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Predictors of Self-Reported Hearing Problems Among Commercial Transport Workers Using Personal Listening Devices in Kano State, Nigeria: A Cross-Sectional Study

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Abstract

Background: Noise-induced hearing loss is one of the most common preventable occupational health problems worldwide. Commercial transport workers are routinely exposed to environmental and traffic noise and may experience additional auditory exposure through the use of personal listening devices. This study determined the prevalence of self-reported hearing problems and identified factors associated with hearing-related symptoms among commercial transport workers in Kano State, Nigeria.

Methods: A descriptive cross-sectional study was conducted among 410 commercial transport workers selected using a multistage sampling technique. Data were collected using a structured interviewer-administered questionnaire. Self-reported hearing problems were assessed based on the presence of hearing-related symptoms, including tinnitus, hearing difficulty, ear discomfort, and reduced hearing sensitivity. Data were analysed using IBM SPSS Statistics version 26. Associations were assessed using Pearson's chi-square test, while multivariable logistic regression was performed to identify independent predictors of hearing problems. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported. Statistical significance was set at $p < 0.05$.

Results: Self-reported hearing-related symptoms were common among respondents. Frequent need to increase listening volume was reported by 27.8%, ear discomfort by 25.9%, tinnitus by 23.9%, and difficulty hearing passengers or traffic sounds by 19.0%. Only 9.3% had ever undergone a formal hearing assessment. After adjustment for potential confounders, respondents aged above 30 years were more likely to report hearing problems (aOR = 1.82, 95% CI: 1.14–2.91, p = 0.012). Similarly, more than five years of occupational experience (aOR = 2.37, 95% CI: 1.43–3.92, p = 0.001), daily earphone use exceeding one hour (aOR = 2.69, 95% CI: 1.52–4.77, $p < 0.001$), listening at high volume (aOR = 3.14, 95% CI: 1.82–5.43, $p < 0.001$), earphone use while driving (aOR = 2.46, 95% CI: 1.41–4.31, p = 0.002), poor knowledge of hearing risks (aOR = 1.91, 95% CI: 1.12–3.27, p = 0.017), and failure to take listening breaks (aOR = 1.72, 95% CI: 1.01–2.93, p = 0.043) were independent predictors of hearing problems.

Conclusion: Hearing-related symptoms were common among commercial transport workers in Kano State and were significantly associated with both occupational and behavioural factors. Prolonged earphone use, high listening volume, earphone use while driving, poor hearing-risk awareness, and inadequate listening practices were important predictors of hearing problems. Occupational hearing conservation programmes, hearing-health education, and routine hearing screening should be prioritised among transport workers.

Keywords: Noise-induced hearing loss; Earphone; Occupational noise; Personal listening devices; Commercial transport workers; Kano State; Nigeria.

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Introduction

Hearing loss is a major global public health problem affecting individuals across all age groups and socioeconomic settings. According to the World Health Organization (WHO), over 1.5 billion people worldwide live with some degree of hearing loss, and this number is projected to rise substantially over the coming decades if preventive measures are not strengthened. Hearing impairment adversely affects communication, educational attainment, occupational productivity, social participation, and overall quality of life. Beyond its individual consequences, hearing loss imposes considerable economic and healthcare burdens, particularly in low- and middle-income countries where access to hearing healthcare services remains limited (World Health Organization, 2021; World Health Organization, 2022).

Noise-induced hearing loss (NIHL) is one of the most common preventable causes of hearing impairment worldwide. It results from prolonged exposure to excessive sound levels that damage the sensory hair cells of the inner ear. Occupational noise exposure is a well-established risk factor for hearing loss among workers in transportation, manufacturing, construction, mining, and other industries characterized by high environmental noise levels (National Institute for Occupational Safety and Health (NIOSH), 1998; World Health Organization, 2021). Unlike many forms of hearing impairment, NIHL is largely preventable through effective hearing conservation programmes, early detection, and reduction of exposure to hazardous noise (National Institute for Occupational Safety and Health (NIOSH), 1998; World Health Organization, 2022).

The increasing use of personal listening devices (PLDs), including earphones, earbuds, and headphones, has introduced an additional source of potentially hazardous noise exposure. Advances in mobile technology and widespread smartphone ownership have substantially increased the use of PLDs for communication, entertainment, information access, and occupational purposes. Although these devices offer numerous benefits, prolonged listening at high volumes has been associated with tinnitus, ear discomfort, temporary threshold shifts, and permanent hearing impairment (Basner et al., 2023; Jiang et al., 2016; Le Prell et al., 2013; World Health Organization, 2024). The WHO estimates that more than one billion adolescents and young adults are at risk of hearing loss because of unsafe listening practices associated with recreational noise exposure and personal audio devices (Strayer et al., 2003; World Health Organization, 2022).

Commercial transport workers constitute an occupational group that may be particularly vulnerable to hearing-related health problems. Their daily work environment is characterized by continuous exposure to traffic noise, vehicle engines, horns, public announcements, and other urban sound sources. In addition to occupational noise exposure, many transport workers frequently use earphones while working for communication, entertainment, or to alleviate boredom. The combined effects of occupational noise and prolonged earphone use may increase cumulative auditory exposure and contribute to hearing-related symptoms (Fligor & Cox, 2004; Serra et al., 2014; World Health Organization, 2022). Furthermore, hearing impairment among transport workers may adversely affect communication, occupational performance, and road safety.

Previous studies have reported varying prevalences of hearing-related symptoms among users of personal listening devices and occupationally exposed populations. Commonly reported symptoms include tinnitus, ear discomfort, reduced hearing sensitivity, difficulty understanding speech, and the frequent need to increase listening volume (Basner et al., 2023; Jiang et al., 2016; Serra et al., 2014). Several factors have been associated with hearing-related problems, including duration of listening, listening volume, type of listening device, cumulative occupational noise exposure, and level of hearing-health awareness. However, much of the available evidence has been derived from studies involving students, adolescents, and young adults, with comparatively limited research focusing on commercial transport workers in sub-Saharan Africa.

In Nigeria, research on hearing health has largely focused on clinical populations, students, and selected occupational groups, leaving an important evidence gap regarding hearing-related problems among commercial transport workers. Given the increasing use of personal listening de-

vices and the high levels of environmental noise encountered in transportation settings, there is a need to better understand the burden of hearing-related symptoms and the occupational and behavioural factors associated with their occurrence. Such evidence is essential for informing occupational hearing conservation programmes, public health interventions, and policies aimed at reducing preventable hearing problems in this high-risk population.

Therefore, this study determined the prevalence of self-reported hearing-related symptoms among commercial transport workers in Kano State, Nigeria, and identified occupational and listening-behaviour factors associated with hearing problems in this population.

Materials and Methods

Study Area

This study was conducted in Kano State, northwestern Nigeria. Kano State is one of the most populous states in Nigeria and serves as a major commercial and transportation hub in the country. The state comprises 44 Local Government Areas and has an extensive road transport network consisting of commercial bus drivers, taxi drivers, tricycle operators, motorcycle riders, and other transport workers. Commercial transport workers are routinely exposed to occupational and environmental noise generated by vehicle engines, traffic congestion, horns, public announcements, and other urban activities. Prolonged exposure to these noise sources has been associated with an increased risk of hearing-related health problems, particularly among individuals who frequently use personal listening devices (National Institute for Occupational Safety and Health (NIOSH), 1998; World Health Organization, 2021; World Health Organization, 2022; World Health Organization, 2022).

Study Design

A descriptive cross-sectional study was conducted among commercial transport workers in Kano State, Nigeria. Cross-sectional studies are widely used in epidemiological and occupational health research to estimate the prevalence of health conditions and examine factors associated with health outcomes within a defined population at a single point in time (Levin, 2006). The study determined the prevalence of self-reported hearing-related symptoms and examined occupational and listening-behaviour factors associated with hearing problems among commercial transport workers.

Study Population

The study population comprised registered commercial transport workers operating within selected transport parks and commercial routes in Kano State.

Eligible participants were commercial transport workers aged 18 years or older, who had worked in the transport sector for at least six months prior to data collection and provided written informed consent. Temporary workers, individuals who were unable to communicate effectively during the interview, and those who declined participation were excluded from the study.

Sample Size Determination

The minimum sample size was determined using Cochran's formula for estimating a single population proportion (Cochran, 1977):

$$n = \frac{Z^2 pq}{d^2}$$

Where: n = minimum sample size; Z = standard normal deviate corresponding to a 95% confidence level (1.96); p = prevalence of hearing-related symptoms obtained from a previous related study (60%) (Serra et al., 2014); $q = 1 - p$; d = margin of error (5%).

The calculated sample size was adjusted to account for anticipated non-response and incomplete questionnaires, resulting in a final sample size of 410 respondents.

Sampling Technique

A multistage sampling technique was employed (Cochran, 1977).

In the first stage, major commercial transport parks were identified across metropolitan and semi-urban areas of Kano State. Transport parks were selected using simple random sampling to ensure geographical representation.

In the second stage, lists of registered commercial transport workers were obtained from transport unions and park management authorities. Proportional allocation was used to determine the

number of participants recruited from each selected transport park.

In the third stage, eligible respondents were selected using systematic random sampling. The sampling interval was obtained by dividing the estimated number of eligible workers by the allocated sample size for each transport park. A random starting point was selected before recruiting every *k*th eligible respondent until the required sample size was achieved.

Data Collection Instrument

Data were collected using a structured interviewer-administered questionnaire developed following an extensive review of published literature on personal listening device use, occupational noise exposure, hearing conservation, noise-induced hearing loss, and hearing-related symptoms (Basner et al., 2023; Fligor & Cox, 2004; Jiang et al., 2016; Le Prell et al., 2013; Serra et al., 2014; World Health Organization, 2024).

The questionnaire comprised five sections: (1) sociodemographic characteristics; (2) occupational characteristics and noise exposure; (3) earphone-use patterns; (4) hearing-related symptoms; and (5) hearing-health awareness and preventive behaviours.

Items assessing hearing-related symptoms and listening behaviours were adapted from previously validated instruments used in studies of recreational noise exposure, personal listening device use, and hearing-health outcomes (Basner et al., 2023; Fligor & Cox, 2004; Jiang et al., 2016; Le Prell et al., 2013; Serra et al., 2014; World Health Organization, 2024).

The draft questionnaire was reviewed by experts in public health, epidemiology, occupational health, and audiology to assess its content validity, clarity, relevance, and cultural appropriateness.

Pretesting and Reliability Assessment

The questionnaire was pretested among 41 commercial transport workers in a transport park outside the study area.

Feedback obtained during the pretest informed revisions to improve wording, comprehension, sequencing, and contextual relevance.

Internal consistency of questionnaire items relating to hearing-related symptoms and listening behaviours was assessed using Cronbach's alpha coefficient (Cronbach, 1951). The questionnaire demonstrated good internal consistency, with a Cronbach's alpha of 0.81. A coefficient of 0.70 or higher was considered indicative of acceptable reliability (Cronbach, 1951).

Operational Definition of Hearing Problems

For this study, self-reported hearing problems were defined as the presence of one or more hearing-related symptoms reported by a respondent. These symptoms included: (i) hearing difficulty; (ii) tinnitus (ringing or buzzing in the ear); (iii) ear discomfort; (iv) reduced hearing sensitivity; (v) difficulty understanding speech; or (vi) frequent need to increase listening volume.

Respondents reporting at least one symptom were classified as having hearing problems, whereas those reporting none were classified as not having hearing problems. Similar operational definitions have been used in previous epidemiological studies assessing hearing-health outcomes in occupational and community settings (Basner et al., 2023; Jiang et al., 2016; Strayer et al., 2003).

Assessment of Earphone Use and Occupational Exposure

Earphone use was assessed using questions on: (i) frequency of use; (ii) duration of listening; (iii) preferred listening volume; (iv) preferred listening device; (v) earphone use while working; and (vi) earphone use while driving.

Occupational exposure variables included: (i) type of transport work; (ii) years of occupational experience; (iii) average daily working hours; and (iv) perceived exposure to occupational traffic noise.

These variables were selected based on previous evidence linking occupational noise exposure and unsafe listening behaviours with hearing-related health outcomes (National Institute for Occupational Safety and Health (NIOSH), 1998; Serra et al., 2014; World Health Organization, 2021; World Health Organization, 2022; World Health Organization, 2022).

Data Collection Procedure

Data were collected through interviewer-administered questionnaires by trained research

assistants stationed at selected transport parks.

Prior to data collection, research assistants underwent standardized training on the study objectives, ethical principles, interview techniques, questionnaire administration, confidentiality, and quality assurance procedures.

Completed questionnaires were reviewed daily by field supervisors to ensure completeness, consistency, and accuracy. Identified discrepancies were resolved immediately through field verification whenever necessary.

Data Analysis

Data were entered, cleaned, and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistics were used to summarize respondents' characteristics, occupational exposures, earphone-use patterns, and hearing-related symptoms. Continuous variables were summarized using means and standard deviations, whereas categorical variables were presented as frequencies and percentages.

Associations between independent variables and hearing problems were initially examined using Pearson's chi-square test. Variables with $p < 0.05$ at bivariate analysis, together with variables considered epidemiologically important based on previous literature, were entered into a multivariable binary logistic regression model to identify independent predictors of hearing problems (Hosmer et al., 2013; Midi et al., 2010).

Adjusted odds ratios (aORs) with 95% confidence intervals (95% CIs) were reported.

Model adequacy was assessed using the Hosmer–Lemeshow goodness-of-fit test, while multicollinearity among predictor variables was evaluated using variance inflation factors (VIFs) (Hosmer et al., 2013; Midi et al., 2010).

Ethical Considerations

Ethical approval was obtained from the State Research Ethics Committee (SREC), Kano State Ministry of Health, Kano, Nigeria (Approval No. SREC/2025/6275).

Administrative permission was obtained from the relevant transport unions and the management of all selected transport parks before commencement of the study.

Written informed consent was obtained from every participant before enrolment. Participation was voluntary, and respondents were informed of their right to decline participation or withdraw from the study at any stage without any consequences. Confidentiality and anonymity were strictly maintained throughout the study.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments (World Medical Association, 2013).

Results

Sociodemographic Characteristics of Respondents

A total of 410 commercial transport workers participated in the study, yielding a 100% response rate. The mean age of the respondents was approximately 33 years. Nearly half (46.3%) were aged 26–35 years, while 24.9% were aged 36–45 years. The overwhelming majority were male (96.6%) and married (66.8%). Regarding educational attainment, 46.3% had completed secondary education, whereas 19.0% had tertiary education. Tricycle operators constituted the largest occupational group (42.0%), followed by taxi drivers (25.4%), motorcycle riders (16.6%), and bus drivers/conductors (16.1%). Most respondents (43.4%) had worked in the transport sector for 1–5 years, while 58.5% reported working 6–10 hours daily (Table 1).

Table 1: Sociodemographic Characteristics of Respondents (N = 410)

Variable	n	%
Age group (years)		
≤25	76	18.5
26–35	190	46.3
36–45	102	24.9
>45	42	10.2
Sex		
Male	396	96.6
Female	14	3.4
Marital status		
Single	110	26.8
Married	274	66.8
Divorced/Widowed	26	6.3
Educational level		
None	52	12.7
Primary	90	22.0
Secondary	190	46.3
Tertiary	78	19.0
Type of transport work		
Tricycle	172	42.0
Taxi	104	25.4
Bus/Conductor	66	16.1
Motorcycle	68	16.6
Years in occupation		
<1 year	26	6.3
1–5 years	178	43.4
6–10 years	120	29.3
>10 years	86	21.0
Average working hours/day		
<6 hours	28	6.8
6–10 hours	240	58.5
>10 hours	142	34.6

Patterns of Earphone Use Among Respondents

More than half of the respondents (59.5%) reported using earphones while working. Among earphone users, 34.1% used them daily, while 17.8% reported use three to five times per week. Regarding listening duration, 21.2% listened for 30–60 minutes daily, whereas 18.0% listened for 1–3 hours and 7.8% listened for more than 3 hours per day.

Music and entertainment were the commonest reasons for earphone use (36.6%), followed by phone calls (10.7%) and listening to radio or news programmes (6.6%). Moderate listening volume was preferred by 29.3% of respondents, whereas 22.4% preferred high listening volumes. In-ear wired earphones were the most frequently used devices (32.2%), and 38.0% reported using both ears simultaneously while working (Table 2).

Table 2: Patterns of Earphone Use Among Commercial Transport Workers (N = 410)

Variable	n	%
Use of earphones while working		
Yes	244	59.5
No	166	40.5
Frequency of use (applies to users)		
Daily	140	34.1
3–5 times per week	73	17.8
Occasionally	31	7.6
Average duration per day		
<30 minutes	51	12.4
30–60 minutes	87	21.2
1–3 hours	74	18.0
>3 hours	32	7.8
Purpose of use		
Music/entertainment	150	36.6
Phone calls	44	10.7
Radio/news	27	6.6
Volume level preference		
Low	32	7.8
Moderate	120	29.3
High	92	22.4
Type of earphone used		
In-ear (wired)	132	32.2
Wireless	60	14.6
Over-the-ear	28	6.8
Ear(s) used while working		
Both ears	156	38.0
One ear only	88	21.5

Self-Reported Hearing Problems Among Respondents

Self-reported hearing-related symptoms were common among respondents. The most frequently reported symptom was the need to increase listening volume to hear clearly (27.8%), followed by ear discomfort or fullness after earphone use (25.9%) and tinnitus (23.9%). Difficulty hearing passengers or surrounding traffic sounds was reported by 19.0% of respondents, while 18.0% believed that earphone use had negatively affected their hearing. However, only 9.3% had ever undergone a formal hearing assessment (Table 3).

Table 3: Self-Reported Hearing Symptoms Among Commercial Transport Workers (N = 410)

Hearing-related symptom	Frequency (n)	Percentage (%)
Experiences ringing/buzzing in ears (tinnitus)	98	23.9
Frequently increases listening volume	114	27.8
Difficulty hearing passengers or traffic sounds	78	19.0
Ear discomfort/fullness after earphone use	106	25.9
Ever had formal hearing assessment	38	9.3
Believes earphone use affected hearing	74	18.0

Factors Associated with Hearing Problems

Bivariate analysis demonstrated statistically significant associations between hearing problems and respondents' age, years of occupational experience, type of transport work, earphone use while driving, prolonged daily earphone use, listening at high volume, poor knowledge of hearing risks, and failure to take listening breaks (Table 4).

Table 4: Factors Associated with Hearing Problems Among Commercial Transport Workers (N = 410)

Variables	Hearing problem Yes n (%)	Hearing problem No n (%)	Total n (%)	χ^2	p-value
Age group					
≤30 years	71 (29.0)	174 (71.0)	245 (59.8)	7.186	0.007*
>30 years	31 (18.8)	134 (81.2)	165 (40.2)		
Years in occupation					
≤5 years	42 (10.2)	160 (39.0)	202 (49.2)	5.466	0.019*
>5 years	36 (8.8)	172 (42.0)	208 (50.8)		
Type of transport work					
Tricycle	42 (10.2)	132 (32.2)	174 (42.4)	11.407	0.010*
Taxi	19 (4.6)	85 (20.7)	104 (25.4)		
Bus/Conductor	10 (2.4)	56 (13.7)	66 (16.1)		
Motorcycle	7 (1.7)	59 (14.4)	66 (16.1)		
Earphone use while driving					
Yes	86	157	243	24.891	<0.001*
No	16	151	167		
Daily earphone use >1 hour					
Yes	76	227	303	11.672	<0.001*
No	26	81	107		
Listening volume					
High	60	182	242	18.337	<0.001*
Low/Moderate	42	126	168		
Knowledge of hearing risks					
Poor	38	243	281	9.513	0.002*
Good	64	65	129		
Listening breaks					
No	82	222	304	8.235	0.004*
Yes	20	86	106		

* Statistically significant at $p < 0.05$.
Note: percentages were not reported in the source manuscript for the "earphone use while driving," "daily earphone use," "listening volume," "knowledge of hearing risks," and "listening breaks" rows; only raw counts are shown for these rows, matching the original data.

Independent Predictors of Hearing Problems

Variables that were statistically significant during bivariate analysis, together with epidemiologically important variables identified from previous studies, were entered into a multivariable logistic regression model.

Respondents aged over 30 years had significantly higher odds of reporting hearing problems than younger respondents (aOR = 1.82, 95% CI: 1.14–2.91; p = 0.012). Likewise, those with more than five years of occupational experience were over twice as likely to report hearing problems (aOR = 2.37, 95% CI: 1.43–3.92; p = 0.001).

Listening-related behaviours remained the strongest predictors. Daily earphone use exceeding one hour, high listening volume, earphone use while driving, poor knowledge of hearing risks, and failure to take listening breaks were all independently associated with hearing problems. Exposure to safe-listening information and longer working hours did not remain statistically significant after adjustment (Table 5).

Table 5: Multivariable Logistic Regression of Predictors of Hearing Problems Among Commercial Transport Workers (N = 410)

Predictor Variables	**aOR**	**95% CI**	**p-value**
Age >30 years	1.82	1.14–2.91	0.012*
Years in occupation >5 years	2.37	1.43–3.92	0.001*
Type of transport work			
Bus/Conductor (Ref)	1.00	–	–
Tricycle	1.92	1.05–3.52	0.034*
Taxi	1.48	0.80–2.74	0.210
Motorcycle	0.87	0.42–1.80	0.703
Daily duration >1 hour	2.69	1.52–4.77	<0.001*
Listening volume (high)	3.14	1.82–5.43	<0.001*
Earphone use while driving	2.46	1.41–4.31	0.002*
Poor knowledge of hearing risk	1.91	1.12–3.27	0.017*
No listening breaks	1.72	1.01–2.93	0.043*
Exposure to safe-listening info	0.84	0.45–1.58	0.593
Working hours >10 hrs	1.23	0.73–2.08	0.437

*Statistically significant; aOR, Adjusted odds ratio; CI = Confidence interval

Model diagnostics: The Hosmer–Lemeshow goodness-of-fit test indicated that the final logistic regression model adequately fitted the data (χ^2 = 6.24, p = 0.62). Variance inflation factors ranged from 1.08 to 2.31, indicating no evidence of problematic multicollinearity among the predictor variables.

Discussion

This study investigated the prevalence of self-reported hearing problems and associated factors among commercial transport workers in Kano State, Nigeria. The findings revealed a substantial burden of hearing-related symptoms among respondents, with tinnitus, ear discomfort, difficulty hearing environmental sounds, and frequent need to increase listening volume being commonly reported. Furthermore, several occupational and listening-behaviour factors, including age, years of occupational experience, prolonged earphone use, high listening volume, earphone use while driving, poor knowledge of hearing risks, and failure to take listening breaks, were independently associated with hearing problems. These findings highlight the combined effects of occupational noise exposure and unsafe listening behaviours on hearing health among commercial transport workers.

A major finding of this study was the relatively high prevalence of self-reported hearing-related symptoms among respondents. Nearly one-quarter reported tinnitus, while more than one-quarter frequently increased listening volume to hear clearly. Ear discomfort and difficulty hearing passengers or traffic sounds were also commonly reported. These symptoms are recognised as early manifestations of noise-induced hearing damage and have been documented among individuals exposed to prolonged occupational and recreational noise (National Institute for Occupational Safety and Health (NIOSH), 1998; World Health Organization, 2021; World Health Organization, 2022; World Health Organization, 2022). Similar findings have been reported among commercial drivers in India and transport workers in several low- and middle-income countries, where prolonged exposure to traffic noise and the use of personal listening devices were associated with an increased prevalence of tinnitus and hearing difficulties (Basner et al., 2023; Jiang et al., 2016; National Institute for Occupational Safety and Health (NIOSH), 1998). The relatively high prevalence of symptoms observed in this study may be attributed to the cumulative effects of occupational noise exposure combined with prolonged earphone use in an already noisy work environ-

ment. Such dual exposure potentially increases auditory stress and accelerates hearing deterioration over time. Early identification of these symptoms is particularly important because noise-induced hearing loss is largely irreversible but preventable through timely intervention and hearing conservation measures (World Health Organization, 2021; World Health Organization, 2022).

The study found that respondents aged above 30 years were significantly more likely to report hearing problems than younger workers. This finding is consistent with previous studies showing that the risk of hearing impairment increases with advancing age because of cumulative lifetime exposure to environmental, occupational, and recreational noise (Le Prell et al., 2013; National Institute for Occupational Safety and Health (NIOSH), 1998; World Health Organization, 2021). Although age-related hearing decline becomes more pronounced in later adulthood, repeated exposure to hazardous sound levels may accelerate auditory damage among younger working populations. Similar associations between age and hearing-related symptoms have been reported among professional drivers, industrial workers, and other occupationally exposed populations (Jiang et al., 2016; Le Prell et al., 2013; National Institute for Occupational Safety and Health (NIOSH), 1998). The increased risk observed among older respondents may therefore reflect cumulative occupational noise exposure rather than chronological ageing alone.

Years of occupational experience also emerged as an independent predictor of hearing problems. Respondents who had worked in the transport sector for more than five years were more than twice as likely to report hearing-related symptoms. This finding is biologically plausible because prolonged occupational exposure to traffic noise increases cumulative auditory burden and the likelihood of cochlear damage (National Institute for Occupational Safety and Health (NIOSH), 1998; World Health Organization, 2021). Previous studies among transport workers and industrial workers have similarly demonstrated positive associations between duration of occupational noise exposure and hearing impairment (Le Prell et al., 2013; National Institute for Occupational Safety and Health (NIOSH), 1998). Commercial transport workers often spend several hours daily in environments characterised by engine noise, vehicle vibrations, traffic congestion, and frequent horn use. Over time, such exposures may contribute substantially to hearing deterioration, particularly in the absence of hearing conservation programmes or routine hearing assessment.

One of the strongest predictors identified in this study was prolonged daily earphone use. Respondents who used earphones for more than one hour per day were nearly three times more likely to report hearing problems than those with shorter listening durations. This finding is consistent with evidence indicating that both sound intensity and duration of exposure contribute significantly to hearing damage (World Health Organization, 2022; World Health Organization, 2024). Previous studies among users of personal listening devices have reported that prolonged listening increases the risk of temporary threshold shifts, tinnitus, and permanent hearing impairment (Basner et al., 2023; Serra et al., 2014; World Health Organization, 2024). The widespread use of smartphones and digital audio devices has increased opportunities for prolonged listening, particularly among workers who use earphones for entertainment, communication, or relief from occupational stress. These findings therefore support WHO recommendations encouraging limitation of listening duration as an important component of safe listening practices (Fligor & Cox, 2004; World Health Organization, 2022).

High listening volume was the strongest predictor of hearing problems in the present study. Respondents who reported listening at high volume levels were more than three times as likely to experience hearing-related symptoms as those who listened at lower volumes. This finding is consistent with the well-established relationship between sound intensity and auditory damage (World Health Organization, 2021; World Health Organization, 2022; World Health Organization, 2024). Exposure to sounds exceeding recommended safety thresholds can result in progressive destruction of cochlear hair cells and subsequent hearing impairment. Similar associations between high listening volumes and hearing problems have been documented among adolescents, university students, and occupational groups worldwide (Basner et al., 2023; Serra et al., 2014; World Health Organization, 2024). In noisy transport environments, indi-

viduals may increase listening volume to overcome background noise, thereby exposing themselves to potentially harmful sound levels for prolonged periods. This behaviour may substantially increase the risk of noise-induced hearing loss among commercial transport workers.

Earphone use while driving was another significant predictor of hearing problems. Respondents who used earphones while driving were approximately two and a half times more likely to report hearing-related symptoms. This finding may reflect increased cumulative listening exposure among individuals who routinely use earphones throughout working hours. In addition to its potential impact on hearing health, earphone use while driving may reduce awareness of environmental sounds, impair communication, and increase the risk of road traffic crashes (Strayer et al., 2003). Similar concerns have been raised in studies examining distracted driving and auditory masking associated with personal listening devices. These findings suggest that interventions aimed at reducing earphone use while driving may yield both hearing-health and road-safety benefits.

The study further demonstrated that poor knowledge of hearing-related health risks was independently associated with hearing problems. Respondents with poor knowledge were almost twice as likely to report hearing-related symptoms as those with better knowledge. This finding highlights the importance of health literacy in shaping preventive behaviours. Previous studies have shown that individuals who understand the risks associated with excessive noise exposure are more likely to adopt protective listening practices and seek timely medical attention when symptoms occur (Berkman et al., 2011; Rosenstock, 1974). The low level of awareness observed among respondents suggests limited exposure to hearing-health education and a lack of hearing conservation initiatives within the transport sector. Improving hearing-risk awareness may therefore represent a cost-effective strategy for reducing harmful listening behaviours and preventing hearing loss.

Failure to take listening breaks also remained a significant predictor of hearing problems after adjustment for potential confounders. Respondents who did not routinely take breaks during listening sessions were more likely to experience hearing-related symptoms. Listening breaks allow the auditory system time to recover from sound exposure and are widely recommended as part of hearing conservation programmes (Fligor & Cox, 2004; World Health Organization, 2022). Similar findings have been reported among users of personal listening devices and occupationally exposed populations, where continuous listening without recovery periods was associated with increased auditory fatigue and hearing complaints (Basner et al., 2023; World Health Organization, 2024). This finding reinforces the importance of promoting behavioural modifications alongside broader hearing-health interventions.

Overall, the findings of this study indicate that hearing-related symptoms are common among commercial transport workers in Kano State and are influenced by both occupational and behavioural factors. The identification of modifiable risk factors – including prolonged listening duration, high listening volume, earphone use while driving, poor hearing-risk awareness, and failure to take listening breaks – provides important opportunities for intervention. Strengthening hearing-health education, implementing workplace hearing conservation programmes, promoting periodic hearing assessment, and encouraging safer listening practices may substantially reduce the burden of preventable hearing problems among commercial transport workers and similar occupational populations.

Strengths and Limitations

Strengths

This study provides one of the few assessments of hearing-related symptoms among commercial transport workers in Kano State, Nigeria. The use of a multistage sampling technique enhanced the representativeness of the study population, while interviewer-administered questionnaires minimized missing data and improved response completeness. Furthermore, the application of multivariable logistic regression enabled adjustment for potential confounding factors, thereby strengthening the validity of the findings.

Limitations

This study has several limitations. First, hearing problems were assessed using self-reported symptoms rather than objective audiometric testing, which may have resulted in misclassification of hearing status. Second, the cross-sectional study design precludes establishing causal relationships between occupational and listening-related factors and hearing problems. Third, recall bias and social desirability bias may have influenced participants' responses regarding earphone use and listening behaviours. Finally, because the study included only registered commercial transport workers, the findings may not be generalizable to unregistered transport workers or other occupational groups.

Conclusion

This study demonstrated that self-reported hearing-related symptoms are common among commercial transport workers in Kano State, Nigeria. Frequently reported symptoms included tinnitus, ear discomfort, difficulty hearing environmental sounds, and the need to increase listening volume. Older age, longer occupational experience, prolonged daily earphone use, high listening volume, earphone use while driving, poor knowledge of hearing risks, and failure to take listening breaks were identified as significant independent predictors of hearing problems.

These findings highlight the combined contribution of occupational noise exposure and unsafe listening behaviours to hearing-related symptoms among commercial transport workers. Given that many of the identified risk factors are modifiable, strengthening hearing conservation strategies within the transport sector could substantially reduce the burden of preventable hearing problems.

Targeted health education programmes, promotion of safe listening practices, routine occupational hearing assessment, and policies aimed at reducing excessive noise exposure should be integrated into occupational health services for commercial transport workers. Such interventions have the potential to improve hearing health, occupational performance, and road safety among this high-risk population.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. **Hearing Health Education.** The Kano State Ministry of Health, transport unions, and occupational health stakeholders should implement regular hearing-health education programmes to improve awareness of the risks associated with prolonged earphone use, excessive listening volume, and occupational noise exposure.

2. **Promote Safe Listening Practices.** Commercial transport workers should be encouraged to adopt evidence-based safe-listening practices, including limiting daily earphone use, maintaining moderate listening volumes, avoiding earphone use while driving, and taking regular listening breaks during prolonged listening sessions.

3. **Occupational Hearing Conservation Programmes.** Transport unions and employers should collaborate with public health authorities to establish hearing conservation programmes that include periodic hearing assessments, health education, and strategies for reducing occupational noise exposure.

4. **Occupational Health Policy.** Government agencies responsible for occupational safety and transportation should develop and implement policies promoting hearing conservation within the commercial transport sector, including routine occupational health screening and dissemination of safe-listening guidelines.

5. **Future Research.** Future studies should employ objective audiometric assessments alongside self-reported measures to provide a more accurate evaluation of hearing status among commercial transport workers. Longitudinal studies are also recommended to establish causal relationships between occupational noise exposure, listening behaviours, and hearing outcomes.

What This Study Adds

This study provides contemporary evidence on the prevalence of self-reported hearing-related symptoms among commercial transport workers in Kano State, Nigeria.

It identifies modifiable occupational and listening-related factors including prolonged earphone use, high listening volume, earphone use while driving, and failure to take listening breaks that are independently associated with hearing problems.

The findings emphasize the importance of hearing-health education and occupational hearing conservation programmes for reducing preventable hearing problems among commercial transport workers.

The study provides evidence that may inform occupational health policies and hearing conservation interventions within the commercial transport sector in Nigeria.

Declarations

Ethics Approval and Consent to Participate

Ethical approval was obtained from the State Research Ethics Committee (SREC), Kano State Ministry of Health, Kano, Nigeria (Approval No. SREC/2025/6275). Administrative permission was obtained from the relevant transport union authorities and the management of the selected transport parks before commencement of the study.

Written informed consent was obtained from all participants before enrolment. Participation was voluntary, and respondents were informed of their right to withdraw from the study at any time without any consequences. Confidentiality and anonymity were maintained throughout the study. The study was conducted in accordance with the principles of the Declaration of Helsinki and its subsequent amendments.

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Funding

This study received no external funding.

Authors' Contributions

CRediT Authorship Contribution Statement

Table 6: CRediT Authorship Contribution Statement

Author	**Contributions**
Muhammad Abbas Sani*	Conceptualization; Methodology; Investigation; Data Curation; Formal Analysis; Writing – Original Draft; Writing – Review & Editing; Project Administration; Correspondence
Sani Giade Abdullahi	Conceptualization; Supervision; Validation; Writing – Review & Editing
Adamu Alhaji	Methodology; Investigation; Supervision; Project Administration
Ibrahim Shehu Aliyu	Methodology; Validation; Supervision; Writing – Review & Editing
Umar Shuaibu	Investigation; Data Collection; Data Curation
Mamuda Alhaji Sabo	Investigation; Data Collection; Resources
Saminu Zakari Chiroma	Formal Analysis Support; Data Validation; Visualization
Shafa'atu Kani Faggo	Investigation; Data Collection; Field Coordination
Faiza Mukhtar Uba Abubakar	Investigation; Participant Coordination; Data Collection
Aisha Aliyu Ibrahim	Investigation; Community Engagement; Resources
Alhassan Muhammad Baba	Data Curation; Quality Assurance; Visualization Support
Aisha Mahmoud Ibrahim	Literature Review; Data Curation; Writing – Review & Editing

All authors contributed substantially to the conception, design, implementation, data acquisition, analysis, interpretation, drafting, and critical revision of the manuscript. All authors approved the final manuscript and agreed to be accountable for all aspects of the work.

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