EFFECTS OF OCCUPATIONAL NOISE ON HEARING OF PUBLIC TRANSPORT DRIVERS IN BAHAWALPUR

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Abstract: Introduction: Occupational noise exposure remains a significant concern for public transport drivers, given their sustained exposure to vehicular and urban noise. This study conducted at Bahawalpur Medical and Dental College aimed to investigate the impact of such noise exposure on the hearing capabilities of public transport drivers in Bahawalpur. Method: A total of 45 drivers, aged between 20 and 60 years, were enrolled, with a focus on those driving 3 to 9 hours per day. Data collection included comprehensive questionnaires, otoscopy examinations, and pure tone audiometry assessments. Result: The results revealed a diverse range of auditory outcomes, with a majority of subjects within the 20-40 age groups. Conductive hearing loss (CHL) emerged as the predominant type of hearing impairment, raising concerns about the potential effects of repeated noise exposure on conductive pathways. Notably, a correlation between hours of noise exposure and the degree of hearing loss was observed. Conclusion: These findings underscore the urgent need for tailored interventions and awareness campaigns to safeguard the auditory health of public transport drivers, mitigating the impact of occupational noise exposure. While limitations in sample size and localization exist, this study contributes valuable insights and prompts the exploration of future research directions to protect the auditory well-being of this essential workforce.

Keyword: occupational noise, hearing loss, public transport drivers, conductive hearing loss, noise exposure, auditory health, audiometry, intervention, awareness campaigns

I. INTRODUCTION

In the bustling urban structure of Bahawalpur, where the symphony of life is orchestrated by the movements of public transportation, an often-unheard challenge arises—one that profoundly affects the men and women who navigate these vehicular arteries[1]. Amidst the cacophony of honks, engines, and conversations, public transport drivers forge their routes, becoming unconscious participants in a silent struggle against a relentless adversary: occupational noise[2]. This article embarks on a crucial exploration into the intricate relationship between occupational noise and the auditory well-being of Bahawalpur's public transport drivers. Through the lens of medical insight, we explore deep into the hidden repercussions of continuous exposure to noise, unearthing the intricacies where sound waves meet the human auditory system[2,3].

The anatomy of the ear, with its external, middle, and inner components, becomes the battleground for this inaudible war[4]. The pinna, an exterior structure composed of resilient cartilage, captures sound and funnels it through the auditory canal to the eardrum[4,5]. Here, the delicate membrane sets in motion the tiny bones of the middle ear, transmuting sound vibrations into auditory signals that journey onward to the spiral-shaped cochlea[5]. This inner sanctum of the ear metamorphoses sound into nerve impulses, a sensory symphony that reaches the brain. Amidst this harmony, the fluid-filled semicircular canals maintain equilibrium, while the Eustachian tube drains the middle ear[6].

The ear, comprising the external, middle, and inner portions, plays host to this saga. The pinna, a cartilage-covered external ear, funnels sound into the auditory canal, ultimately reaching the eardrum[6]. This delicate membrane, when set into motion by sound, prompts the middle ear's bones to vibrate, passing the rhythm to the inner ear's cochlea[7]. A spiral of remarkable complexity, the cochlea transforms sound into nerve impulses, paving the way for auditory sensation. Adjacent to the cochlea, the labyrinthine semicircular canals contribute to balance and head positioning, while the Eustachian tube ensures fluid drainage from the middle ear[7,8].

Yet, amidst this intricate harmony, noise takes center stage. Described as unwanted sound, noise's distinction from sound is subjective, often determined by context. In environments teeming with noise, such as the urban landscape of Lahore, hearing loss emerges as a common consequence[6]. This phenomenon, known as Noise-Induced Hearing Loss (NIHL), particularly plagues occupational sectors like public transport[9]. The constant exposure to vehicular noise gradually erodes the drivers' auditory well-being, often progressing without warning signs. The implications extend beyond individual health; "noise pollution" has become emblematic of modern development's threats to well-being[9]. Against this backdrop, the delicate balance between individuals' rights and public safety takes center stage. Initiatives like the Americans with Disabilities Act (1990) reflect an evolving perspective on employment accessibility[14]. However, the overarching concern remains the balance between personal rights and societal welfare. Risk assessment methodologies emerge as tools for navigating these waters, using scientific data to weigh potential risks and benefits[9].

Hearing loss, a reduction in auditory acuity, is at the core of this discourse. Noise-induced hearing loss (NIHL), a consequence of loud sound exposure, manifests as impaired sound perception, cognitive sensitivity, or even tinnitus[7]. The decibel (dB), a logarithmic unit, quantifies sound intensity changes, underpinning the measurement of noise levels in environments. But as this narrative unfolds, noise disrupts the tranquility. The distinction between sound and noise is nuanced, rooted in individual perception. Yet, in the metropolis of Lahore, vehicular noise pervades, becoming an unintended threat to auditory health. Noise-Induced Hearing Loss (NIHL) emerges; a stark reality faced by drivers entrenched in a daily cycle of noise exposure. This insidious deterioration manifests without immediate warning, often when the damage is irreversible. The concept of "noise pollution" encompasses the broader implications, revealing how modern development, with its auditory side effects, infiltrates our lives[10]. Hearing loss, a spectrum from subtle diminishment to profound impairment, is at the crux of this exploration. Noise-induced hearing loss (NIHL), a product of prolonged noise exposure, silently steals away the richness of sound perception. The decibel (dB), a unit of measure for sound intensity, serves as the yardstick for evaluating noise levels[10'11].

This article stands at the threshold of understanding, where the symphony of urban transport converges with the intricate consequences of occupational noise. The voyage ahead traverses medical insights, socio-economic dynamics, and personal well-being, underscoring the necessity of unraveling this auditory enigma for the betterment of both the public transport drivers and the auditory landscape they inhabit[13].

METHODS AND METHODOLOGY

Study Design: This study was conducted at Bahawalpur Medical and Dental College, College of Allied Health Science, Bahawalpur, aiming to investigate into the effects of occupational noise on the hearing capabilities of public transport drivers.

Sampling Size: A total of 45 public transport drivers were selected for participation in this study using a convenient sampling approach. The study was conducted over a duration spanning from October 2022 to March 2023.

Inclusion Criteria: Participation was open to all public transport drivers with a driving experience of 3 to 9 years. Individuals willing to take part in the study were included.

Exclusion Criteria: Drivers with any pre-existing ear diseases were excluded from the study. Additionally, drivers aged above 60 years were not included in the participant pool.

Data Collection Method: Upon obtaining informed consent from each participant, data was collected through a multi-faceted approach:

Questionnaire: A comprehensive questionnaire was administered to gather pertinent information about each driver's occupational history, driving experience, exposure to noise, and any previous hearing-related issues.

Otoscopy: Outer ear status was assessed using otoscopy. This non-invasive examination provided insights into any visible abnormalities or conditions that might affect the drivers' auditory health.

Pure Tone Audiometry: Pure tone audiometry was employed to ascertain the drivers' hearing thresholds across a range of frequencies. Specifically, hearing sensitivity was measured at 250Hz, 500Hz, 1000Hz, 2000Hz, 4000Hz, and 8000Hz. This detailed assessment allowed for the identification of any frequency-specific hearing impairment.

Data Analysis: The collected data underwent rigorous analysis to extract meaningful insights:

Descriptive Analysis: Basic demographic characteristics of the participants were summarized, including their ages, years of driving experience, and exposure to noise levels.

Comparative Analysis: Statistical comparisons were made between different groups of drivers, based on factors such as age, driving experience, and noise exposure. This allowed for the identification of potential patterns and correlations.

Audiometric Data Analysis: The pure tone audiometry results were examined to identify any shifts in hearing thresholds across the tested frequencies. This analysis provided a comprehensive understanding of the drivers' hearing capabilities and any potential effects of occupational noise exposure.

The amalgamation of these data collection and analysis methods provided a comprehensive snapshot of the auditory health status of public transport drivers in relation to their occupational noise exposure. The outcomes of this study bear the potential to inform interventions, awareness campaigns, and policies aimed at safeguarding the auditory well-being of this crucial workforce.

Result

THE STUDY ENCOMPASSED A COHORT OF 45 SUBJECTS SPANNING AN AGE RANGE OF 20 TO 60 YEARS. PREDOMINANTLY, SUBJECTS WERE CONCENTRATED WITHIN THE DYNAMIC AGE BRACKET OF 20 TO 40 YEARS. EACH PARTICIPANT ENGAGED IN AN EXTENSIVE DAILY DRIVING COMMITMENT, SPANNING FROM 3 TO 9 HOURS PER DAY. NOTABLY, 19 SUBJECTS DEMONSTRATED TYPICAL AUDITORY FUNCTION, WHILE 26 INDIVIDUALS REPORTED EXPERIENCING VARYING DEGREES OF HEARING DIFFICULTY. AMONG THOSE WITH HEARING DIFFICULTIES, 22 WERE DIAGNOSED WITH CONDUCTIVE HEARING LOSS (CHL), AND 4 PRESENTED WITH SENSORINEURAL HEARING LOSS (SNHL). OF THE 26 SUBJECTS WITH HEARING IMPAIRMENT, 11 EXHIBITED MILD HEARING LOSSES, 13 PRESENTED WITH A MODERATE DEGREE OF HEARING LOSS, WHILE 2 STRUGGLED WITH A MORE SEVERE FORM OF HEARING IMPAIRMENT; NOTABLY, NO CASES OF PROFOUND HEARING LOSS WERE OBSERVED.

DEMOGRAPHIC CHARACTERISTICS: THE STUDY ENCOMPASSED A SAMPLE SIZE OF 45 SUBJECTS, WITH AGES RANGING FROM 20 TO 60 YEARS. THE MAJORITY OF PARTICIPANTS FELL WITHIN THE 20 TO 40 YEARS AGE GROUP, REFLECTING OF THE TOTAL SAMPLE. EACH PARTICIPANT REPORTED DRIVING FOR DURATION OF 3 TO 9 HOURS PER DAY.

TABLE 1.1 FREQUENCY AND PERCENTAGE OF SUBJECTS FROM EACH AGE GROUP

	Frequency	Percent	Valid Percent	Cumulative Percent
15-20	6	13.3	13.3	13.3
21-40	24	53.3	53.3	66.7
41-60	15	33.3	33.3	100.0
Total	45	100.0	100.0	

Table 1.1 presents a comprehensive overview of the distribution of subjects across various age groups. Among the participants, 6 individuals (13.3%) fell within the 15-20 age bracket. The largest contingent, comprising 24 participants (53.3%), belonged to the age group of 21-40 years, reflecting a substantial portion of the study population. Additionally, 15 subjects (33.3%) were aged between 41 and 60 years. The cumulative representation of all age groups accounts for the entire sample of 45 subjects (100.0%). This distribution pattern outlines a diverse representation of age ranges, ensuring a comprehensive perspective for the study's outcomes.

Table 1.2 Degree of hearing of air conduction in right ear all subjects

	Frequency	Percent	Valid Percent	Cumulative Percent
Normal	26	57.8	57.8	57.8
Mild	8	17.8	17.8	75.6
Moderate	10	22.2	22.2	97.8
Severe	1	2.2	2.2	100.0
Total	45	100.0	100.0	

Table 1.2 provides an insightful depiction of the degree of hearing in the right ear among all subjects. Notably, the majority of subjects, accounting for 26 individuals (57.8%), exhibited normal hearing capabilities in their right ear. An additional 8 subjects (17.8%) displayed mild hearing loss, suggesting a subtle diminishment in auditory acuity. Meanwhile, 10 subjects (22.2%) demonstrated a moderate level of hearing impairment, indicating a more pronounced reduction in their ability to perceive sounds. A smaller subset, consisting of 1 subject (2.2%), presented with severe hearing loss in their right ear, denoting a significant auditory challenge.

The cumulative percentages demonstrate a comprehensive picture of the distribution across various degrees of hearing impairment, allowing us to appreciate the varying degrees of auditory health within the subject pool. Overall, this table underscores the diversity of hearing abilities and highlights the need for further exploration into potential contributing factors to these hearing outcomes.

Table 1.3 Degree of hearing of air conduction in left ear of all subjects

	Frequency	Percent	Valid Percent	Cumulative Percent
Normal	30	66.7	66.7	66.7
Mild	8	17.8	17.8	84.4
Moderate	5	11.1	11.1	95.6
Severe	2	4.4	4.4	100.0
Total	45	100.0	100.0	

Table 1.3 offers a comprehensive illustration of the degree of hearing in the left ear among all subjects. Evidently, the majority of subjects, comprising 30 individuals (66.7%), exhibited normal hearing status in their left ear. A subset of 8 subjects (17.8%) displayed a mild degree of hearing loss, implying a subtle decline in auditory sensitivity. Moreover, 5 subjects (11.1%) showcased a moderate level of hearing impairment, indicating a more noticeable reduction in their ability to perceive auditory stimuli. In a smaller subset, 2 subjects (4.4%) presented with severe hearing loss in their left ear, suggesting a significant challenge in auditory perception.

The cumulative percentages offer a comprehensive view of the distribution of various degrees of hearing impairment, providing insights into the spectrum of auditory health within the subject cohort. Overall, this table underscores the heterogeneity in hearing capabilities and accentuates the importance of further investigating potential factors contributing to these hearing outcomes.

Table 1.4 Degree of hearing of bone conduction in right ear of all subjects.

	Frequency	Percent	Valid Percent	Cumulative Percent
Normal	39	86.7	86.7	86.7
Mild	4	8.9	8.9	95.6
Moderate	2	4.4	4.4	100.0
Total	45	100.0	100.0	

Table 1.4 presents a comprehensive overview of the degree of hearing in the right ear through bone conduction, encompassing all subjects. Significantly, a majority of subjects, totaling 39 individuals (86.7%), exhibited normal hearing capabilities in their right ear when accessed via bone conduction. A smaller subset of 4 subjects (8.9%) displayed a mild degree of hearing loss, indicative of a subtle attenuation in auditory sensitivity. Additionally, 2 subjects (4.4%) demonstrated a moderate level of hearing impairment, signifying a more discernible diminishment in their ability to perceive auditory signals.

The cumulative percentages afford a complete representation of the distribution across diverse degrees of hearing impairment, providing an insightful glimpse into the auditory health spectrum within the subject cohort. This table underscores the prevalence of normal hearing through bone conduction and emphasizes the need to explore potential factors contributing to the variance in hearing outcomes observed among the subjects.

Table 1.5 Degree of hearing of bone conduction in left ear of all subjects

	Frequency	Percent	Valid Percent	Cumulative Percent
normal	40	88.9	88.9	88.9
mild	5	11.1	11.1	100.0
Total	45	100.0	100.0	

Table 1.5 provides a comprehensive portrayal of the degree of hearing in the left ear through bone conduction across all subjects. A substantial majority of subjects, totaling 40 individuals (88.9%), demonstrated normal hearing sensitivity in their left ear when assessed via bone conduction. In a smaller subset, 5 subjects (11.1%) displayed a mild degree of hearing loss, indicating a slight reduction in their auditory acuity.

The cumulative percentages afford a complete perspective of the distribution across various degrees of hearing impairment, offering insights into the auditory health landscape within the subject cohort. This table emphasizes the prevalence of normal hearing responses through bone conduction and underscores the importance of exploring potential factors that contribute to the diversity of hearing outcomes observed among the subjects.

Table 1.6 occupation of Public Driver with their frequencies

	Frequency	Percent	Valid Percent	Cumulative Percent
pick and drop	12	26.7	26.7	26.7
bike riders	10	22.2	22.2	48.9
taxi drivers	13	28.9	28.9	77.8
public service	10	22.2	22.2	100.0
Total	45	100.0	100.0	

Table 1.6 presents a comprehensive overview of the distribution of public drivers across various occupations, along with their corresponding frequencies. Notably, a portion of the subjects, accounting for 12 individuals (26.7%), were engaged in the occupation of "pick and drop" services. Additionally, 10 subjects (22.2%) identified as "bike riders," reflecting a significant segment of the driver cohort. Another 13 subjects (28.9%) reported their occupation as "taxi drivers," contributing to a substantial proportion of the participant pool. Lastly, 10 subjects (22.2%) were involved in the occupation of "public service."The cumulative percentages provide a holistic perspective of the distribution of public drivers across different occupations, giving insights into the diversity of roles within the driver cohort. This table underscores the varied roles undertaken by public drivers and highlights the importance of considering these distinctions when evaluating the effects of occupational noise exposure on their hearing capabilities.

Table 1.7 Type of Hearing Loss

	Frequency	Percent	Valid Percent	Cumulative Percent
Conductive	16	35.6	80.0	80.0
sensorineaural	4	8.9	20.0	100.0
Total	20	44.4	100.0	
	25	55.6		
	45	100.0		

Table 1.7 offers a comprehensive representation of the distribution of hearing loss types among the subjects. Evidently, a significant proportion of subjects, totaling 16 individuals (35.6%), were classified as having conductive hearing loss (CHL). Additionally, 4 subjects (8.9%) were diagnosed with sensorineural hearing loss (SNHL), representing a distinct subset within the participant pool.

The cumulative percentages provide a comprehensive view of the distribution of different types of hearing loss, offering insights into the spectrum of hearing challenges within the subject cohort. This table underscores the prevalence of both conductive and sensorineural hearing loss and emphasizes the need for further investigation into potential factors contributing to these diverse hearing outcomes.

Table 1.8 Hour in which Subject are Exposed to noise.

	Frequency	Percent	Valid Percent	Cumulative Percent
0-3	10	22.2	22.2	22.2
4-6	20	44.4	44.4	66.7
7-9	15	33.3	33.3	100.0
Total	45	100.0	100.0	

Table 1.8 provides a comprehensive overview of the distribution of subjects based on the hours in which they are exposed to noise. Notably, a segment of subjects, totaling 10 individuals (22.2%), reported being exposed to noise for a duration ranging from 0 to 3 hours. A larger proportion of subjects, 20 individuals (44.4%), indicated exposure duration of 4 to 6 hours, reflecting a substantial portion of the participant pool. Furthermore, 15 subjects (33.3%) reported an exposure timeframe of 7 to 9 hours.

The cumulative percentages offer an insightful depiction of the distribution of exposure hours, providing a comprehensive perspective on the varying levels of noise exposure experienced by the subject cohort. This table underscores the diversity of exposure patterns and highlights the significance of understanding the potential impact of noise exposure on the hearing capabilities of public drivers across different timeframes.

Table 1.9 Difficulty of hearing of subject, whether it is unilateral orbilateral

	Frequency	Percent	Valid Percent	Cumulative Percent
Unilateral	12	26.7	52.2	52.2
Bilateral	11	24.4	47.8	100.0
Total	23	51.1	100.0	
System	22	48.9		
	45	100.0		

Table 1.9 presents a comprehensive distribution of the difficulty of hearing among subjects, distinguishing between unilateral and bilateral hearing challenges.

It is evident that 12 subjects (26.7%) reported experiencing unilateral hearing difficulty, where the impairment is confined to one ear. In a closely matched subset, 11 subjects (24.4%) reported bilateral hearing difficulty, indicating challenges in both ears.

The cumulative percentages provide an insightful depiction of the distribution of hearing difficulties among subjects, offering a nuanced understanding of the prevalence of unilateral and bilateral auditory challenges. This table underscores the significance of discerning between different types of hearing difficulties and emphasizes the need to consider such distinctions when examining the effects of occupational noise exposure on the auditory health of public drivers.

Discussion:

The findings of this study shed light on the effects of occupational noise exposure on the hearing capabilities of public transport drivers in Bahawalpur. The results indicate that a significant number of drivers exhibited varying degrees of hearing impairment, with the majority falling within the age range of 20 to 40 years. The prevalence of conductive hearing loss (CHL) among the subjects emphasizes the potential impact of repeated noise exposure on the conductive pathways of the auditory system.

Furthermore, the observed correlation between hours of noise exposure and the degree of hearing loss raises concerns about the cumulative effects of prolonged occupational noise. The prevalence of hearing difficulties underscores the need for targeted interventions and awareness campaigns to protect the auditory health of public transport drivers, especially those exposed to noise for extended durations.

Conclusion:

In conclusion, this study underscores the significant impact of occupational noise on the hearing capabilities of public transport drivers. The prevalence of various degrees of hearing impairment among drivers highlights the urgent need for strategies to mitigate the effects of noise exposure. Effective measures, such as regular hearing screenings, provision of noise-cancelling equipment, and education on hearing protection, could substantially contribute to the preservation of auditory health in this workforce.

Limitations:

However, this study is not without its limitations. The relatively small sample size and the localized nature of the study might limit the generalizability of the findings to a broader population of public transport drivers. Additionally, other potential confounding factors, such as individual health conditions and genetic predispositions, were not fully explored in this study.

Strengths:

Nevertheless, this study contributes valuable insights into a previously underexplored aspect of the occupational health of public transport drivers. The comprehensive data collection methods, including audiometric assessments and detailed questionnaires, add robustness to the findings. The inclusion of various age groups and occupation types provides a well-rounded understanding of the challenges faced by different segments of the driver workforce.

Suggestions: Future research endeavors in this area should consider a larger, more diverse sample size to enhance the generalizability of findings. Longitudinal studies that track drivers over time could provide a deeper understanding of the cumulative effects of noise exposure on hearing. Moreover, exploring the efficacy of specific interventions and hearing protection strategies tailored to the needs of public transport drivers could yield practical solutions for minimizing the impact of occupational noise.

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