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RESEARCH ARTICLE

Road traffic accidents, near-misses and their associated factors among commercial tricycle drivers in a Nigerian city

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Abstract: Tricycles form an important part of the intra-city transport system, following the ban placed on motorcycles in Maiduguri, Nigeria. However, no previous studies have been conducted to assess the occurrence of accidents among them. The objective of this study was to determine the prevalence of road accidents, near-misses, and their associated factors among commercial tricycle drivers in Maiduguri. A cross-sectional study was conducted among registered commercial tricycle drivers in Maiduguri who had been in the business for at least a year. Data was collected through face-to-face interviews, using a structured questionnaire, and was subjected to bivariate and multivariate analysis using SPSS. The prevalence of road accidents and near misses were 46% and 50.3% respectively. Only six (3.9%) of respondents who had experienced a near-miss mentioned that they occurred while they were fully awake; during clear weather; and on a smooth, broad, and non-congested road. All the others had experienced the near miss under an unfavourable weather, road, and/or while feeling sleepy. In the bivariate analysis, only psycho-active substance use (χ^2=3.941; df=1; p=0.047) and having experienced more than one near miss (χ^2=31.807; df=1; $p<0.001$) were significantly associated with having an accidents. However, in the multivariate analysis, having experienced more than one near miss was the only factor which significantly predicted having an accident (OR=2.89 95% CI: 1.64-5.09; $p<0.001$). There is a need to conduct further intervention studies to determine the effectiveness of intervention measures in reducing accident rates among these tricycle drivers.

Keywords: road accident, near-miss, tricycle, vehicular factors, driver factors

1 Introduction

The morbidity and mortality burden from road traffic accidents (RTAs) in developing countries has been on the increase[1]. In almost all countries in Africa, Asia and Latin America, road traffic crashes have become one of the leading causes of deaths in older children and economically active adults between the ages of 30 and 49 years[2]. They also cost these countries 1–2% of their gross national product (GNP) yearly, from premature death, disability, medical expenses, loss of productivity, and material damages[3] . The World Health Organization (WHO) and World Bank estimate that within the next two decades, the rate of fatal traffic crashes in high income countries would be reduced by as much as 28%; however, in low and middle income countries, the fatal crash rate will increase by nearly 92% to 147%[4,5]. In Nigeria, the main victims of RTAs are pedestrians, cyclists and public transport passengers[6]. Nigeria loses about 80 billion naira annually to road accidents, and of all persons involved in road traffic accidents in Nigeria, 29.1% suffer disability, while 13.5% are unable to return to work[2,7].

Road traffic accidents (RTA) are accidents which happen on the road between two or more objects, one of which must be any kind of moving vehicle[8]. There have been attempts to explain the occurrence of road accidents using theories. The systems theory is based on the concept of risks and man-environment adjustments and maladjustments[9]. The components of the theory are the environment, the means of transport and the behaviour of man[10]. Driver factors in road traffic accidents are all factors related to drivers and other road users which include their socio-demographic characteristics, physiological factors and behavioural factors[11]. In a study among motor drivers in the College of Medicine, Ibadan, vehicular mechanical faults had been reported in 50% of reported accidents[12]. Risk factors such as poor ve-

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hicle maintenance (including tyres, brakes, and lights) and driving old vehicles were also identified in Ethiopia and Libya[13, 14]. Road conditions (construction, surface, wet or dry), obstacles (*e.g.* debris on the road) and the landscape near the road were reportedly major contributors to RTAs[15]. A study among commercial drivers in a city in South-southern Nigeria showed that the drivers perceived that the nature of the road; time of the day; and weather, were some of the major contributory factors to road accidents[16]. Chocked roads were also reportedly associated with higher risks of a road traffic crash in Libya[17].

Near-miss has been defined as sudden braking and rapid steering operations by the driver without resulting in an accident[18]. They have also been defined as a detected event that has not caused any harm, and therefore has limited immediate impact[19]. The use of a 'scale of danger' was suggested for determining near-miss accidents, and proposed for this 'danger scale' is the 'time-measured-to-collision' (TMTC) between two vehicles involved in an unsafe event[20]. One second had been concluded as a good TMTC threshold for defining near-miss accidents. Near-misses had also been pointed out to constitute the major determinant of workplace level of safety, with several near-misses preceding the occurrence of an actual accident. In a similar light, near-misses on our roads could serve as a very good determinant of the level of road safety as they have been reported to be important predictors of actual driving accidents[21]. The odds of reporting at least one actual accident was about twice (OR=1.13; 95% CI: 1.10-1.16) among those reporting four or more near-miss sleepy accidents[19].

Motorcycles are a part of the essential mode of transportation in most developing countries and pose the greatest risk of serious injury or death compared to other means of transportation[22]. A similar state could be said of Maiduguri, until a total ban was placed on motorcycles in the year 2011, after which they gradually got replaced with tricycles. There is need to view RTAs as an issue of urgent national importance that needs urgent attention aimed at reducing the health, social, and economic impact[23]. However, relevant information needed for such policy making and for relevant interventions are lacking. No road traffic accident studies have been conducted among tricycle drivers in Nigeria. There have also been no studies on near-miss driving accidents, and it is not even captured in the Annual Report of the Federal Road Safety Commission (FRSC).

The objective of this study was to determine the prevalence of accidents and near-misses and their associated factors among commercial tricycle drivers in Maiduguri, North-eastern Nigeria. With the prevailing paradigm shift of focus from disaster management to disaster risk reduction, an effort to investigate the occurrence of near-misses and actual driving accidents associated with a very important means of commercial transport (tricycles) on our roads seems logical. The results of this study would objectively reveal the level of road safety in Maiduguri, and the role played by certain factors in determining road safety. This would guide the development of evidence-based road traffic accident intervention programmes which would further improve the present observed trend.

2 Materials and Methods

This study was conducted in Maiduguri, the Borno state capital, located in North-eastern Nigeria. Borno state is located between latitudes 10°30' and 13°50' north and longitudes 11.00° and 13°45' east, with a total land area of 69,435 km^2[24]. It has a population of 540,016 consisting of 282,409 males and 257,607 females[25]. It is a cosmopolitan town consisting of the indigenous ethnic group, the Kanuris and other ethnicities from the state and other states in northern Nigeria and even other parts of the country. An image of a tricycle is presented in Figure 1.

Figure 1. Image of a tricycle (Source: Google images)

A cross-sectional study design was used for this research. The study population was commercial tricycle drivers, operating within Maiduguri metropolis, Borno State, Nigeria. The criteria for inclusion into the study were: to be a registered commercial tricycle driver operating within Maiduguri metropolis, and must have been in the work for at least a year.

The sample size for this study was calculated using the one-proportion formula, and an anticipated proportion of the respondents who had experienced a road traffic accident which was taken as 0.68, from the study among commercial motorcycle drivers in Uyo, Nigeria[26]. This gave a required sample size of 335 participants. To en-

sure representativeness, a multi-stage random sampling was utilized to recruit participants, and the process is illustrated in Figure 2. Five wards were selected at random from the list of wards in Maiduguri, from each of which three units were selected.

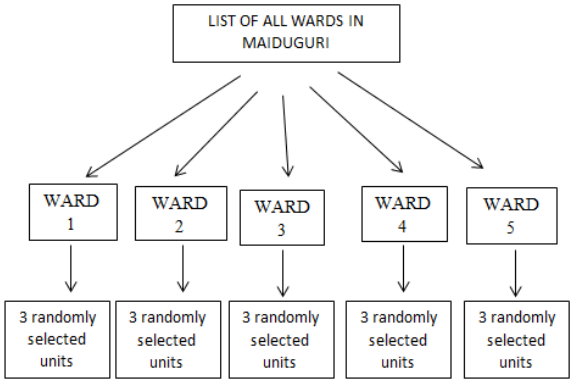

Figure 2. Sampling process for the recruitment of respondents

The dependent variables in this study were near-misses and driving accidents. The independent variables were: socio-demographic factors; vehicular factors and driver factors. Validated bi-lingual (English and Hausa languages) questionnaire was used for data collection. The items of the questionnaire were developed from extensive review of publications of the FRSC and other relevant research articles. It was first developed in English language and then translated into Hausa language by a senior University academic staff of the Hausa Language Department. The questionnaire consisted of six broad sections: socio-demography, physiological factors, driver behavioural factors, vehicular factors, diver factors and environmental factors.

Due to low literacy rates, questionnaires were administered as face-to-face interviews. A person with educational background up to Diploma level was engaged to serve as an enumerator. Two to three training sessions were held for the enumerator to ensure a good grasp of the contents of the questionnaire; and training on how to avoid interviewer bias. Content validity was assessed using an expert group[27] who went through the questionnaire to ensure that wordings of its items are clear and that they represented their content domain.

Data analysis was performed with Statistical Package for Social Sciences (SPSS) version 22. Categorical data were summarized as frequency and percentage. Chi-squared test was used to test the association between each categorical independent variable and the dependent variable. Variables with significance value at or less than 0.25 Level of significance was set at 0.05, with 95% Confidence Interval. Approval and ethical clearance to carry out this study was obtained from the National Commercial Tricycle and Motorcycle Owners and Riders Association (NACTOMORAS) office in Maiduguri. Informed consent was also obtained from each respondent before completing the questionnaire.

3 Results

Data collection for this study was carried out within the month of August, 2017. A total of 301 questionnaires were completed of which one was invalid to due gross missing data rendering it useless for analysis. This gave a total of 300 questionnaires to be included in the final analysis (a response rate of 89.6%).

3.1 Socio-demographic characteristics of the respondents

The socio-demographic characteristics of the respondents is presented in Table 1. Their ages ranged from 12 to 44 years with mean(SD) of 24.7(6.2) years. All of them were males, with Hausa being the most predominant ethnicity (29.3%). Less than a fifth of them had no form of formal education (18.7%). Ninety five (31.7%) of the respondents also reported having problems with their vision.

Table 1. Socio-demographic characteristics of the respondents

Socio-demography	n = 300	Freq. (%)
Ethnicity		
Kanuri	61	20.30
Hausa	89	29.30
Babur	32	10.70
Shuwa	21	7.00
Marghi	18	6.00
Fulani	40	13.30
Yoruba	13	4.30
Others	23	7.70
Missing	3	1.00
Total	300	100.00
Marital status		
Single	163	54.30
Married	133	44.30
Missing	4	1.30
Total	300	100.00
Level of education		
None	56	18.70
Primary	46	15.30
Secondary	134	44.70
Tertiary	61	20.30
Missing	3	1.00
Total	300	100.00

3.2 Vehicular and driver behavioural characteristics

For each of the vehicular characteristics assessed in this study, around a fifth of the respondents reported hav-

ing problem with them, as presented in Table 2, with 17.7% of them reporting having faulty brakes. Table 3 shows the distribution of driver behavioural factors. Over seventy per cent of them engaged in dangerous driving practices, though at different frequency levels. Thirty eight per cent reported taking kola nuts while 24% reported taking some psycho-active substances like cannabis.

Table 2. Vehicular characteristics

Variables	n = 300	Freq. (%)
Functional brakes		
Yes	247	82.30
No	53	17.70
Total	300	100.00
Indicator lights		
Yes	236	78.70
No	63	21.00
Missing	1	0.30
Total	300	100.00
Tyres in good condition		
Yes	225	75.00
No	64	21.30
Missing	11	3.70
Total	300	100.00
Side mirrors in good condition		
Yes	240	80.00
No	58	19.30
Missing	2	0.70
Total	300	100.00

3.3 Road traffic crashes and near-misses

One hundred and thirty eight (46%) and 151 (50.3%) respectively of the respondents, had been involved in at least one road traffic crash or near-miss accident during the previous one year while driving their tricycles as shown in Figure 3. As presented in Table 4, a large number of the near-misses had occurred while they were using their phones (45.7%) and under dusty or rainy weather (63.6%). A sizeable proportion also occurred on rough and pot-holed roads (40.4%), narrow (43.0%) and congested roads (50.3%).

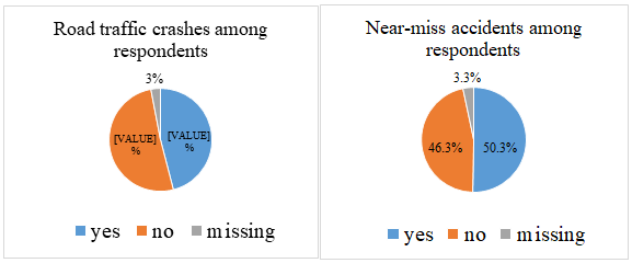

Figure 3. Road traffic crashes and near-miss accidents among respondents

3.4 Factors associated with the occurrence of an accident

Association between driver characteristics and vehicular factors, with accident occurrence are presented in Table 5 and 6. The responses for driver behavioural factors were collapsed into two levels ('always', 'often', and 'sometimes' collapsed into one category, 'yes'; and 'never' classified as another category, 'no') before running the chi-squared test. Only psycho-active substance

Table 3. Driver behavioural characteristics

Variables	n = 300	Freq. (%)
Exceeding speed limits		
Always	50	16.70
Often	86	28.70
Sometimes	122	40.70
Never	36	12.00
Missing	6	2.00
Total	300	100.00
Using phone while driving		
Always	31	10.30
Often	93	31.00
Sometimes	106	35.30
Never	66	22.00
Missing	4	1.30
Total	300	100.00
Playing music while driving		
Always	77	25.70
Often	58	19.30
Sometimes	80	26.70
Never	81	27.00
Missing	4	1.30
Total	300	100.00
Passenger loading		
Two	14	4.70
Three	50	16.70
Four	210	70.00
Five and above	24	8.00
Missing	2	0.70
Total	300	100.00
Wrongful overtaking		
Always	29	9.70
Often	72	24.00
Sometimes	123	41.00
Never	64	21.30
Missing	12	4.00
Total	300	100.00
Kola-nut		
Yes	114	38.00
No	182	60.60
Missing	4	1.30
Total	300	100.00
Alcohol and other psycho-active substances		
Yes	72	24.00
No	222	74.00
Missing	6	2.00
Total	300	100.00

use (χ^2=3.941; df=1; p=0.047) and having experienced more than one near miss (χ^2=31.807; df=1; p<0.001) were significantly associated with having an accidents.

Table 4. Conditions under which the near-miss occurred

Variables	n = 151	Freq. (%)
Using your phone		
Yes	69	45.70
No	78	51.70
Missing	4	2.60
Total	151	100.00
Sleeping		
Fully awake	55	36.40
Slightly tired	28	18.50
Very tired	31	20.50
Exhausted	16	10.60
I cannot remember	15	9.90
Missing	6	4.00
Total	151	100.00
Weather condition		
Dusty	41	27.20
Rainy	55	36.40
Clear weather	51	33.80
Missing	4	2.60
Total	151	100.00
Road surface		
Smooth	88	58.30
Rough and pot-holed	61	40.40
Missing	2	1.30
Total	151	100.00
Road width		
Narrow	65	43.00
Broad enough	77	51.00
Missing	9	6.00
Total	151	100.00
Road congested		
Congested	76	50.30
Not congested	60	39.70
Missing	15	9.90
Total	151	100.00

For the multivariate logistic regression, the model fitted the sample, evidenced by a Hosmer-Lomeshow significance value of 0.778. The Negelkerke's R square also showed that the model explained about 9.8% of the accident occurrence. Having experienced more than one near miss was associated with thrice the odds of having an accident (OR=2.89 95% CI: 1.64-5.09; p<0.001) (Table 7).

4 Discussion

It was hypothesized that a complex of socio-demographic factors, driver factors, vehicular factors and road environmental factors predispose to accidents and near-misses. Engagement in risky practices like using the phone while driving; exceeding speed limits; playing music while driving; wrongful overtaking and overloading of passengers were quite high among the respondents. Young age has reportedly been associated with such practices[28,29], and could be the likely reason for the high prevalence of these risky behaviours among the respondents, as only 47% of them were above thirty years of age. Though these practices didn't show significant association with near-misses or accidents in this study, other studies have demonstrated their significant role in the occurrence of accidents[26,30]. The significant association between psycho-active substance use and accidents were in keeping with previous findings among commercial drivers in a motor park in Port-Harcourt, Nigeria, though not significant in multivariate analysis[31]. Near miss was a predictor of having an actual accident, similar to findings in a previous study[19].

As for the conditions under which the near-misses occurred, only six of those who had experienced a near-miss (3.97%) mentioned that they occurred while they were fully awake; during clear weather; and on a smooth, broad, and non-congested road. All the others had occurred under an unfavourable condition of at least one of these variables. These agree with previous findings of a positive association between sleepiness with both near-miss and actual accidents[19], and other reports of poor road environmental states as factors in the causation of road traffic accidents[17,30,32]. That the model only explains around 10% of the outcome variable (accidents), further buttresses the complex nature behind accident occurrence, and the possibility of many other predictor factors yet to be explored.

Some limitations of the study include its reliance on self-reporting, for data on vision problem, instead of visual acuity test. Also, this study utilized a cross-sectional study design, making it difficult to ascertain the temporal relationship between the variables. For example, it cannot be categorically concluded that the psycho-active substance use by a respondent pre-dated the accident he experienced.

In conclusion, this study reveals the existence of a high burden of road accidents and near-misses among commercial tricycle drivers in Maiduguri, Nigeria. It is as such recommended for the FRSC and relevant organizations like the NACTOMORAS, to raise awareness among tricycle users and the general public of the high burden of this problem. This can be done by organizing workshops and trainings for tricycle drivers as well as awareness campaigns through the media. This measure is likely to stimulate a conscious effort by the tricycle drivers to adopt safety measures. Vehicles and drivers should also be screened to ensure they meet the minimum standards, before being registered to start the business. Further research should also be conducted to develop, implement and assess the effectiveness of certain interventions in reducing the burden of this problem.

Table 5. Association between driver characteristics and the occurrence of accident

Variables	History of accident		χ^2	*df*	*p*
	Yes n (%)	No n (%)			
Marital status			0.006	1	0.94
Single	75 (54.7)	82 (54.3)			
Married	62 (45.3)	69 (45.7)			
Education level			2.710	3	0.438
None	28 (20.7)	26 (17.0)			
Primary	24 (17.8)	21 (13.7)			
Secondary	59 (43.7)	69 (45.1)			
Tertiary	24 (17.8)	37 (24.2)			
Visual problems			3.146	1	0.076
Yes	49 (35.8)	40 (26.1)			
No	88 (64.2)	113 (73.9)			
Excessive speed			0.264	1	0.608
Yes	117 (86.7)	133 (88.7)			
No	18 (13.3)	17 (11.3)			
Using phone			1.437	1	0.231
Yes	110 (80.9)	114 (75.0)			
No	26 (19.1)	38 (25.0)			
Wrongful overtaking			0.159	1	0.69
Yes	104 (78.2)	112 (76.2)			
No	29 (21.8)	35 (23.8)			
Overloading			0.844	1	0.358
Yes	105 (76.6)	124 (81.0)			
No	32 (23.4)	29 (19.0)			
Kolanuts			0.567	1	0.451
Yes	56 (41.2)	56 (36.8)			
No	80 (58.8)	96 (63.2)			
Total	136 (100)	152 (100)			
Psycho-active			3.941	1	0.047
Yes	40 (29.9)	30 (19.7)			
No	94 (70.1)	122 (80.3)			
Near-miss					
Once or never	51 (43.2)	105 (77.8)	31.807	1	<0.001
More than once	67 (56.8)	30(22.2)			

Table 6. Association between vehicular factors and the occurrence of accident

Variables	History of accident		χ^2	*df*	*p*
	Yes n (%)	No n (%)			
Functional brake			0.049	1	0.825
Yes	115 (83.3)	126 (82.4)			
No	23 (16.7)	27 (17.6)			
Total	138 (100)	153 (100)			
Indicator lights			0.549	1	0.459
Yes	112 (81.2)	118 (77.6)			
No	26 (18.8)	34 (22.4)			
Total	138 (100)	152 (100)			
Good tyres			0.822	1	0.365
Yes	101 (75.9)	119 (80.4)			
No	32 (24.1)	29 (19.6)			
Total	133 (100)	148 (100)			
Good mirrors			0.535	1	0.465
Yes	108 (78.8)	125 (82.2)			
No	29 (21.2)	27 (17.8)			
Total	138 (100)	153 (100)			

Table 7. Predictors of having an accident

Factors	B	SE	Wald	*df*	*p*	Adjusted OR	95% CI
Using phone while driving							
No						1	
Yes	0.38	0.33	2.31	1	0.26	1.46	0.76-2.81
Visual problems							
No						1	
Yes	0.07	0.32	0.05	1	0.83	1.07	0.57-2.00
Psycho-active substance use							
No						1	
Yes	0.55	0.36	2.40	1	0.12	1.74	0.86-3.48
Near misses							
No						1	
Yes	1.06	0.29	13.40	1	<0.001	2.89	1.64-5.09

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Competing interests

None declared.

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