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Research article

Awareness and practices of commercial motorcyclists regarding motorcycle crash-related risk factors and protective measures in Mbeya, Tanzania

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Abstract: An increase in number of motorcycles in Tanzania has resulted in higher rates of motorcycle crashes. The factors associated with the risk of motorcycle crashes include rider characteristics, riding behavior, and riding experience. This study aimed to determine the awareness and practices of commercial motorcyclists regarding motorcycle crash-related risk factors and protective measures in Mbeya, Tanzania. This cross-sectional study targeted 404 commercial motorcyclists in Mbeya, Tanzania. Data were collected using a questionnaire composed of questions on sociodemographic characteristics, and the awareness and practices of motorcyclists regarding motorcycle crash-related risk factors and protective measures. The SPSS computer software version 27 was used for data analysis. For descriptive analysis means, and proportion were used. The outcome variables were level of awareness and degree of practice. Multivariate regression analysis was utilized to analyze how participants' sociodemographic characteristics influenced their level of awareness and degree of practice. A p-value of less than 0.05 was considered statistically significant. Overall, most (63.4%) participants had a high level of awareness regarding motorcycle crash-related risk factors and protective measures. Whereas, slightly more than half (52.2%) of participants had poor practice. Working experience of < 2 years as a commercial motorcyclist, training in driving teaching institutes, and a history of being involved in motorcycle crashes increased the odds of a high level of awareness by 2-fold. A higher level of education and higher levels of awareness increased the likelihood of good practice by 157% and 184% respectively. Though most commercial motorcyclists have a good level of awareness regarding motorcycle crash-related risk factors and protective measures their practices were not satisfactory. The authorities should consider integrating road safety measures in school programs, use mass media to educate society on road safety, and introduce incentives such as free training for commercial motorcyclists.

Keywords: commercial motocyclists, motorcycle crash, protective measures, risk factors, Tanzania

1 Introduction

Tanzania is experiencing rapid urbanization as it is in other African countries. Most of the increase in urban population is occurring in small- and medium-sized cities (Güneralp et al., 2018; Sohal et al., 2022). With rapid urbanization, several challenges including unemployment and the transportation needs of citizens are unavoidable (Nzuchi et al., 2022). Thus, in efforts to overcome this, commercial use of motorcycles, commonly referred to as bodaboda, has become a common means of transport and source of employment in many parts of Tanzania (Moshy et al., 2020; Owibingire et al., 2018). The popularity of 'bodaboda' has partly been due to its fast nature and easy navigation within poorly planned urban road networks and its low cost of maintenance (Owibingire et al., 2018; Agbor et al., 2014; Ndagire et al., 2019).

It had been estimated that between 2003 and 2016, almost 1.2 million motorcycles were registered in Tanzania, with the number expected to increase yearly (Luambano, 2020). An increase in the number of motorcycles in Tanzania has led to a rise in motorcycle crashes (MCC), thus, responsible for a significant number of motor vehicle crash-related hospital admissions and deaths each year (Nzuchi et al., 2022). As cited by Salum et al. (2019), the traffic police reports in Tanzania in 2016 showed that motorcycle crashes were the leading cause of fatalities (27.5%) and injuries (26.4%) compared to other modes of transportation. Considering this, motorcycle crash injuries are considered an epidemic for the current society, thus a public health concern (Moshy et al., 2020).

To reduce the number of motor traffic crashes in Tanzania, the government has put forward several strategies. These include improvement in the traffic environment, and provision of education and reliable information to the road users, especially drivers. Yet still, the country experiences MCCs (Moshy et al., 2020; Nzuchi et al., 2022). Moreover, motorcycle riders are responsible for the majority of Motor Traffic Crash (MTC) related injuries and deaths (Raga et al., 2023).

Several studies investigating factors associated with the risk of motorcycle crashes have pointed to rider characteristics, riding behavior, riding conditions, and riding experience (Raga et al., 2023; Möller et al., 2020). Recent reports from Tanzania have depicted that only 39.7% of commercial motorcyclists reported having a good level of compliance with road safety measures (Nzuchi et al., 2022). A previous study noted that there is no strict enforcement of existing traffic laws such as the inspection and verification of driving licenses due to police corruption (Nguyen et al., 2018). Such findings call for a need to understand the readiness of motorcyclists to practice various preventive measures against MCC. Therefore, it is of utmost importance to assess the commercial motorcyclists' current level of awareness and practices related to risk factors and preventive measures for motorcycle crashes. This study was anticipated to give baseline information on the subject of concern and hence aid in influencing policies regarding commercial motorcyclists in Mbeya and Tanzania in general. The policies should target commercial motorcyclists' behaviors and education by planning the best approaches to implement various strategies to reduce MCC in the country. The present study was conducted to determine commercial motorcyclists' awareness and practices regarding motorcycle crash-related risk factors and protective measures in Mbeya, Tanzania.

2 Methods

2.1 Study design, setting, and population

This cross-sectional study included commercial motorcyclists at registered parking stations in Mbeya, Tanzania. The survey was conducted between December 2020 and March 2021. The inclusion criteria were all commercial motorcyclists aged 18 and above willing to participate and provided informed consent. Exclusion criteria were the commercial motorcyclists who did not complete the form for one reason or another and those who appeared drunk during data collection.

The population adjustment formula for single-proportion was applied to estimate the sample size (Charan & Biswas, 2013). A minimum sample size of 384 participants was calculated based on a 95% confidence level, a precision of 5%, and an expected proportion of 50%, however, a total of 420 participants were recruited. A convenience sampling method was adopted, whereby all commercial motorcyclists present at their street stations (MPS) were approached and recruited until the calculated sample size was obtained. Since there are multiple registered parking stations on each street, the streets were randomly selected (from the prepared list of streets). Each selected street was visited during the day of data collection and surveyed

to ascertain the number of registered parking stations, from each street 2 parking stations were taken by random selection, and all the motorcyclists who were available at the time of data collection were recruited upon consenting. The process of sampling continued till the required sample size was reached.

2.2 Data collection methods and technique

A close-ended questionnaire developed in English and later translated into Swahili was used for data collection. An independent translator later back-translated the Swahili version of the questionnaire into English to ascertain consistency with the original version. The questionnaire used was composed of questions inquiring about the sociodemographic characteristics of the participants (age, sex, marital status, level of education, alcohol use during working hours, and cigarette smoking currently) and questions inquiring about motorcycle riding details (duration of training to ride a motorcycle, mode of training, time taken to start working as commercial motorcyclist after training, experience of working as commercial motorcyclist, history of motorcycle accident, possessing a valid driving license and average riding speed on daily-basis). There were 20 questions on awareness regarding motorcycle crash-related risk factors and protective measures and 13 practice-related questions. The awareness questions were measured in the 'agree/disagree' format, while practice questions were measured using the 'yes/no' format. Each correct response was allocated 1 point. The researchers developed the set of questions used in this study. To ascertain the validity and reliability of the questions, a pilot study was carried out among 25 commercial motorcyclists in Dar es Salaam Tanzania.

During the day of data collection, the questionnaires were administered to the participants to fill in their responses. The researcher was always available to ensure the participants were not discussing the answers. For a few who could not read and write, the researcher interviewed them and recorded their response on the questionnaire.

2.3 Data handling and Statistical analysis

The Statistical Package for Social Sciences software (SPSS) for Windows (version 27, Armonk, New York: IBM Corp) was used to code and analyze the data. For descriptive analysis means, standard error of the mean (SEM), median, and proportion were used.

The participants' age was categorized as young adults (18–34 years) and middle-aged (35–59 years). The level of education was dichotomized into a low level (no formal and primary education) and a high level (secondary and tertiary education). Marital status was grouped into those with partners (married, cohabiting) and those without partners (single, divorced, widowed).

The duration of training was categorized into < 2 weeks, 2–4 weeks, and ≥ 1 month. The time taken to ride commercial bikes after completing training was dichotomized as ≤ 1 week and > 1 week. The experience as a commercial motorcyclist was dichotomized into ≤ 2 years and > 2 years. The mode of training was grouped as non-institutional (self-trained and trained by friends) and institutional (trained in a driving school) and average riding speed was categorized as safe speed (≤ 40 km/hr) and high speed (> 40 km/hr).

Total scores were calculated respectively for questions related to awareness and practices by adding up the number of preferred responses to the questions. The cut-off point between high level and low level of awareness, and good and poor practice domains was decided based on the sample mean points for each domain. The cut-off point for a high level of awareness was ≥ 16 points (a score below 16 was considered low level of awareness), and for good practice, it was ≥ 8 points.

For univariate analysis, a chi-square test was carried out to assess factors associated with a high level of awareness, and good practices with respect to motorcycle crash-related crash-related risk factors and protective measures. The probability level of $\alpha < 0.05$ was selected for statistical significance. Multivariate logistic regression was used to assess the strength of the association between the predictor variables and high level of awareness and good practices towards motorcycle crash-related crash-related risk factors and protective measures. All predictor factors with a p-value of < 0.1 on univariate analysis, were included in the multivariate logistic regression model. The p-value and 95% confidence interval (CI) for the adjusted odds ratio (AOR) were used to confirm the significance of the association.

Table 1 Distribution of study participants according to sociodemographic characteristics

Sociodemographic characteristic		Frequency (N)	Percentage (%)
Age groups	Young adults	349	86.4
	Middle-aged adults	55	13.6
Sex	Female	1	0.2
	Male	403	99.8
Education level	Informal education	45	11.1
	Primary	122	30.2
	Secondary	194	48.0
	Tertiary	43	10.7
Marital status	Without partner	243	60.1
	With partner	161	39.9
Cigarette smoking currently	No	238	59.9
	Yes	166	41.1
Alcohol use during working hours	No	213	52.7
	Yes	191	47.3

3 Results

3.1 Characteristics of the study population

Of the 420 participants recruited, 404 (96.2%) returned were eligible to be included in this study. Of these, all except one participant was female. The participants' ages ranged from 18 years to 51 years with a mean age of 27.48 (SEM = 0.3). A majority (N = 349, 86.4%) were young adults and most (N = 237, 58.7%) had attained a minimum secondary level of education. Overall 243 (60.1%) participants had no partner. 166 (41.1%) participants reported smoking cigarettes, while 191 (47.3%) used alcohol (Table 1).

3.2 Details about motorcycle riding

Majority (N = 307, 76.0%) of participants were trained by a friend to ride the motorcycle. A half (N = 202, 50.0%) of the participants trained for less than 2 weeks. After training, participants started working as commercial motorcyclists within 1 day to 90 days (median = 7 days). The duration of participants riding commercial motorcycles ranged from 2 weeks to 10 years with a median time of 36 months (3 years). Most (N = 280, 69.3%) participants had a driving license, and slightly more than half (N = 229, 56.7%) had a history of being involved in a motorcycle crash as a commercial motorcyclist. The participants reported that their riding speed ranged from 20 km/hrs to 70 km/hrs, with a mean speed of 44.9 km/hrs (SEM = 0.44 km/hrs) (Table 2).

The mode of training was significantly associated with duration of training ($p < 0.001$), time taken to work as a commercial motorcyclist after training ($p < 0.001$), and possession of a driving license ($p = 0.001$). Majority of self-trained commercial motorcyclists trained for a shorter duration compared to their counterparts, while most of those who were trained by friends took less than 2 weeks to work as commercial motorcyclists. Majority of graduates of the training institutes possessed a driving license (Table 2).

3.3 Awareness regarding motorcycle crash-related risk factors and protective measures

The total awareness score ranged between 8 to 20 points, with a mean of 16.5 (SEM = 0.12) points. While a majority (> 90%) were aware of various risk factors for motorcycle crashes, very few were aware of riding under excessive sunlight (N = 117, 29.0%) followed by riding while tired (N = 241, 59.7%). Though the participants were aware of protective measures against motorcycle crashes, wearing gloves and wearing reflective clothes were the least known measures (Table 3).

3.4 Practice of measures against motorcycle crashes

The total score range for good practice was between 3 and 12 points, with a mean of 7.42 (SEM = 0.08) points. The most common preferred response to

Table 2 Distribution of study participants according to the mode of training in relation to various motorcycle riding details

Various details of commercial motorcyclists		Mode of training			p-value
		Self (n = 24)	Friend (n = 307)	Institution (n = 73)	
Duration of training	< 2 weeks	17 (70.8%)	176 (57.3%)	9 (12.3%)	< 0.001
	2–4 weeks	6 (25.0%)	124 (40.4%)	49 (67.1%)	
	> 1 month	1 (4.2%)	7 (2.3%)	15 (20.5%)	
Time taken to ride commercial bikes after completing training	≤ 1 week	14 (58.3%)	195 (63.5%)	22 (30.1%)	< 0.001
	> 1 week	10 (41.7%)	112 (36.5%)	51 (69.9%)	
Experience as a commercial motorcyclist	≤ 2 years	9 (37.5%)	149 (48.5%)	29 (39.7%)	0.268
	> 2 years	15 (62.5%)	158 (51.5%)	44 (60.3%)	
Average daily riding speed	Safe speed	12 (50.0%)	131 (42.7%)	36 (49.3%)	0.499
	High speed	12 (50.0%)	176 (57.3%)	37 (50.7%)	
Driving license possession	No	6 (25.0%)	108 (35.2%)	10 (13.7%)	0.001
	Yes	18 (75.0%)	199 (64.8%)	63 (86.3%)	
History of motorcycle crash as a motorcyclist	No	10 (41.7%)	131 (42.7%)	34 (46.6%)	0.821
	Yes	14 (58.3%)	176 (57.3%)	39 (53.4%)	

Table 3 Distribution of study participants according to preferred response to the question regarding awareness towards risk factors for motorcycle crash

Question	Preferred response	Frequency (N)	Percentage (%)
The following are considered to be risk factors for motorcycle crashes:			
1. Riding while tired	Agree	241	59.7
2. Riding at high speed	Agree	400	99.0
3. Carrying more than one person on a pillion	Agree	369	91.3
4. Overtaking more than one vehicle at a time	Agree	378	93.6
5. Riding under the influence of alcohol	Agree	375	92.8
6. Smoking cigarettes while riding	Agree	259	64.1
7. Using a mobile phone while riding	Agree	298	73.8
8. Not following traffic rules and road signs	Agree	387	95.8
9. Riding without proper training	Agree	301	74.5
10. Roads with bumps and potholes	Agree	396	98.0
11. Slippery roads	Agree	389	96.3
12. Heavy rainfall	Agree	392	97.0
13. Excessive sunlight	Agree	117	29.0
14. Lack of vehicle maintenance services	Agree	392	97.0
The following are considered protective measures against motorcycle crashes:			
15. Wearing a crash helmet	Agree	404	100
16. Wearing appropriate footwear	Agree	363	89.9
17. Wearing hand gloves	Agree	181	44.8
18. Wearing heavy jacket	Agree	375	92.8
19. Wearing reflective clothes	Agree	261	64.6
20. Checking motorcycle lamps, tires, and brakes before a trip	Agree	393	97.3

Table 4 Distribution of study participants according to preferred response to the question regarding practices towards risky behaviour and protective measures against motorcycle crash

Question	Preferred response	Frequency (N)	Percentage (%)
The following measures do you practice against motorcycle crashes:			
1. Carrying more than one person on a pillion	No	119	29.5
2. Overtaking more than one vehicle at a time	No	27	6.7
3. Riding at high speed	No	179	44.3
4. Riding under the influence of alcohol	No	302	74.8
5. Smoking cigarettes while riding	No	362	89.6
6. Using a mobile phone while riding	No	64	15.8
7. Overworking (> 12 hrs/day)	No	38	9.4
8. Wearing a crash helmet	Yes	385	95.3
9. Wearing appropriate footwear	Yes	315	78.0
10. Wearing hand gloves	Yes	156	38.6
11. Wearing heavy jacket	Yes	362	89.6
12. Wearing reflective clothes	Yes	305	75.5
13. Checking motorcycle lamps, tires, and brakes before a trip	Yes	382	94.6

risky behaviour included not smoking while riding the bike (N = 362, 89.6%) followed by not being under the influence of alcohol when riding commercial motorcycles (N = 302, 74.8%). The commonly practiced measures against motorcycle crashes were the use of crash helmets (N = 385, 95.3%) and inspecting the motorcycle before starting a trip (N = 382, 94.6%) (Table 4).

3.5 Factors determining awareness and practices of participants towards motorcycle crash-related risk factors and protective measures

Overall, most (N = 256, 63.4%) participants had a high level of awareness regarding motorcycle crash-related risk factors and protective measures. Whereas, slightly more than half (N = 211, 52.2%) of the participants had poor overall practice towards motorcycle crash-related risk factors and safety measures (Figure 1). Upon performing univariate analysis, except for age groups and duration of working as a commercial motorcyclist the rest of the factors were significantly associated with awareness regarding motorcycle crash-related risk factors and protective measures ($p < 0.05$). On the other hand, practice towards motorcycle crash-related risk factors and safety measures was significantly associated with the education level of participants, possessing a driving license, and level of awareness regarding motorcycle crash-related risk factors and protective measures ($p < 0.05$) (Table 5).

Figure 1 Risky behavior of commercial motorcyclists carrying more than one pillion passengers

In the multivariable analysis, we added all variables associated with awareness and practice in the univariate model at $p < 0.1$. Multivariate analysis depicted that the odds of having a high level of awareness regarding motorcycle crash-related risk factors and protective measures were almost 2 fold higher among individuals who have been working as commercial motorcyclists for less than 2 years, who trained in driving teaching institutes, who possess a driving license and those with a history of being involved in a motorcycle crash as a commercial motorcyclist. Regarding practice

Table 5 Univariate analysis of factors associated with awareness and practices of commercial motorcyclists in relation to motorcycle crash-related risk factors and protective measures

Factors		Level of awareness		Practice	
		Low	High	Poor	Good
Age group (year)	Young adults	126 (36.1%)	223 (63.9%)	182 (52.1%)	167 (47.9%)
	Middle-aged	22 (40.0%)	33 (60.0%)	29 (52.7%)	26 (47.3%)
	p-value	0.577		0.936	
Education level	Low level	73 (43.7%)	94 (56.3%)	101 (60.5%)	66 (39.5%)
	High level	75 (31.6%)	162 (68.4%)	110 (46.4%)	127 (53.6%)
	p-value	0.013		0.005	
Marital status	Without a partner	78 (32.1%)	165 (67.9%)	128 (52.7%)	115 (47.3%)
	With a partner	70 (43.5%)	91 (56.5%)	83 (51.6%)	78 (48.4%)
	p-value	0.02		0.825	
Riding a commercial motorbike after training	Within 1 week	97 (42.0%)	134 (58.0%)	128 (55.4%)	103 (44.6%)
	After 1 week	51 (29.5%)	122 (70.5%)	83 (48.0%)	90 (52.0%)
	p-value	0.01		0.139	
Experience as a commercial motorcyclist	$\leq$ 2 years	60 (32.1%)	127 (67.9%)	102 (54.5%)	85 (45.5%)
	> 2 years	88 (40.6%)	129 (59.4%)	109 (50.2%)	108 (49.8%)
	p-value	0.078		0.136	
Training facility	Non-institution	132 (39.9%)	199 (60.1%)	175 (52.9%)	156 (47.1%)
	Institution	16 (21.9%)	57 (78.1%)	36 (49.3%)	37 (50.7%)
	p-value	0.004		0.582	
Possessing a driving license	No	64 (51.6%)	60 (48.4%)	77 (62.1%)	47 (37.9%)
	Yes	84 (30.0%)	196 (70.0%)	134 (47.9%)	146 (52.1%)
	p-value	< 0.001		0.008	
History of being involved in MCC	No	75 (42.9%)	100 (57.1%)	84 (48.0%)	91 (52.0%)
	Yes	73 (31.9%)	156 (68.1%)	127 (55.5%)	102 (44.5%)
	p-value	0.023		0.137	
Level of awareness	Low	-	-	94 (63.5%)	54 (36.5%)
	High	-	-	117 (45.7%)	139 (54.3%)
	p-value	-		< 0.001	

towards motorcycle crash-related risk factors and safety measures, those with a higher level of education had 1.5 times higher odds of good practice than their counterparts. Similarly, the likelihood of good practice was nearly 2 folds higher among individuals with higher levels of awareness regarding motorcycle crash-related risk factors and safety measures (Table 6).

4 Discussion

Whereas motorcycles are being used for recreation in most developed countries, in Africa, they are among the most common means of transportation, especially as commercial public transport (Moshy et al., 2020; Owibingire et al., 2018; Oginni et al., 2007). With rapid urbanization and an increase in the rate of unemployment, most young individuals resort to riding motorbikes for commercial purposes, thus, raising in number of motorcycles on streets. Considering commercial motorcyclists are very vulnerable to motorcycle crash injuries (Rahman et al., 2015), it is of utmost importance that they observe various protective measures against road traffic crashes. In determining an individual's readiness to comply with anything, it is fundamental to assess their awareness and practices about that particular matter (Sohal et al., 2022). Hence, the current study adds to the growing literature by reporting on the awareness and practices of commercial motorcyclists regarding motorcycle crash-related risk factors and protective measures in Tanzania.

Table 6 Multivariate analysis of factors associated with awareness and practices of commercial motorcyclists in relation to motorcycle crash-related risk factors and protective measures

Factors		Adjusted Odds Ratio (95% CI)	
		High level of awarenes	Good practice
Education level	Low level	1	1
	High level	1.44 (0.93–2.24)	1.57 (1.04–2.38)
Marital status	Without a partner	1.55 (0.97– 2.47)	-
	With a partner	1	-
Riding a commercial motorbike after training	Within 1 week	1	-
	After 1 week	1.30 (0.82–2.05)	-
Experience as a commercial motorcyclist	≤ 2 years	1.62 (1.00–2.62)	-
	> 2 years	1	-
Training facility	Non-institution	1	-
	Institution	2.02 (1.06–3.83)	-
Possessing a driving license	No	1	1
	Yes	2.13 (1.33–3.41)	1.47 (0.94–2.31)
History of being involved in MCC	No	1	-
	Yes	1.76 (1.12–2.77)	-
Level of awareness	Low	-	1
	High	-	1.84 (1.20–2.82)

Similar to studies from various parts of Africa (Luambano, 2020; Nguyen et al., 2018; Nzuchi et al., 2022; Konlan et al., 2020; Ndagire et al., 2019; Oginni et al., 2007), in this survey majority of participants were educated, male, and young. The participants' rather young age and high education level may lead to the speculation that the unemployment rate is high in the country to the point that most veer off into commercial motorcycling. However, it is also possible that with rising living costs in the cities, others took the 'bodaboda' job as a supplementary source of income from other vocations (Oginni et al., 2007). In this study, almost all commercial motorcyclists were male, which may be attributed to the sociocultural gender-defined activities. In most African cultures males are providers and caretakers of the family, hence traveling on the road as commercial motorcyclists while women are often restrained to their houses to take care of household chores and other family responsibilities Luambano (2020); Moshy et al. (2020).

The current study's findings revealed that only 18% of commercial motorcyclists had undertaken formal training on how to ride a motorbike. In addition to that, a majority had trained for less than two weeks and started riding as commercial motorcyclists within 1 week of training. Moreover, the data show that most commercial motorcyclists had less than 2 years of experience, which is in line with previous reports from Tanzania (Nguyen et al., 2018; Nzuchi et al., 2022) and Ethiopia (Raga et al., 2023). Furthermore, about 1/3 of the commercial motorcyclists did not possess a valid driving license, which is higher than findings from Ethiopia (Raga et al., 2023). Such findings are worrisome since they point to the fact that most commercial motorcyclists are inexperienced when they start working. Research has shown that inexperienced riders tend to overestimate their riding ability and are slower to recognize and respond to potential hazards (Nguyen et al., 2018), thus, are vulnerable to motor traffic crashes (Möller et al., 2020), as augmented by the findings of this study, that positive history of MCC was more common among commercial motorcyclists without formal training. The high number of inexperienced commercial motorcyclists on the streets may contribute to an increase in rates of road traffic crashes thereby endangering not only their lives but the lives of their customers as well.

The finding from the current survey that almost three-quarters of the commercial motorcyclists were not formally trained and about a third possessed no driving license may point out that though the laws and regulations for traffic safety are in place in the country, they are not implemented seriously by the authority especially when it comes to motorcyclists.

It is encouraging to report that most majority of commercial motorcyclists in this study had a high level of awareness regarding various risk factors for, and preventive measures against motorcycle crashes. This was in agreement with the previous study from Tanzania (Nzuchi et al., 2022). The odds of having a high level of awareness regarding motorcycle crash-related risk factors and protective measures were determined by years of experience as a commercial motorcyclist, mode of training, and history of motorcycle crashes. It is plausible that riders who attended a formal institute had been taught various aspects of road safety measures as part of their training curriculum, and likewise, the riders who had little experience, must have the information regarding road safety fresh in the back of their minds. Riders who had a positive history of motorcycle crashes may attribute their increased odds of increased levels of awareness to the negative experience. Having a negative experience of a crash might have influenced the riders to learn from their mistakes in an effort of avoiding another incidence of a crash in the future, thereby increasing awareness.

In this study, good practice against motorcycle-related crash risk factors and preventive measures was noted in slightly less than half of the participants, similar to findings by Nzuchi et al. (2022) and Oginni et al. (2007). Though the results were not very satisfying, still were higher than those reported by Nzuchi et al. (2022) and Afelumo et al. (2021). Most commonly practiced risky behaviors included overtaking more than 1 vehicle at a time, overworking, and using mobile phones while riding. As pointed out correctly by Nguyen et al. (2018), most commercial motorcyclists work longer hours for monetary gains. The long working hours put them at risk for exhaustion and stress (physical and mental). Exhaustion due to sleep deprivation can lead to variability in riding speed and poor judgment (Du et al., 2015), which when coupled with the risky behavior of overtaking more than one vehicle at a time increases the chances of being involved in road traffic crashes.

Though it is believed that having good knowledge and awareness does not necessarily warrant good practice (Singh et al., 2022), the results of this study pointed out otherwise. The odds of good practice were nearly 2 times higher among individuals who had higher levels of awareness regarding motorcycle crash-related risk factors and safety measures, such findings support the idea of necessitating training for commercial motorcyclists regarding road safety.

5 Limitations

This study has some limitations which should be acknowledged when evaluating the results. First, the survey was carried out during day time among active boda boda drivers. As such, we might have missed some commercial motorcyclists who start working during the evening and night hours. This might have an intrinsic bias in self-reporting practices such as the use of alcohol during work hours and riding speed. Secondly, data collected from commercial motorcyclists were based on self-reports and there is a very low chance of bias. Even in light of this, the results from this study carry valuable information about the awareness and practices of commercial motorcyclists in Tanzania on issues about road safety.

6 Conclusions

The findings of this study depict that most commercial motorcyclists have a good level of awareness regarding motorcycle crash-related risk factors and protective measures. However, their practices regarding motorcycle crash-related risk factors and protective measures were not satisfactory. Determinants of the high level of awareness were working experience, mode of training, possession of a driving license, and previous history of motor traffic crashes. Good practice was determined by the level of awareness regarding risk factors for motorcycle crashes and the education level of the commercial motorcyclist.

From the findings of this study, we suggest that the government institutes should have more vocational training institutes that train safe motorcycle riding at affordable fees. The road safety authorities should ensure road safety measures apply to all motor vehicles as currently commercial motorcyclists are often overlooked by traffic officers. It is also recommended that government and non-government institutions should put deliberate efforts into organizing frequent road safety awareness education sessions directed towards commercial motorcyclists through different media (e.g. social media, televisions, radios, etc.).

CRediT contribution statement

Karpal Singh Sohal: Conceptualization, Data curation, Formal analysis, Investigation, Methodology,

Project administration, Software, Supervision, Validation, Visualization, Writing—original draft, Writing—review & editing. **Steven Reuben:** Conceptualization, Investigation, Methodology, Validation, Visualization, Writing—review & editing. **Ashu Michael Agbor:** Methodology, Project administration, Supervision, Validation, Visualization, Writing—review & editing.

Declaration of competing interests

Authors declare that no conflicts of interest exist.

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Ethics statement

Ethical clearance was sought from the MUHAS research and ethics committee (Ref. No.DA.25/111/01). Permission for data collection was sought from the local government authorities of Mbeya city and the leadership of the commercial motorcyclist union. Only those participants who freely gave written consent to participate were included in the study. All information gathered was handled confidentially and refusal to participate or withdraw from the study did not result in any consequence. Personal information such as name of the commercial motorcyclist and the area where they conduted their business was not collected.

Availability of data

Data generated or analyzed during this study are included in this article and can be requested from the corresponding author.

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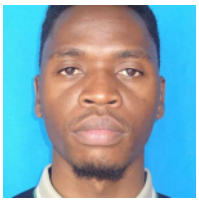

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