnerable, as continuous exposure damages inner ear cells, leading to permanent auditory loss (Basner et al., 2014). Additionally, noise-related discomfort, cognitive impairment, and increased heart rates suggest that noise pollution affects both physiological and psychological health (Millar, 2020)

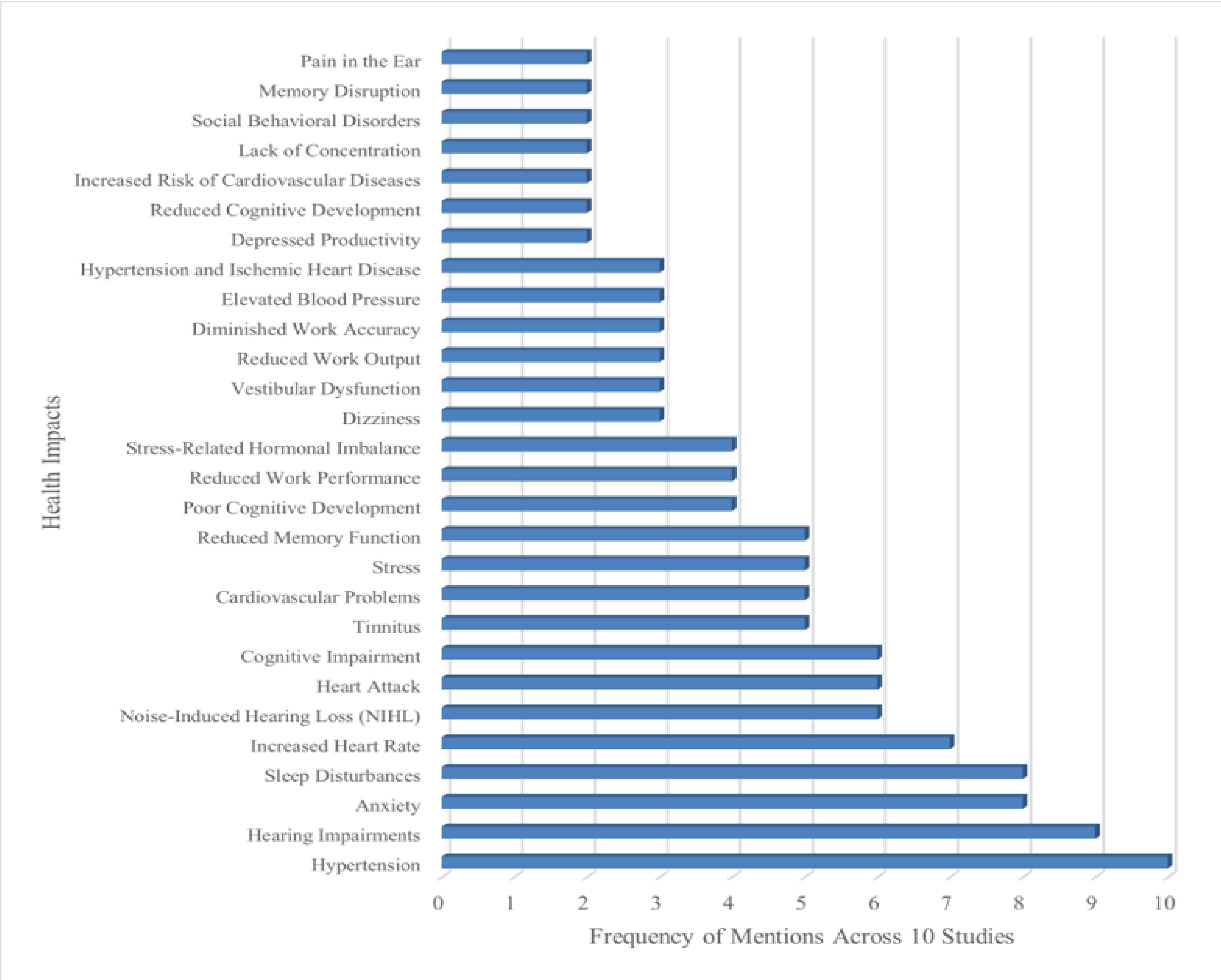

Fig 4 Frequency of Health Impacts Associated with Noise Pollution from Urban Transport Mode

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Stress and sleep disturbances are also common consequences of noise pollution. Chronic exposure to environmental noise leads to heightened secretion of stress hormones such as cortisol and adrenaline, increasing the risk of anxiety, mood disorders, and cardiovascular diseases (Babisch, 2014). Sleep disruptions due to traffic noise contribute to fatigue, reduced cognitive performance, and long-term health risks such as weakened immune function and metabolic disorders (Liu et al., 2020).

Cognitive impairments, including reduced concentration and slower learning, are particularly concerning for children in high-noise environments, leading to lower academic performance (Clark & Paunovic, 2018).

Additionally, workplace productivity suffers due to noise-related distractions, impacting efficiency and work performance.

The broad health consequences of noise pollution underscore the need for effective mitigation strategies, including stricter noise regulations, improved urban planning, and noise-reducing infrastructure such as sound barriers and low-noise road surfaces (Ranpise, 2023 ; Eren et al., 2024). Raising public awareness and encouraging protective measures, such as noise-canceling devices, can help reduce long-term health risks. Addressing noise pollution requires a multi-faceted approach that prioritizes public health and sustainable urban development (WHO, 2018 ; EEA, 2020).

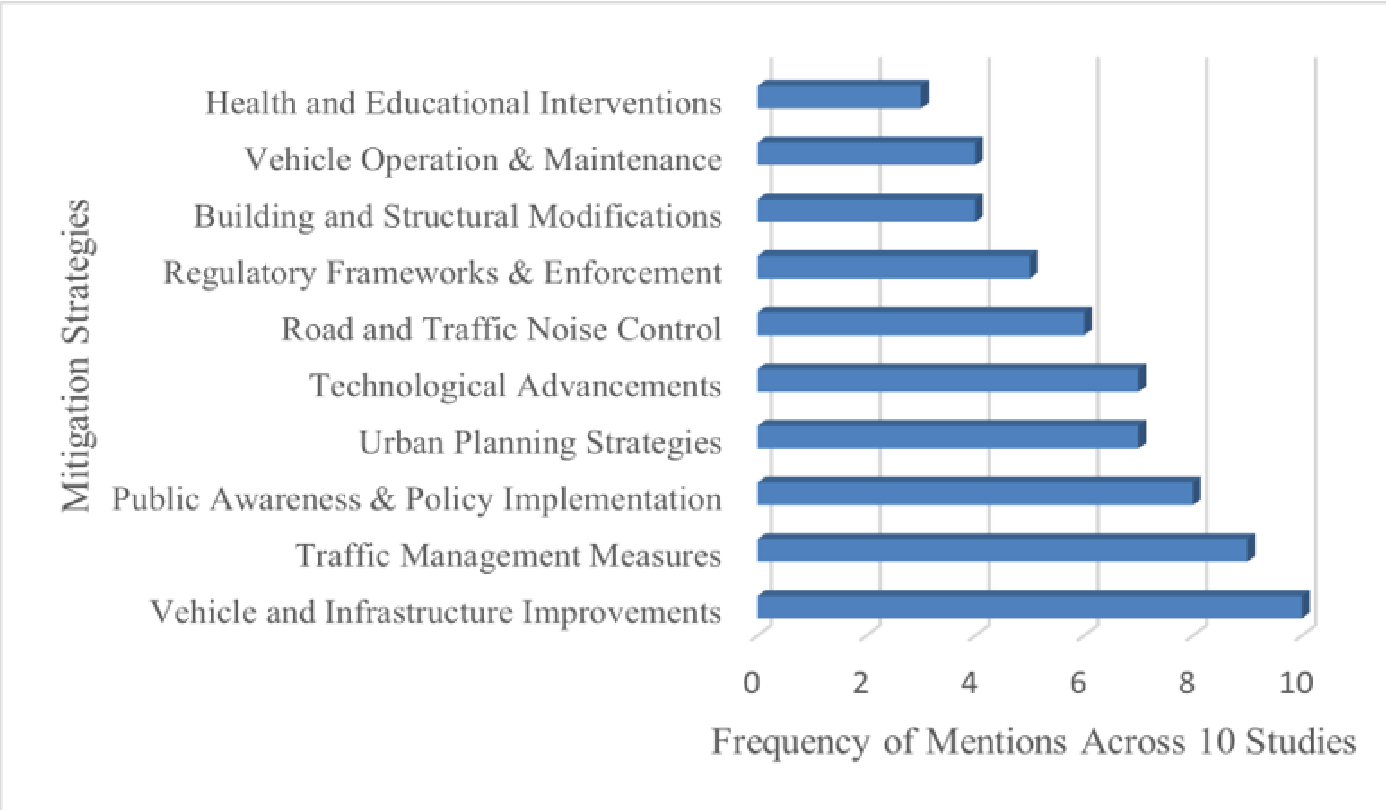

Fig 5 Mitigation Strategies for Noise Pollution in Urban Transport: Frequency of Interventions Across Studies

F. Mitigation Strategies

Figure 5 highlights various strategies to mitigate transport noise pollution, with vehicle and infrastructure improvements being the most commonly cited. Measures such as noise insulation, road maintenance, quieter surfaces, and noise barriers effectively reduce noise at its source and limit its propagation (Murphy & King, 2014). These interventions, when consistently implemented, play a crucial role in minimizing overall noise levels in urban areas.

Traffic management strategies, includes speed regulations, optimized traffic flow, and vehicle restrictions in noise-sensitive areas, also significantly contribute to noise reduction (Rey-Gozalo et al. 2022). Studies show that reducing vehicle speeds and improving road designs can lower noise levels by minimizing abrupt acceleration and braking, two major sources of excessive transport noise (Ouis, 2001 ; Campolieti and Bertoni 2009). Integrating intelligent transportation systems can further optimize traffic movement, reducing congestion-related noise (Brown & Muhar, 2004).

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Policy implementation and public awareness are equally essential in sustaining noise reduction efforts. Regulatory frameworks, noise ordinances, and incentives for low-noise technologies ensure long-term compliance, while public campaigns encourage responsible behavior, such as limiting honking and adopting quieter transport options (WHO, 2018). Additionally, urban planning strategies, including noise buffer zones and green spaces, contribute to noise control while providing environmental benefits like improved air quality and urban cooling (Van Renterghem & Botteldooren, 2012).

Technological advancements, such as the adoption of electric vehicles (EVs) and low-noise road materials, present promising long-term solutions. EVs and hybrid vehicles significantly reduce transport noise emissions, particularly in urban settings where low-speed traffic dominates (Keller et al., 2020). Infrastructure innovations like porous asphalt and advanced railway track designs have also proven effective in minimizing noise pollution in high-density areas (Licitra et al., 2016).

Other crucial strategies include building modifications and proper vehicle maintenance. Noise-reducing architectural designs, such as double-glazed windows and enhanced insulation, provide additional protection in urban environments (Stansfeld & Matheson, 2003). Ensuring regular vehicle maintenance further reduces noise emissions caused by engine vibrations and deteriorated exhaust systems (Miedema & Oudshoorn, 2001). An integrated approach combining engineering, policy, technology, and public engagement is essential to achieving sustainable noise reduction and fostering healthier urban environments (EEA, 2020)

IV. CONCLUSION

This systematic review highlights the profound impact of transportation noise on public health and urban environments. Many transport modes, including buses, motorcycles, and aircraft, frequently exceed. WHO recommended noise limits, leading to serious health issues such as noise-induced hearing loss (NIHL), cardiovascular diseases, cognitive impairments, and sleep disturbances. Noise pollution also negatively affects mental health, productivity, and children's cognitive development, particularly in densely populated urban areas.

Furthermore, transport noise pollution requires a multi-faceted approach, including technological advancements, infrastructure improvements, policy enforcement, and public awareness initiatives. Strategies such as electric and hybrid vehicle adoption, noise-absorbing tires, and quieter braking systems have shown promise in reducing transport-related noise. Infrastructure solutions like noise barriers, green buffer zones, and low-noise pavements, along with urban planning strategies that prioritize noise-conscious development, can significantly mitigate exposure.. Additionally, regulatory enforcement, optimized traffic flow, and incentives for quieter transport options are critical for sustainable noise reduction.

Despite existing regulations, stronger enforcement and further technological innovations are needed to effectively control noise pollution. Gaps in regulation and limited public awareness continue to contribute to excessive noise exposure, particularly in urban centers. A proactive, interdisciplinary approach involving policymakers, urban planners, transport authorities, and the public is essential for creating quieter, healthier, and more sustainable urban environments. Future research should focus on long-term health impacts, assess the effectiveness of mitigation strategies, and integrate noise reduction measures into broader urban development and public health policies.

REFERENCES

[1]. Babisch, W. (2008). Road traffic noise and cardiovascular risk. *Noise and Health*, *10*(38), 27–33. https://doi.org/10.4103/1463-1741.39005

[2]. Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S. A., & Stansfeld, S. A. (2014). Auditory and non-auditory effects of noise on health. *The Lancet*, *383*(9925), 1325–1332. https://doi.org/10.1016/S0140-6736(13)61613-X

[3]. European Environment Agency. (2020). *Environmental noise in Europe – 2020*. Publications Office of the European Union. https://www.eea.europa.eu/publications/environmental-noise-in-europe

[4]. European Parliament and Council. (2002). *Directive 2002/49/EC relating to the assessment and management of environmental noise*. *Official Journal of the European Communities*.

[5]. Guski, R., Schreckenberg, D., & Schuemer, R. (2017). WHO environmental noise guidelines for the European region: A systematic review on environmental noise and annoyance. *International Journal of Environmental Research and Public Health*, *14*(12), 1539. https://doi.org/10.3390/ijerph14121539

[6]. International Organization for Standardization. (2016). *ISO 1996-1:2016 Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures*. ISO. https://www.iso.org/standard/59765.html

[7]. Kamineni, A., Duda, S. K., Chowdary, V., & Prasad, C. (2019). Modelling of noise pollution due to heterogeneous highway traffic in India. *Transport and Telecommunication Journal*, *20*(1), 22–39. https://doi.org/10.2478/ttj-2019-0003

[8]. Karimi, A., Nasiri, S., Kazerooni, F., & Oliaei, M. (2010). Noise-induced hearing loss risk assessment in truck drivers. *Noise and Health*, *12*(46), 49. https://doi.org/10.4103/1463-1741.59999

[9]. Kasagıcı, B., & Ates, N. (2021). Evaluation of environmental noise pollution (Traffic, schools, hospitals) and noise perception. *Energy Environment & Storage*, *1*(2). https://doi.org/10.52924/ywkd5166

[10]. Kumari, S., Sharma, A., & Ghosh, A. K. (2023). Noise pollution and associated health impacts at Ganeshpeth Bus Terminus in Nagpur, India. *Noise Mapping*, *10*(1). https://doi.org/10.1515/noise-2022-0168

[11]. Lacerda, A., Ribas, A., Mendes, J., & Andrade, P. (2004, December 1). Noise level and its perception by commuters in urban buses of Curitiba. *Journal of the Canadian Acoustical Association*. https://jcaa.caa-aca.ca/index.php/jcaa/article/view/1706
[12]. Lu, Y., Chen, L., Wu, S. F., Hu, J., & Li, H. (2022). Analyzing motorcycle low-frequency noise. *Journal of Theoretical and Computational Acoustics, 30*(2). https://doi.org/10.1142/s2591728522500050
[13]. Paviotti, M., & Vogiatzis, K. (2012). On the outdoor annoyance from scooter and motorbike noise in the urban environment. *Science of the Total Environment*. https://www.sciencedirect.com/science/article/pii/S0048969712006560
[14]. Schwela, D., & Zali, O. (1999). *Urban traffic pollution*. Spon Press.
[15]. Sørensen, M., & Poulsen, A. H. (2021). Transportation noise and health. In S. Dzhambov & D. Dimitrova (Eds.), *Noise and public health* (pp. 73-95). Elsevier.
[16]. Supriya Kumari, S., Sharma, A., & Ghosh, A. K. (2024). *Noise pollution and its impact on human health*. De Gruyter. https://www.degruyter.com/document/doi/10.1515/noise-2022-0180/html
[17]. World Health Organization. (1999). *Guidelines for community noise*. WHO. https://apps.who.int/iris/handle/10665/66217
[18]. World Health Organization. (2018). *Environmental noise guidelines for the European region*. WHO Regional Office for Europe. https://www.who.int/europe/publications/i/item/9789289053563
[19]. World Health Organization. (2021). *Noise and health impacts: WHO findings and recommendations*. WHO.
[20]. Yang, W., & Kang, J. (2005). Soundscape and sound preferences in urban squares: A case study in Sheffield. *Journal of Urban Design*, *10*(1), 61–80.
[21]. Yao, C. M., Cushing, S. L., & Lin, V. Y. (2017). Noise exposure while commuting in Toronto - A study of personal and public transportation. *Journal of Otolaryngology - Head and Neck Surgery, 46*(1). https://doi.org/10.1186/s40463-017-0239-6
[22]. Yavuz, A., Hazar-Yavuz, A. N., & Hacıbektaşoğlu, S. E. (2024). Vehicle noise pollution awareness for human health and environmental impacts: A comprehensive review. *Acta Pharmaceutica Sciencia, 62*(2), 244-266. https://www.actapharmsci.com/pdf.php?id=869
[23]. Respicio, H. (2024b, April 12). *Noise pollution Philippines*. RESPICIO & CO. https://www.respicio.ph/commentaries/noise-pollution-philippines?