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Rider Risk Factors Associated With Commercial Motorcycle Accidents At Olkalou Sub-County, Nyandarua County

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ABSTRACT
Motorcycle injuries have become a public health problem globally, the situation being more severe in low- and middle-income countries where the accidents and injuries reported are twice as high as those in high-income countries. Majority of the motorcycles operate in the rural areas where the industry is largely informal and unregulated. Moreover, there are limited statistics on the nature of crashes, predisposing risk factors and the extent of damage to guide in understand the problem and policy formulation. This study sought to analyze the rider risk factors associated with commercial motorcycle accidents in Olkalou Sub-County, Nyandarua County, Kenya. The study adopted a cross-sectional survey. A sample of 188 motorcycle riders and accident victims and 20 police officers were selected to participate in the study. A questionnaire with structured questions was used to collect data from the commercial motorcyclists while an interview schedule was used to collect data from the traffic police officers, and FGD was used to collect data from motorcycle accident victims in the study. The study established that the risk factors significantly associated with motorcycle accidents include drug and substance abuse, riding at high speed, overloading and failure to observe traffic rules.

KEY WORDS: *Rider Characteristics, Commercial Motorcycle, Accident.*

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I. INTRODUCTION

Background to the Study

Motorcycles have become a popular means of transportation especially in low and middle income countries. The market is also characterized by growth in the private motorcycle riders who opt not to take the public option (Mutiso and Behrens 2011). The increased use of motorcycles for transport has led to an upward surge in road accident crashes majority of the cases involving motorcycles.

Motorcycle injuries are a public health problem globally. The effects of motorcycle injuries in low- and middle-income countries are twice as high as those in high-income countries. These injuries contribute significantly to mortality and morbidity, placing a significant economic burden on individuals injured, the public health system, and governments, as shown by lost wages, unemployment, long-term medical expenses, and intangible suffering. Globally, motorcycle fatalities account for 28%of all road traffic deaths. In the World Health Organization Africa region, between 7% and 16% of all road traffic deaths are motorcycle-related deaths (Cholo, Odero & Ogendi, 2023).

In Rwanda, motorcycle accidents account for over 15% of 2878 deaths recorded recently (The New Times, 2009). In Kenya, 40% of crashes are caused by the MCA "bodaboda" mode of road transport (Were, 2021) According to the traffic police data 519 motorcyclist died due to motorcycle died in 2018,728 in 2019 1.136 people died in 2020 while 1,270 people due to the same in 2021 this shows an increased rate of mortality over the last 3 year. At Kenyatta National Hospital, 44 cases of severe injuries arising from motorcycle accidents were reported in 2008, in September 2009 the hospital recorded 160 cases of severe motorcycle-related injuries, 10 of them died and 52 out of the 160 cases in 2009 died. In September 2010 out of the 210 cases, 89 died with 10% ending up paralyzed (Wachira, 2017).

Olkalou Sub-county in Nyandarua County, Kenya is not an exception in commercial motorcycle accidents since the most common means of transportation in the area is motorcycle. In 2017 records from the Olkalou sub-county health services department indicated that 8 people died on motorcycle accidents, 5 being

riders and 3 passengers with 204 being involved in motorcycle accidents. In 2018, there were 9 fatalities, 5 being motorcycle riders and 4 passengers while 420 were involved in motorcycle accidents. In 2019, 388 people were involved in motorcycle accidents, 70 were admitted with serious injuries, and 11 deaths (7 riders and 4 passengers). The recent data from the department of health in olkalou Sub County indicates that there were 350 accident 15 were fatal with the riders being the main victims at 7 the remaining 5 were passengers while remaining 3 pedestrians. Traffic department in the sub-county have also noted a rise in the cases of accidents involving boda boda with another bodaboda.

The area has also recorded increased morbidity hospitalization in both public and private hospitals due to commercial Motorcycle Accidents. In addition, there have been an upward surge in the number of disabilities from head injuries or loss of a limb contributing to increased suffering, loss of livelihood as well as draining of family resources used to offset the resulting huge hospital bills. Assessment of the accident scenes by the police also noted that majority of those involved in the accident were intoxicated with alcohol and those involved with the drugs and alcohol tended to have more severe accidents involving head injuries, spinal injuries as well as severe forms of fractures.

Problem Statement

Motorcycle injuries have become a public health problem globally, the situation being more severe in low- and middle-income countries where the accidents and injuries twice as high as those in high-income countries. These injuries contribute significantly to mortality and morbidity, placing a significant economic burden on individuals injured, their families, the public health system, and governments, through lost wages, unemployment, long-term medical expenses, and intangible suffering. Being that majority of the motorcycles operate in the rural areas where the industry is largely informal and unregulated, there is a shortage of statistics on the nature of crashes, predisposing risk factors and the extent of damage to guide in understand the problem and policy formulation. This study sought to analyze the risk factors associated with commercial motorcycle accidents among business riders in Olkalou Sub-County, Nyandarua County, Kenya.

Research Objective

The study was guided by the following research objectives:

To identify the rider demographic characteristics and riding habits associated with commercial motorcycle accidents in Olkalou Sub-County, Nyandarua County, Kenya.

Research Question

Which rider demographic characteristics and riding habits are associated with commercial motorcycle accidents in Olkalou Sub-County, Nyandarua County, Kenya?

II. METHODOLOGY

Research Design

The study adopted a cross-sectional survey where data was collected from a selected sample of commercial motorcycle operators and stakeholders in the sector to provide their responses to the research questions.

Study Site

The study was conducted at Olkalou Sub-County in Nyandarua County, Kenya. Olkalou forms a suitable location for the study because of the high population of commercial motorcycles used in the area to ferry passengers, agricultural inputs, and produce to and from the rural areas to the urban areas.

Target population

The target population for the study was victims of motorcycle accidents, traffic police officers and commercial motorcycle operators within Olkalou Sub-County who have been involved in motorcycle accidents before. There are an estimated 700 commercial motorcycle operators registered with motorcycle riders associations within the Olkalou Sub County, A sample of 188 motorcycle riders and accident victims and 20 police officers were selected to participate in the study.

Data Collection Instruments

A questionnaire with structured questions was used to collect data from the commercial motorcyclists while an interview schedule was used to collect data from the traffic police officers, and FGD was used to collect data from motorcycle accident victims in the study.

III. FINDINGS

Demographic Characteristics of Commercial Motorcycle riders

To determine whether the participants in a given study are a representative sample of the target population for generalization purposes, demographic information about the participants in the study is required. The study's demographic characteristics were determined and presented in Table 1

Table 1: Demographic Characteristics

Test item		**F**	**%**
Age of motorcycle riders	Less than 25 years	36	23.4%
	26 - 35 years	65	42.2%
	36 - 45 years	39	25.3%
	More than 45 years	14	9.1%
What is your Gender	Male	154	100.0%
	Female	0	0.0%
What is Marital status	Married	92	59.7%
	Single	53	34.4%
	Separated	8	5.2%
	Divorced	1	0.6%
What is your highest education?	Not completed primary	46	29.9%
	Completed Primary Education	51	33.1%
	Secondary Education	54	35.1%
	College	3	1.9%
	University	0	0.0%

According to the study in terms of age majority of the motorcycle riders were found to be aged between 26 – 35 years with a represented rate of 65(42.2%), followed by those aged between 36 – 45 years of age with a response rate of 39(25.3%) respondents, those who aged less than 25 years were 36(23.4%) respondents and finally, those who were over 45 years and more were 14(9.1%) respondents. All the respondents who were our respondents were male respondents with a representation of 154(100.0%) with none being female motorcycle riders. In terms of marital status, the respondents who were found to be married were 92(59.7%) respondents while those who were single were represented by a response rate of 53(34.4%) respondents, the other indicated response were separated and divorced with a response rate of 8(5.2%) and 1(0.6%) respondents respectively. The majority of the study respondents indicated that they had up to secondary education with a response rate of 54(35.1%) respondents, followed by those who had up to completed primary education with a response rate of 51(33.1%) respondents, a response of 46(29.9%) respondents indicated they never completed primary education and none of the respondents had a university education. In Nigeria, most of the youths operating motorcycles were at aged 16-30 years (Odumosu PT officer & Yaro, 2017). Cordellieri, *et al.*, (2016) explains that danger-taking conduct is higher in young fellows than in ladies. Men tended to be involved in an accident twice more as women and tended to have a higher fatality that men's fatality index was 0.72 per 100 patients compared to women's at 0.19 per 100 victims (Surgio & Baeza, 2019).

Responses to Commercial Motorcycle Accidents

Table 2 indicates the descriptive statistics of commercial motorcycle accidents.

Table 2: Motorcycle riders' involvement in motorcycle accidents.

Test Item		**F**	**%**
Have you ever been involved in a road accident as a motorcycle rider?	Yes	120	77.9%
	No	34	22.1%
For how long were you hospitalized following the accident?	Treated as Outpatient	52	43.7%
	Below 1 Week	29	24.4%
	2-4 Weeks	21	17.6%
	5-12 Weeks	8	6.7%
	Above 12 Weeks	9	7.6%
What was the extent of the injuries sustained during the accident?	Minor bruises	51	42.9%
	Deep cuts & burns	23	19.3%
	Fractured limbs	23	19.3%
	Spine injuries	7	5.9%
	Head injury	14	11.8%
	Lost limbs	1	0.8%
How many times have you been involved in road accidents as a rider since the time you started your riding career?	~~None~~	~~0~~	~~0.0%~~
	1 time	69	58.5%
	2 - 3 times	44	37.3%
	4 - 5 times	3	2.5%
	Over 6 times	2	1.7%
How recently were you involved in a motorcycle accident?	One week	7	5.9%
	One month	10	8.4%
	Three months	5	4.2%
	Six months	23	19.3%
	One year and above	74	62.2%

The majority of the motorcycle riders indicated that they have been involved with the representation of 120(77.9%) respondents while those who have never been involved in an accident were represented with a response rate of 34(22.1%) respondents. The study indicated that from the sample of those who were involved in the accident majority of them were hospitalized following the accident as the outpatient treatment method with a response of 52(43.7%) respondents, followed by those who were indicated to be below 1-week treatment with a response of 29(24.4%) respondents, those who were hospitalized for 2 – 4 weeks, 5 – 12 weeks and above 12 weeks were represented by a response rate of 21(17.6%), 8(6.7%) ad 9(7.6%) respondents respectively. The extent of the injuries sustained during the accident majority of the them indicated to have minor bruises with a response of 51(42.9%), followed by those who indicated deeper cuts and burns with a response rate of 23(19.3%) similarly with those who indicated fractured limbs, other major recorded injuries included spine injuries, head injuries and lost limbs with a response rate of 7(5.9%), 14(11.8%) and 1(0.8%) respondents respectively.

From the sample of 120 respondents who indicated to have been ever been involved in an accident, the study indicated that the majority had been involved one time with a response rate of 69(58.5%) response rate followed by those who have been involved for 2 – 3 times with a response rate of 44(37.3%) respondents while those who had over 4 – 5 times and over 5 times were represented by a response rate of 3(2.5%) respondents and 2(1.7%) respondents respectively. In terms of recent when they were involved in an accident the majority of the respondents indicated that they have been involved in the past year and above with a response rate of 74(62.2%) respondents, followed by those who indicated for the past 6 months with a response rate of 23(19.3%) respondents, a response rate of 7(5.9%), 10(8.4%) and 5(4.2%) were indicated to have been involved in an accident for the last one week, one month and three months respectively.

The police officers had the following say about riders' involvement in motorcycle accidents:

> *"… What I think is important is knowing the rules and regulations of the road. This can be learned without formal training. by training in an informal environment, you can learn how to drive competently…."*
> *(KII 20, Male)*
> *"…However, one interviewee in IDI had a different opinion. Interviewees argued that formal driver education does not necessarily lead to fewer accidents. Even though many commercial motorcyclists have no formal training, interviewees explained: Most of them have never been in an*

accident. Interviewees also said they had formal driving training, had a driver's license, and had several drivers involved in accidents."

In this context, possession of a driver's license is often assumed to be evidence of having completed formal training as a driver or passenger.

According to Balami AD (2019), human factors, such as socio-demographic, physiological, and behavioral traits, are important in modulating RTC. To lessen the risk brought on by impaired functioning, motorcyclists' mental and physical stability must be at its peak. Human physio-physical stability may be negatively impacted by intoxication, substance consumption, or exhaustion. According to Dapilah F. (2017) in Ghana, young guys predominately engage in commercial motor riding in Africa. This group of people's disabilities may have devastating effects on sociodemographic trends and economic progress. To reduce the risks connected with RTCs, authorities must implement a systematic, coordinated training program that specifically targets young male riders, especially those in commercial service.

Inferential analysis Motorcycle riders' involvement in motorcycle accidents.

Model summary

To indicate the variation of the Motorcycle riders' involvement in motorcycle accidents model summary is tabulated in table 3. This was determined and was represented on the Cox & Snell R Square and Nagelkerke R Square values, which are both methods of calculating the explained variation.

Table 3: Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	40.168[a]	.485	.744

The study indicated that the total variation of each motorcycle rider to be involved in motorcycle accidents ranged from 48.5% to 74.4%, depending on whether the rider was referencing the Cox & Snell R Square or Nagelkerke R Square. This on-road disregard for safety standards may be the result of lax enforcement, negligence, a lack of education, or heightened youthful vigor. In most African cities, commercial motor riders' associations can work with police and road safety authorities to enforce rules, provide proper education, an effective licensing system, and regulated speed and time intervals for journeys in order to control and ensure positive behaviors on the roads, especially by members.

Further, the study conducted multiple logistic regression to determine the relationship of each parameter towards the involvement of motorcycle riders in an accident this was represented in table 4 below.

Table 4: Multiple Logistic Regression

Model		Unstandardized Coefficients		Wald	Sig.
		B	Std. Error		
	Have you ever been involved in a road accident as a motorcycle rider?	.084	.013	6.578	.000
	For how long were you hospitalized following the accident?	.194	.016	12.069	.000
	What was the extent of the injuries sustained during the accident?	.186	.015	12.729	.000
	How many times have you been involved in road accidents as a rider since the time you started your riding career?	.191	.018	10.445	.000
	How recently were you involved in a motorcycle accident?	.166	.018	9.006	.000

The Wald test was determined to explain how each parameter varied when it come to the motorcycle riders' involvement in motorcycle accidents. From the column of the sig, the study indicated that all the factors were significant since they were all less than 0.05 at a 95% confidence interval.

Assessment of Motorcycle Riders Habits

Table 5 summarizes motorcycle riders' habits.

Table 5: Rider Personal Characteristics

Test item		**F**	**%**
What was your age at the time of first the accident	Below 20 years	7	5.9%
	21 - 25 years	34	28.6%
	26 - 30 years	37	31.1%
	31 - 35 years	18	15.1%
	above 36 years	23	19.3%
What was your riding speed at the time of the accident?	Very high speed	2	1.7%
	High Speed	22	18.6%
	Average Speed	67	56.8%
	Low Speed	18	15.3%
	Very low speed	9	7.6%
What was the weight of the load that you were carrying at the time of the accident?	Very heavy	9	8.0%
	slightly heavy	16	14.3%
	Average	49	43.8%
	Slightly Low	6	5.4%
	Very Low	32	28.6%
Were you under influence of any drugs during the accident?	Yes	24	20.3%
	No	94	79.7%
If Yes what type of drug?	Cigarette/Tobacco substances	2	8.3%
	Marijuana	4	16.7%
	Khat	13	54.2%
	Alcohol	4	16.7%
	Others	1	4.2%
What would you say was the level of intoxication with the drug at the time of the accident?	Very low	3	12.5%
	Low	7	29.2%
	Average	8	33.3%
	High	6	25.0%
Do you maintain insurance coverage for your motorcycle?	Not at all	20	16.7%
	When necessary	16	13.3%
	Sometimes	25	20.8%
	Most of the time	21	17.5%
	All the time	38	31.7%

The study found that the first time a motorcycle rider was involved in an accident was when they aged between 26 – 30 years with a response rate of 37(31.1%), followed by those aged 21 – 25 years with a response rate of 34(28.6%) respondents, while those who were below 20 years, 31 – 35 years and above 36 years were represented by a response rate of 7(5.9%), 18(15.1%) and 23(19.3%) respondents respectively. The majority of the motorcycle riders indicated that they were on the average speed with a response rate of 67(56.8%) respondents while those who were at very high speed with high chances of having an accident were 2(1.7%) those who indicated low and very low speed was represented by a response rate of 18(15.3%) and 9(7.6%) respondents respectively. The weight of the load was determined and the majority of the motorcycle riders indicated that average weight they carried when they had an accident with a response rate of 49(43.8%) respondents, followed by those who had slightly heavyweight with a response rate of 16(14.3%), those who had an accident with very heavy and very low weight were represented a response rate of 9(8.0%) and 32(28.6%) respondents respectively. The study found that of those who happened to have had an accident those who were under influence of drugs 24(20.3%) while 94(79.7%) indicated to have not been under influence of drugs. Where majority were found to abuse khat with a response rate of 13(54.2%), followed by those who abused marijuana and alcohol with a

response rate of 4(16.7%), with those who abused cigarette and tobacco substances being 2(8.3%) respondents. The level of intoxication with the drug at the time of the accident majority of the motorcycle riders indicated to be average with a response of 8(33.3%) with low and high responses having a response rate of 7(29.2%) and 6(25.0%) respondents respectively. Most of the motorcycle drivers were found to maintain insurance coverage for their motorcycles all the time with a response rate of 38(31.7%) respondents, followed by those who maintained sometimes with a response rate of 25(20.8%), those who never maintain their insurance at all were 20(16.7%) respondents.

The policemen agreed that some of the riders' used drugs or other substances. Some excerpts are shown below:

"…driving under the influence of alcohol/drug abuse is a common phenomenon, especially among commercial motorcyclists..."
(KII….)
"….The hospital found that many patients who were commercial motorcyclists involved in accidents, especially on weekends and Monday mornings, showed signs of alcohol and drug use…."
(KII…..)

The study further determined whether there is safety gear during the accident among the motorcycle riders and the results were tabulated as per table 4.6 below;

Mullin et al. (2000) state that although this study did not find it to be very significant, other studies have indicated a link between lower education level and traffic injury among motorcyclists. According to Moskal et al. (2012), studies conducted in numerous nations, including the USA, New Zealand, and France, have found a correlation between alcohol intake and short riding experience and road injuries among motorcycle riders. Alcohol affects judgment, which explains why there is a link between road injury and alcohol consumption. Alcohol use can also serve as a stand-in for addictive habits like smoking, which have been found to be highly associated with motorcycle accidents. Longer riding experience is substantially correlated with greater road etiquette, helmet use, and older age, according to (Ali, 2015).

Multiple logistic regression analysis on rider habits and accidents

Model summary of binary logistic regression was determined to assess the behavior of the motorcycle Riders' Habits. The table was presented in table 4.10 and was represented in form of the Cox & Snell R Square and Nagelkerke R Square values, which are both methods of calculating the explained variation.

Table 6: Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	58.168[a]	.735	.844

The table above indicated that the total variation of the motorcycle rider to be involved in motorcycle accidents ranged between 73.5% and 84.4% whether the rider was referenced the Cox & Snell R Square or Nagelkerke R Square. This confirms the study by Johnson & Owoaje, (2015), where they indicated that riding intention and behavior control, habits, and health motivation underlie the rider to being involved in an accident. This can indicate that the correlation between behavioral intention and the results obtained strongly agree that the accident may have been contributed by the motorcycle riders.

This was similar to the study conducted by Horberry et. Al (2008) where the information on other factors stated can help to explain the significant correlation of injury with lesser degree of understanding of traffic safety rules, higher AUDIT score, and having been stopped by traffic police officers. Higher AUDIT scores indicate alcohol use, which is already linked to an increased risk of injury. Being stopped by the police may indicate a motorcycle-related issue, such as impairment from alcohol or risk-taking that could result in injury. If a rider exhibits a lack of knowledge of the regulations of the road, which can also result in injuries, the police may also stop him.

Further, the study conducted multiple logistic regressions to determine the statistical significance of each motorcycle rider's habits towards the contribution towards accident involvement. The results achieved were tabulated according to table 7 below.

Table 7: Regression Summary

Model		Unstandardized Coefficients		Wald	Sig.
		B	Std. Error		
	What was your age at the time of first the accident	.044	.029	1.526	.127
	What was your riding speed at the time of the accident?	.026	.027	.966	.334
	What was the weight of the load that you were carrying at the time of the accident?	.045	.026	1.721	.086
	If Yes what type of drug?	.065	.025	2.598	.010
	What would you say was the level of intoxication with the drug at the time of the accident?	.060	.025	2.381	.018
	Do you maintain insurance coverage for your motorcycle?	-.018	.023	-.782	.434

The Wald test was determined to explain how each parameter varied when it come to the motorcycle riders' habits contributing towards being involved in motorcycle accidents. The study found that "*If Yes what type of drug?*" they were found to have a high probability of a rider being involved in an accident with a significance value of 0.010 followed by *"What would you say was the level of intoxication with the drug at the time of the accident?*" with a significance of 0.018. The rest of the parameters were not significant since were greater than 0.05.

Nyagwui (2016) indicated that the most frequent kind of injury was a bruise. Compared to other motorcycle users, commercial motorcycle riders were more than 4 times as likely to not be wearing any "protective gear." The median cost of medical care due to motorcycle-related RTAs was 112.1 USD, and nearly two-thirds of respondents thought the cost of healthcare was expensive.

IV. CONCLUSIONS

The risk factors associated with motorcycle accidents include drug and substance abuse, riding at high speed, and overloading, lack of ownership of a personal motorcycle and resources. The study shows that speeding, improper overtaking, and poor roads account for a higher proportion of the contributing factors to high accident rates for commercial two-wheelers. To a large extent commercial motorcycle drivers do not comply with traffic safety regulations which predisposes them to accidents. This is because it is prohibited by the Road Law to carry more than one person at the same time, not to wear safety equipment such as a helmet, and not to drive with a driver's license. Many of them drink alcoholic beverages before driving, but some cannot decipher the rules and regulations of driving on the road.

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