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ORIGINAL ARTICLE

Risk Factors and Patterns of Road Traffic Accidents among Commercial Tricycle Operators in Nigeria: A Public Health Perspective

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ABSTRACT

Background: Road traffic accidents (RTAs) remain a significant public health issue, with low-and-middle income countries experiencing disproportionately high fatality rates. In Nigeria, commercial tricycles, locally known as "keke NAPEP," have become a popular mode of transport, yet their structural vulnerabilities and limited safety features contribute to rising RTA prevalence. This study investigates the frequency, patterns, and risk factors of RTAs among commercial tricyclists in Ilorin-South Local Government Area, Kwara State, Nigeria.**Methods:** A descriptive cross-sectional study was conducted from September to November 2024, using multistage sampling to recruit 330 registered commercial tricyclists. Data were collected via a semi-structured questionnaire and analyzed using descriptive statistics and chi-square tests.**Results:** The prevalence of self-reported RTAs was 53.6%, with side collisions being the most common type (42.2%). Primary causes included reckless driving by other road users (31.2%), distractions (22.4%), and mechanical failures (26.6%). Most respondents were male (97.9%), aged 31-40 years, with 60.3% lacking valid driving licenses. Accidents were most frequent in the afternoon. Younger drivers (≤20 years) experienced higher accident rates ($\chi 2$=14.450, p=0.008). Risk factors such as excessive speed, phone use, and driving under the influence of alcohol significantly increased accident likelihood.

Conclusion: The high prevalence of RTAs among tricyclists highlights the need for targeted interventions. Recommendations include mandatory safety training, stricter licensing regulations, and improved road infrastructure to enhance tricyclist safety and reduce accident rates.**Keywords:** Road Traffic Accidents; Tricycles; Public Health; Risk Factors; Occupational Health

INTRODUCTION

Road traffic accidents (RTAs) pose a significant public health and economic burden worldwide, with an estimated 1.19 million deaths annually and a mortality rate of 15 deaths per 100,000 people [1]. RTAs remain the leading cause of death among individuals aged 5 to 29 years, disproportionately affecting working-age adults [2]. Despite accounting for just 1% of the world's motor vehicles, low- and middle-income countries (LMICs) contribute to 92% of global RTA fatalities, demonstrating the urgent need for intervention [1].

Africa bears a disproportionate share of this burden, with road traffic injury-related deaths exceeding the global average by 50% [3]. Vulnerable road users—including pedestrians, motorcyclists, and tricyclists—are particularly at risk. The increasing reliance on powered two- and three-wheelers in sub-Saharan Africa has led to a surge in fatalities, with these vehicle users accounting for 21% of global RTA deaths [4]. The economic impact of RTAs is substantial, consuming approximately 3% of a country's Gross Domestic Product (GDP) [5].

Nigeria ranks among the countries with the highest RTA fatality rates, with 33.7 deaths per 100,000 population in 2018, nearly three times the global average [6]. In 2021 alone, 20,596 RTAs were recorded nationwide, with tricycles contributing to 850 of these incidents [7]. Tricycles, popularly known as "keke NAPEP", have become a dominant mode of transport following bans on commercial motorcycles in major cities. Despite their increasing adoption, their structural instability, lack of essential safety features, and minimal crashworthiness make them highly vulnerable to accidents [8].

In Ilorin, the capital of Kwara State, the rapid increase in commercial tricycle usage has been accompanied by rising accident rates [9], particularly in Ilorin-South Local Government Area (LGA). While national reports indicate a high burden of RTAs [7,10-12], there is limited localized data on the specific risk factors, accident patterns, and safety practices of tricyclists. The absence of targeted research hinders the development of effective road safety policies, leaving tricyclists at heightened risk. Moreover, existing transport laws—such as the Kwara State Motorcycle Operations Law (2005)—primarily focus on motorcycles and do not adequately address the safety challenges faced by tricyclists [13].

Research Gap and Study Rationale

Most studies on RTAs in Nigeria have focused on motorcycles, private cars, or commercial buses, neglecting the unique risks faced by tricyclists [7, 10-12,14]. Given that 46% of tricyclists in Maiduguri, northeastern Nigeria, reported being involved in an accident, there is an urgent need to assess the contributory factors, safety practices, and potential interventions to reduce RTAs among this group [15].

This study seeks to bridge this knowledge gap by investigating the frequency, risk factors, and patterns of RTAs among commercial tricyclists in Ilorin-South LGA, Nigeria. Specifically, it aims to (i) determine the frequency of RTAs among tricyclists, (ii) identify key risk factors contributing to these accidents, (iii) evaluate safety practices and compliance with regulations, and (iv) propose evidence-based interventions to improve tricycle-related road safety. Addressing these concerns is essential to reducing accident rates, improving road safety, and informing transport policies in Nigeria.

METHODS

Study Design and Setting

A descriptive cross-sectional study was conducted between September and November 2024 in Ilorin-South LGA, Kwara State, Nigeria. Ilorin-South, with an estimated population of 314,100 people, covers an area of 194.8 km² and has a population density of 1,613/km² [16]. The study area is a major urban transport hub, featuring 32 tricycle parks used by commercial operators. Ilorin South LGA has 11 political wards with her administrative headquarters situated in Fufu, with additional offices located in Pake, Ipata, and other districts. The major towns in Ilorin South include Ilota, Fufu, Gaa-Akanbi, Kangie, Gaa Osibi, Omode, Ogidi, and Oko-olowo, with Yoruba and Fulani being the predominant languages spoken. Figure 1 shows the political map of Ilorin South LGA.

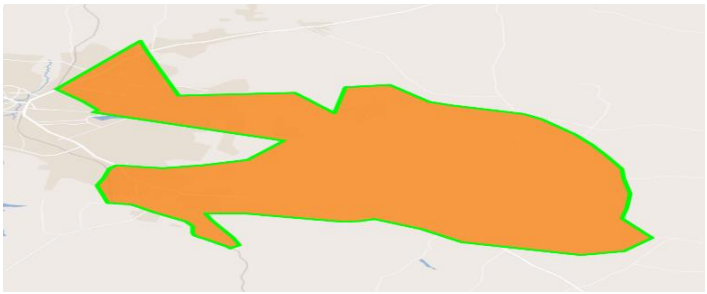

Figure 1: Map of Ilorin South LGA [26]

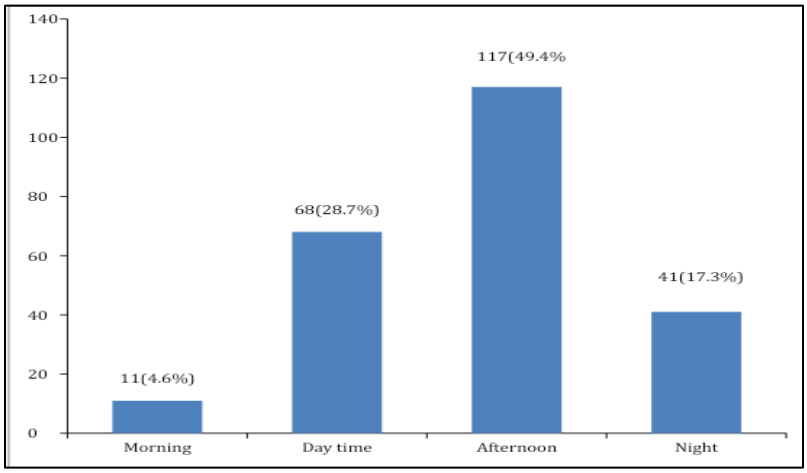

Figure 2: Time of the day accident occurred to respondents

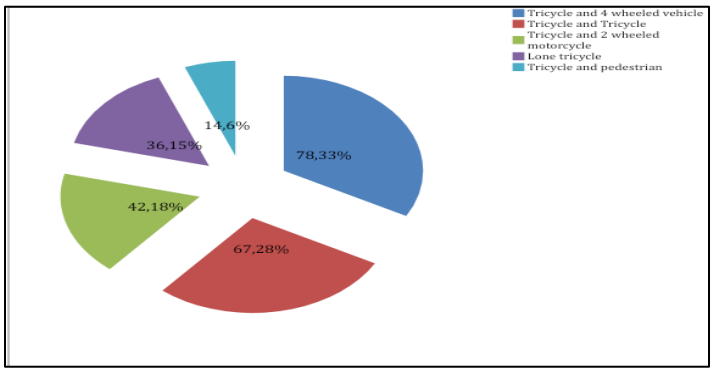

Figure 3: Type of collision experienced by respondents

Study Population

The target population for this study consisted of commercial tricyclists operating within Ilorin South, Kwara State.

Inclusion Criteria

To ensure that the participants accurately represented the target population, specific inclusion criteria were established. Only commercial tricyclists who were registered with their respective unions were eligible to participate. Additionally, these tricyclists needed to be actively using their tricycles for commercial purposes. Furthermore, it was required that participants had been registered with their unions for a minimum of six months prior to the study. These criteria aimed to enhance the reliability of the data collected regarding their driving patterns, safety practices, and accident history.

Exclusion Criteria

In contrast, several exclusion criteria were established to filter out individuals who may not provide valid data for the study. The study excluded commercial tricyclists who declined to participate, as well as those who were ill during the data collection period. Additionally, any potential respondents who were absent during the data collection period were also excluded.

Sample Size Determination

The sample size was calculated using Fisher's formula for populations greater than 10,000, [17] applying the following parameters:

- Z = 1.96 (95% confidence interval)
- P = 51.6% (0.516)……. [14]
- q = 1 - P = 0.484
- d = 0.05 (5% margin of error)

Using the formula, the initial sample size (N) was determined as:

N=(1.96)2×0.516×0.484(0.05)2=384N = \frac{(1.96)^2 \times 0.516 \times 0.484}{(0.05)^2} = 384N=(0.05)2(1.96)2×0.516×0.484=384

Since the target population (1,302) was below 10,000, the modified Fisher's formula was applied, yielding an adjusted sample size of 297. To account for potential non-responses, 10% was added, bringing the sample size to 328, which was rounded up to 330 respondents to enhance statistical power.

Sampling Technique

Respondents were selected using a multistage sampling technique, which involved three distinct stages:

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Stage 1: Selection of Wards

- 3 wards randomly selected from 11 in Ilorin-South
- Simple random sampling (balloting technique) applied

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Stage 2: Selection of Tricycle Parks

- 3 tricycle parks randomly selected per ward
- Total: 9 parks selected
- Proportional allocation applied:

Respondents per park =

(Operators in park / Operators in all 9 parks) × Sample size

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Stage 3: Selection of Respondents

- Simple random sampling used at each park
- Process continues until total 330 respondents are selected

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END

Data Collection and Instrumentation

A semi-structured, interviewer-administered questionnaire was used, adapted from validated studies [15]. The questionnaire comprised six sections, covering socio-demographics, work and driving patterns, accident history, safety practices, risk factors, and additional comments. A pilot study involving 33 respondents (10% of the total sample) was conducted in Ilorin-East to assess the clarity and reliability of the questionnaire.

Ethical Considerations

Ethical approval was obtained from the University of Ilorin Ethical Review Committee (UERC/ASN/2024/2925), and informed consent was secured from all participants. Confidentiality was maintained throughout the study, with respondents assured of voluntary participation.

RESULTS

Socio-Demographic Characteristics of Respondents

Table 1: Socio-demographic characteristics of respondents N=330

Variables	Frequency	Percentage
Age groups		
≤ 20	11	3.3
21 – 30	115	34.8
31 – 40	116	35.2
41 – 50	59	17.9
≥ 51	29	8.8
Gender		
Male	323	97.9
Female	7	2.1
Marital status		
Single	90	27.3
Married	232	70.3
Separated	6	1.8
Widowed	2	0.6
Education		
No formal education	9	2.7
Primary	65	19.7
Secondary	136	41.2
Tertiary	120	36.4
Religion		
Christianity	129	39.1
Islam	195	59.1
Traditional	6	1.8
Ethnicity		
Yoruba	312	94.5
Hausa/Fulani	7	2.1
Nupe	5	1.5
Igbo	3	0.9
Others (Ebira, Igala,Batonu)	3	0.9

A total of 330 commercial tricycle operators participated in the study, with a predominant male representation (97.9%) and only 2.1% female participants (Table 1). The majority of respondents were within the 21–40 age group (70%), while 3.3% were aged ≤ 20 years and 8.8% were ≥ 51 years. Regarding marital status, 70.3% were married, whereas 27.3% were single.

The educational background of participants varied, with 41.2% having completed secondary education, and 36.4% holding tertiary qualifications,

suggesting a relatively literate workforce. Religion-wise, Islam was the predominant faith (59.1%), followed by Christianity (39.1%). Ethnically, the Yoruba ethnic group accounted for 94.5% of respondents, with Hausa/Fulani (2.1%) and Nupe (1.5%) making up the minority. These demographic patterns provide insights into the potential influence of age, education, and experience on road traffic accident risks among tricyclists.

Work Experience and Driving Behavior

Table 2: Work experience and driving behavior of respondents

Variables	Frequency	Percentage
Training on how to drive tricycle		
Friends	181	54.8
Family member	48	14.5
Self	64	19.4
Driving school	10	3.0
Co-driver	24	7.3
Apprentice	3	0.9
Years of experience in tricycle business		
< 1	22	6.7
1 – 2	53	16.1
3 – 5	75	22.7
> 5	180	54.5
Tricycle ownership		
Self	199	60.3
Hired purchase	80	24.2
Rented	51	15.5
Other occupation/second job		
Yes	160	48.5
No	170	51.5
type of occupation/ second job	**n=160**	
Farming	9	5.6
Artisan	121	75.6
Civil servant	11	6.9
Others	19	11.9
Ownership of driving license		
Yes	131	39.7
No	199	60.3
Validity of license	**n=131**	
Yes	107	81.7
No	24	18.3
Average hours of work daily		
4 – 6	121	36.6
7 – 9	90	27.3
≥ 10	119	36.1
Night driving		
Yes	215	65.2
No	115	34.8

The majority of tricycle operators (54.5%) had over five years of experience, while 22.7% had driven for 3–5 years (Table 2). However, only 3.0% had received formal training from a driving school, with 54.8% learning from friends and 19.4% being self-taught. Tricycle ownership varied, with 60.3% of respondents owning their tricycles, while 24.2% were on hired purchase, and 15.5% rented theirs. Notably, 60.3% of the respondents did not possess a valid driving license, raising regulatory concerns. Among those with licenses, 81.7% had valid documentation. In terms of work patterns, 36.1% of drivers worked for 10 or more hours daily, and 65.2% engaged in night driving, a practice often associated with higher accident risks due to reduced visibility and driver fatigue. The lack of formal training and widespread absence of valid licenses highlight critical gaps in regulatory enforcement and driver education, which could contribute to unsafe driving behaviors and increased accident rates.

Prevalence and Patterns of Road Traffic Accidents (RTAs)

Table 3: Prevalence and pattern of road traffic accidents among respondents

Variables	Frequency	Percentage
Ever involved in RTA with my Tricycle		
Yes	177	53.6
No	153	46.4
Number of RTA		
One	117	66.1
Two	49	27.7
Three or more	11	6.2
Persons affected by accident		
Driver	75	31.6
Passenger in front seat	46	19.4
Passenger at back seat	38	16.0
None	78	32.9
Severity of injury		
Minor	91	57.2
Moderate	33	20.8
Severe	35	22.0
Fatal/Death	0	0.0
Causes of accidents		
Distraction	54	22.8
Other vehicles crossed my lane	33	13.9
Mistakenly pressed accelerator instead of brake	8	3.1
Attending to phone calls	35	14.8
Reckless driving by other road users	74	31.2
Brake failure	17	7.2
Others	15	6.3
Type of injury	**n=68**	
Soft tissue injury	31	45.6
Head injury	11	16.2
Single fracture	15	22.1
Multiple injury	11	16.2
Type of accident	***n=237***	
Front hitting	33	13.9
Toppling	43	18.1
Side hitting	100	42.2
Hit from behind	32	13.5
Hit immobile object	29	12.3

A significant proportion (53.6%) of tricyclists self-reported being involved in at least one RTA (Table 3). Among these, 66.1% had experienced one accident, while 27.7% had been involved in two. The most common accident type was side-hitting (42.2%), followed by toppling (18.1%) and front collisions (13.9%). Drivers themselves were the most affected in 31.6% of cases, while 35.2% of injuries involved passengers. Although no fatalities were reported, 22.0% of injuries were classified as severe. These findings indicate that tricyclists in Ilorin-South experience a high rate of RTAs, with most incidents involving lateral collisions and significant driver or passenger injuries.

Causes of Road Traffic Accidents

Table 4: Main causes of accidents among respondents who had accidents n=237

Variables	Yes (%)
Poor road condition	29 (12.2)
Reckless driving	67 (28.3)
Mechanical failure	63 (26.6)
Weather condition	29 (12.2)
Fatigue	22 (9.3)
Distraction	28 (11.8)
Overload	17 (7.2)
Drunk driving	32 (13.5)

The findings indicate that reckless driving by other road users was the most frequently cited cause of road traffic accidents, accounting for 31.2% of reported incidents. This was followed by mechanical failures (26.6%) and distractions while driving (22.8%), both of which significantly contributed to accident occurrences (Table 4).

Table 5: Risk factors of road traffic accidents among respondents N=330

Variables	Yes (%)
Vehicular factors	
Brakes	297 (90.0)
Lights	278 (84.2)
Tires in good condition	290 (87.9)
Side mirror in good condition	272 (83.3)
Drivers risk factors	
Drivers excessive speed	273 (83.0)
Phone calls while driving	247 (74.8)
Music and driving	242 (73.3)
Eating while driving	182 (55.2)
Smoking on wheels	150 (45.5)
Alcohol drinking	214 (64.8)
Age below 18	179 (54.2)
Age above 60	134 (40.6)
Poor vision	232 (70.3)
Environmental factors	
Bad roads	307 (93.0)
Sunrays	277 (83.9)
Poor road layout	304 (92.1)
Road block	243 (73.6)
Robbery	249 (75.5)
Harmattan haze/mist	277 (83.9)
Rain	272 (82.4)
Night driving	261 (79.1)

Potholes, collapsed bridges	300 (90.9)
Fallen trees and stray objects/animals	291 (88.2)
Inadequate street lighting	236 (71.5)
High traffic volume	174 (52.7)

Further analysis of contributory factors revealed that excessive speed was a leading risk, with 83.0% of tricyclists admitting to frequently exceeding speed limits, increasing the likelihood of collisions (Table 5). Additionally, 74.8% of respondents reported using their phones while driving, a behavior known to impair concentration and reaction time, thereby elevating accident risk. Moreover, 64.8% acknowledged consuming alcohol while driving, a factor found to be strongly associated with a heightened probability of accidents ($p < 0.001$, OR = 2.20) (Table 8).

Environmental factors also played a significant role in accident causation. Poor road conditions (93.0%), potholes (90.9%), and inadequate street lighting (71.5%) were commonly reported as challenges that further exacerbated accident risks. These findings underscore the complex interplay between human behavior, inadequate road infrastructure, and vehicle maintenance deficiencies, all of which contribute to the high prevalence of RTAs among commercial tricyclists. Addressing these issues requires a multifaceted approach, incorporating driver education, stricter traffic enforcement, and improvements in road infrastructure to enhance safety for tricycle operators and other road users.

Safety Practices Among Tricyclists

Table 6: Safety practices among respondents N=330

Variables	**Yes (%)**	**No (%)**
Regular maintenance of tricycle	322 (97.6)	8 (2.4)
Attended road safety training before	146 (44.2)	184 (55.8)
Insurance for the tricycle	118 (35.8)	212 (64.2)
Had eye check before	87 (26.4)	243 (73.6)
Frequency of eye checks	**Frequency**	**Percentage**
Annually	31	35.7
Bi annually	20	23.0
Every 3 years	7	8.0
Not regular	29	33.3

Despite the high prevalence of road traffic accidents (RTAs) among commercial tricyclists, the majority of respondents (97.6%) reported engaging in regular tricycle maintenance to ensure vehicle functionality and safety (Table 6). However, significant gaps in safety practices were identified, highlighting areas that require urgent intervention.

Notably, only 44.2% of tricyclists had attended a road safety training program, underscoring the lack of structured driver education and the need for comprehensive training on safe driving practices and accident prevention. Furthermore, 73.6% had never undergone an eye check, despite the well-documented association between poor vision and increased accident risk. Regular vision screening could play a crucial role in reducing RTAs by ensuring that drivers have the necessary visual acuity for safe road navigation.

In addition to these concerns, 64.2% of respondents did not have insurance coverage for their tricycles, leaving them financially vulnerable in the event of an accident. This lack of financial protection could deter injured drivers from seeking timely medical care and contribute to economic hardship following accidents. These findings emphasize the urgent need for enhanced safety measures, including mandatory road safety training, regular vision assessments, and insurance policies for commercial tricyclists. Implementing these strategies could significantly improve road safety outcomes and reduce the burden of RTAs in Ilorin-South LGA.

Association Between Socio-Demographics and Accident Prevalence

Table 7: Association between socio demographic variables and prevalence of accident among respondents

Variables	Prevalence of accident			
	Yes (%)	**No (%)**	χ^2	p-value
Age groups			14.450	**0.008**
≤ 20	3 (27.3)	8 (72.7)		
21 – 30	72 (62.6)	43 (37.4)		
31 – 40	49 (42.2)	67 (57.8)		
41 – 50	35 (59.3)	24 (40.7)		
≥ 51	18 (62.1)	11 (37.9)		
Gender			1.807	0.179
Male	175 (54.2)	148 (45.8)		
Female	2 (28.8)	5 (71.4)		
Marital status			3.549	0.314
Single	53 (58.9)	37 (41.1)		
Married	121 (52.2)	111 (47.8)		
Separated	3 (50.0)	3 (50.0)		
Widowed	0 (0.0)	2 (100.0)		
Education			3.001	0.391
No formal education	6 (66.7)	3 (33.3)		
Primary	31 (47.7)	34 (52.3)		
Secondary	79 (58.1)	57 (41.9)		
Tertiary	61 (50.8)	59 (49.2)		
Years of experience			7.108	0.069
< 1	7 (31.8)	15 (68.2)		
1 – 2	24 (45.3)	29 (54.7)		
3 – 5	42 (56.0)	33 (44.0)		
> 5	104 (57.8)	76 (42.2)		
Tricycle ownership			13.455	**0.001**
Self	123 (61.8)	76 (38.2)		
Hire purchase	33 (41.3)	47 (58.8)		
Rented	21 (41.2)	30 (58.8)		

The analysis revealed significant associations between age, tricycle ownership, and years of experience with the prevalence of road traffic accidents (RTAs) among commercial tricyclists (Table 7). Notably, younger drivers aged 21–30 years had the highest accident rates (62.6%, p = 0.008), suggesting that inexperience and risk-taking behaviors contribute significantly to RTA occurrences. This finding aligns with existing research indicating that younger, less experienced drivers are more prone to reckless driving and slower reaction times in critical situations.

Tricycle ownership also played a key role in accident prevalence. Self-owned tricycle operators had a significantly higher accident rate (61.8%) compared to those on hired purchase (41.3%) and rental agreements (41.2%), p = 0.001. This may be attributed to the increased road exposure of self-employed drivers, who often work longer hours to maximize earnings, leading to fatigue and riskier driving behaviors.

Additionally, years of experience demonstrated an inverse relationship with accident prevalence. Tricyclists with less than one year of experience reported a lower accident rate (31.8%) compared to those with over five years of experience (57.8%). This counterintuitive finding could be explained by

greater road exposure over time, increasing the likelihood of encountering hazardous situations.

These findings suggest that targeted safety interventions should prioritize younger and self-employed tricyclists, who appear to be at the highest risk of RTAs. Implementing mandatory defensive driving courses, structured mentorship programs, and stricter regulatory measures could help mitigate these risks and improve overall road safety among commercial tricycle operators.

Association Between Risk Factors and Accident Prevalence

Table 8: Association between respondents' risk factors for road traffic accident and the prevalence of self-reported accidents

Variables	Prevalence of accident					
	Yes (%)	No (%)	χ^2	p-value	Odd ratio	95 % C I
Vehicular factors						
Functional brakes	159 (53.5)	138 (46.5)	0.012[f]	1.000	0.981	0.706 – 1.364
Indicator lights	137 (49.3)	141 (50.7)	14.217[f]	0.001	0.641	0.529 – 0.775
Tires in good condition	152 (52.4)	138 (47.6)	1.438	0.242	0.839	0.644 – 1.092
Side mirror in good condition	138 (50.2)	137 (49.8)	7.918	0.005	0.708	0.576 – 0.870
Drivers risk factors						
Drivers excessive speed	172 (62.8)	102 (37.2)	54.210	**0.001**	**7.031**	3.031 – 16.309
Phone calls while driving	155 (62.8)	92 (37.2)	32.822	**0.001**	**2.368**	1.634 – 3.431
Music and driving	157 (64.9)	85 (35.1)	46.102	**0.001**	**2.855**	1.921 - 4.243
Passenger loading	29 (46.0)	34 (54.0)	1.811	0.178	0.830	0.623 – 1.108
Alcohol drinking	142 (66.4)	72 (33.6)	39.603	**0.001**	**2.199**	1.641 – 2.947
Age below 18	111 (62.0)	68 (38.0)	11.033	**0.001**	**1.419**	1.145 – 1.758
Age above 60	81 (60.4)	53 (39.6)	5.193	0.004	*Indeterminate*	
Poor vision	137 (59.1)	95 (40.9)	9.213	**0.003**	**1.447**	1.114 – 1.879
Environmental factors						
Bad roads	162 (52.8)	145 (47.2)	1.333	0.284	0.809	0.590 – 1.111
Sunrays	148 (52.7)	131 (47.3)	0.599	0.457	0.901	0.700 – 1.160
Poor road layout	159 (52.30	145 (47.7)	2.760	0.105	0.755	0.572 – 0.997
Road block	132 (54.3)	111 (45.7)	0.174	0.708	1.050	0.832 – 1.326
Robbery	143 (57.4)	106 (42.6)	5.870	**0.021**	**1.368**	1.037 – 1.806
Harmattan haze/mist	145 (52.3)	132 (47.7)	1.154	0.297	0.867	0.678 – 1.109
Rain	140 (51.5)	132 (48.5)	2.919	0.110	0.807	0.644 – 1.011
Night driving	134 (51.3)	127 (48.7)	1.816	0.214	0.847	0.675 – 1.064
Potholes, collapsed bridges	162 (54.0)	138 (46.0)	0.175	0.705	1.080	0.744 – 1.568
Fallen trees and stray objects/animals	161 (55.3)	130 (44.7)	2.929	0.123	1.349	0.913 - 1.992
Inadequate street lighting	118 (50.0)	118 (50.0)	4.405	0.038	0.797	0.651 – 0.974
High traffic volume	99 (56.9)	75 (43.1)	1.148	0.317	1.116	0.912 – 1.366
Poor road conditions	77 (51.3)	73 (48.7)	0.007	0.933	*Indeterminate*	
Inadequate street lighting	35 (36.8)	60 (63.2)	0.011	0.916	*Indeterminate*	
High traffic volume	30 (42.3)	41 (57.7)	0.014	0.906	*Indeterminate*	

Reckless driving by other road users	48 (53.9)	41 (46.1)	1.382	0.105	0.461	0.368 – 0.577

[f]-Fishers Exact test

Logistic regression analysis identified several significant predictors of road traffic accident (RTA) occurrence among commercial tricyclists (Table 8). Among these, excessive speed emerged as the strongest predictor of RTAs, with a highly significant association ($p < 0.001$, OR = 7.03). This finding underscores the critical role of speed regulation and enforcement in reducing accident prevalence. Additionally, phone use while driving ($p < 0.001$, OR = 2.37) and alcohol consumption ($p < 0.001$, OR = 2.20) were strongly associated with an increased likelihood of accidents. These behaviors significantly impair a driver's attention and reaction time, making them more susceptible to collisions. The high prevalence of these risky behaviors highlights the urgent need for targeted awareness campaigns and stricter penalties to discourage dangerous driving practices.

Furthermore, poor vision was identified as a notable risk factor ($p = 0.003$, OR = 1.45), reinforcing the importance of mandatory vision screening for tricyclists. Regular eye examinations could help detect visual impairments that may compromise a driver's ability to safely navigate road conditions.

In addition to behavioral risks, environmental factors also contributed to accident prevalence. Robbery incidents ($p = 0.021$, OR = 1.37) and inadequate street lighting ($p = 0.038$, OR = 0.80) were found to increase accident likelihood, emphasizing the need for improved security measures and enhanced road infrastructure. These findings highlight a multifaceted approach to accident prevention, combining behavioral interventions, regulatory enforcement, and infrastructure improvements to enhance road safety for commercial tricycle operators.

DISCUSSION

Prevalence of Road Traffic Accidents (RTAs)

The findings of this study reveal a high prevalence of self-reported RTAs (53.6%) among commercial tricyclists in Ilorin-South LGA, underscoring the vulnerability of tricyclists to road accidents [14]. This figure aligns with previous studies that have documented high accident rates among informal transport operators in Nigeria. Similarly, Ibhafidon et al. [19] found that a significant proportion of commercial tricyclists in Owerri Municipal Council lacked awareness and adoption of RTA preventive measures, further contributing to accident susceptibility. The low compliance with safety measures, as observed in both studies, suggests that knowledge gaps and weak regulatory enforcement may be key contributors to the high prevalence of RTAs among tricyclists across different Nigerian regions.

Demographic and Behavioral Risk Factors

The findings of this study reaffirm that tricycle operations in Nigeria remain a male-dominated sector, with 97.9% of respondents being male, reflecting broader trends observed across the country's transport industry [20]. Additionally, a significant proportion of tricyclists were young drivers, aged between 21 and 40 years, with accident risk found to be particularly high among those aged ≤20 years ($p = 0.008$). This trend suggests that younger, less experienced drivers are more susceptible to accidents, likely due to risk-taking behaviors and inadequate driving skills. These findings highlight the urgent need for structured, mandatory driver training programs to enhance road safety and minimize accident risks among young tricyclists [21].

Substance use also emerged as a significant behavioral risk factor in this study, particularly the high prevalence of alcohol consumption among tricyclists (64.8%). This aligns with findings by Kosen et al. [22], who established a strong association between tramadol abuse and road traffic crashes among commercial tricyclists in Jos Metropolis. Their study revealed that tricyclists who abuse tramadol are more vulnerable to road accidents, further emphasizing the role of substance use in impaired judgment and increased accident risk. The presence of both alcohol and drug use among tricyclists across different Nigerian cities [23-26] suggests the need for strict regulatory interventions, including random drug and alcohol testing, as part of licensing and road safety enforcement efforts.

Furthermore, personality traits and reckless driving behaviors have been identified as additional risk

factors influencing accident occurrence. Shaapera et al. [27] found that certain personality traits, including impulsivity and aggression, were predictive of reckless driving among commercial tricyclists in Borno State. This finding complements the present study's evidence on excessive speeding (83.0%) and phone use while driving (74.8%) as major RTA risk factors. Given that reckless driving behaviors are often linked to individual personality traits and risk perception, behavioral modification programs should be integrated into driver training curricula to address these tendencies and promote responsible driving habits.

A particularly concerning revelation was that 60.3% of respondents lacked valid driving licenses, underscoring serious gaps in regulatory enforcement [28]. The absence of proper licensing not only raises questions about driver competency but also indicates potential weaknesses in traffic law enforcement and compliance monitoring. Strengthening licensing regulations and ensuring stricter enforcement could play a critical role in reducing accident prevalence and improving overall transport safety within the tricycle sector.

Policy Recommendations for Enhancing Tricycle Road Safety

Based on the findings of this study and insights from previous research, several policy interventions are recommended to improve road safety and reduce the prevalence of road traffic accidents (RTAs) among commercial tricyclists in Nigeria.

One of the most crucial interventions is the implementation of mandatory safety training programs for all commercial tricyclists. These programs should focus on defensive driving techniques, risk management, and behavioral modification strategies to reduce reckless driving tendencies. The need for such training is further reinforced by the findings of Shaapera et al. [27], which highlighted the influence of personality traits on reckless driving behaviors. A structured training curriculum that incorporates behavioral assessments and risk awareness can help instill responsible driving habits among tricyclists, ultimately reducing accident rates.

Another pressing concern is the lack of proper licensing and regulatory enforcement within the commercial tricycle sector. With 60.3% of respondents in this study lacking valid driving licenses, it is imperative to strengthen enforcement mechanisms to ensure that all tricyclists undergo proper certification before operating. A more stringent licensing framework should be implemented, incorporating both theoretical and practical assessments to verify driver competence. Enforcing these measures will enhance compliance with traffic regulations and minimize the presence of untrained drivers on the road.

Given the high prevalence of substance use among commercial tricyclists, stricter monitoring and regulation of drug and alcohol consumption is necessary. This study found that 64.8% of respondents admitted to consuming alcohol while driving, a finding that aligns with most the local studies [22-27], which established strong correlations between drug/substance abuse and road traffic crashes among commercial tricycle operators in different parts of Nigeria. To address this issue, random drug and alcohol testing should be introduced as a mandatory component of licensing and traffic law enforcement. Additionally, awareness campaigns should be launched to educate tricyclists on the dangers of substance-impaired driving and its consequences on road safety.

The mechanical condition of tricycles also plays a vital role in accident prevention. This study identified mechanical failures, including brake malfunctions and tire wear, as significant accident contributors. To mitigate this risk, regular vehicle maintenance inspections should be mandated for all commercial tricycles. These periodic checks will ensure that critical components such as brakes, tires, and lighting systems remain in optimal condition, reducing the likelihood of crashes caused by mechanical defects.

Finally, improvements in road infrastructure are essential to creating a safer operating environment for commercial tricyclists. Poor road conditions, including potholes, inadequate street lighting, and poorly marked roads, were frequently cited as risk factors for RTAs. This aligns with the findings of Ibhafidon et al. [19], who emphasized the need for infrastructural improvements to minimize accident risks among tricyclists in Owerri. Addressing these deficiencies requires investment in better street lighting, prompt pothole repairs, and enhanced road

markings, particularly in accident-prone areas. By improving road quality and visibility, the risk of night-time accidents and collisions can be significantly reduced.

By implementing these evidence-based policy measures, Nigeria can enhance the safety conditions for commercial tricyclists, reduce accident prevalence, and promote a more sustainable urban transport system. A collaborative effort between policymakers, law enforcement agencies, transport unions, and public health officials will be necessary to enforce these interventions and foster a culture of safety and compliance among tricycle operators.

CONCLUSION

This study highlights the urgent need for structured interventions to enhance tricycle safety in Nigeria. By addressing gaps in training, licensing, vehicle maintenance, and road safety enforcement, the risk of RTAs among commercial tricyclists can be significantly reduced, ultimately improving urban transport safety. The integration of findings from previous studies further underscores the multifaceted nature of accident causation, emphasizing the need for behavioral, infrastructural, and regulatory interventions to ensure a safer tricycle transport system.

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