

# The Factors Associated with the Occurrence of Road Traffic Accidents among Commercial Motorcycle Riders in Kenema City, Eastern Sierra Leone

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## Abstract

Motorcycle injuries constitute a major but neglected emerging public health problem in developing countries (Sierra Leonean being among them) and contribute significantly to the overall road traffic injuries. However, motorcycle accidents which cause injuries and death have not received the adequate attention they deserve as the situation is worsening. The general objective of the study was to examine the factors associated with the occurrence of road traffic accidents among motorcycle riders in the Kenema municipality. The main research instrument used for the study was the questionnaire. These questionnaires were randomly distributed among a sample size of 120 respondents. Of the 120 respondents targeted, 61 were motorcycle riders and 59 were passengers. Data collected were descriptively analyzed using graphs, charts and figures.

The study revealed that there were many factors which are responsible for the occurrence of motorcycle accidents. Among those factors to which the occurrence of motorcycle accidents were attributed, the research shows that accidents mainly occur due to riders riding a motorcycle without formal training, the situation of motorcyclists who were without driver's license which shows their lack of adequate professional riding knowledge, mechanical defects, bad roads, over speeding, over-load, traffic officers police harassment of riders and attitude of other riders were among the major causes of motorcycle accidents.

The study concludes by recommending the institution of certain measures geared towards curbing the occurrence of motorcycle accidents. It is deemed necessary for government and NGOs to organize mass campaigns with regards sensitization on road traffic rules, driving/riding codes, and basic accident prevention strategies to both passengers and riders/drivers. The study also uncovered the need for traffic law enforcement and punitive legal action against defaulters. Other recommendations included the enforcement of the wearing of protective gears for riders, maintenance of bad roads, and the enhancement of drivers/riders' skills on the road through continuous training while honoring other users of the road by adhering to laws and changing the riders attitude towards risk-taking behaviors.

**Keywords:** Motorcycle; Accidents; Traffic

## Introduction

Currently road traffic injuries are ranked ninth globally among the leading causes of disability adjusted life years (DALYS) lost. It has been predicted that by 2020, they will rank as high as third among causes of disability adjusted life years lost [1]. Worldwide, it is estimated that 1.2 million people are killed in road crashes each year and as many as 50 million people are injured [2]. The road traffic injury mortality rate is highest in Africa (28.3 per 100,000 populations) when corrected for under reporting compared with 11.0 per 100,000 in Europe [3]. Motorcycle injuries constitute a major but neglected emerging public health problem in developing countries and contribute significantly to the overall road traffic injuries [4]. Motorcycle injuries are among the leading causes of disability and deaths and the main victims are the motorcyclists, passengers and pedestrians in their young reproductive age group [5]. Motorcycle riders have a 34 times risk of death than the drivers of other types of vehicles and 8 times more likely to be injured [6].

Road traffic accidents (injuries) contribute significantly to the burden of disease and mortality throughout the world, but particularly in developing countries [1]. Road traffic accidents (injuries and deaths) are a growing public health concern in Sierra Leone. Road traffic accidents in Sierra Leone reached 1382 or 1.47% of total deaths [7]. Road crashes are the second leading cause of death globally among young people. In Sierra Leone, motorcycle accounted for 60% of all road traffic accidents [7]. Motorcycles are the most common mode of transportation in Sierra Leone, the relatively low price of motorcycle and their low fuel consumption are among the reasons why motorcycle are so popular in the country also because of the poor roads network. Due to increasing usage, the number of motorcycle accidents and related fatal injuries are increasing every day in the country. Motorcyclists are about three times more likely than car occupants to be injured in a crash and 16 times more likely to die as the riders often absorb all kinetic and compressive energy resulting from the crash.

In sub-Saharan Africa, there has been an introduction of commercial motorcyclists who carry passengers for hire. It has become one of the major and most common means of informal transport. Its popularity and widespread acceptance has rapidly risen in recent years. Commercial motorcycling has also served as a means of gainful employment. The emergence of commercial motorcycles is due to inadequacies of mass transportation system in the countries. Bad roads with the associated traffic congestion, as well as the ability of these motorcyclists to pass through traffic jams have encouraged the patronage of this mode of transportation. The other means of transportation are unable to access these roads [8].

In Sierra Leone, riders often ignore safety measures making them more vulnerable to accidents and majority of road traffic fatalities and injuries occurred on roads in rural areas. However, helmet use by motorcyclists in Sierra Leone is generally low and over speeding are very common 3 in 5 riders. From statistics gathered by the researchers from the records kept at the Out Patients' Department (Minor Theater) of Kenema Government Hospital, from January 2015 to December 2015, 382 road traffic accidents cases were recorded and 374 were caused by motorcyclists. Also, between January 2016 to December 2016, 239 cases were reported and 229 were related to motorcyclists. Within the period of 2 years, 603 roads traffic accidents caused by motorcyclists alone for just Kenema City and its surrounding villages. Most traffic accidents in Sierra Leone involve motorcycles and many of their riders are brought to the hospital emergency unit with blunt, contused, lacerations and punctured injuries and some involving head injuries.

In Sierra Leone, the dwindling economy and the decay of infrastructure have led to the emergence of motorcycles for commercial transportation (popularly called Okada) over the past ten years. Motorcycles have increasingly become a popular means of transportation in low and middle income countries [9]. This is partly because motorcycles are relatively cheaper than other motor vehicles in terms of initial purchase and maintenance costs. The motorcycles can easily evade traffic jams making them an attractive means of transportation in this country. Two of the most compelling reasons for the popularity of commercial motorcycling is the deplorable road situation in most parts of Sierra Leone and the high unemployment rate in the country. With potholes being a common sight on most Sierra Leonean roads and the fact those only urban areas have good road network; passengers have no other choice but to turn to motorcycle transportation. The fact also that the eleven years rebel war helped spike the unemployment rate, the prospect of commercial motorcycle transportation presented welcome income generating activity.

Unfortunately, the rise has been accompanied by increased levels of high risk behavior and accidents; as a result they have come under heavy scrutiny culminating in legislation restricting and in some instances prohibiting their operations in other areas like city centers in the capital Freetown. The motorcyclists spends more than 10 hours daily on the roads with direct exposure to various environmental hazards including road traffic accidents (RTA) and associated crashed injuries of various levels of severity. The rate of road traffic accidents associated with commercial motorcycling has also been on the increase with a rise in the number of injuries presented at hospitals [10]. The injuries come with associated huge socio-economic consequences to the injured, their families and the society at large. Many reasons have been suggested for the unacceptable high rate of road traffic accidents. The incidence of motorcycle accidents is not only associated to Sierra Leone, it has been reported in a number of African countries.

Road safety depends on many factors, including the efficiency of the technical system and the behaviour of the driver of the vehicle. The systematic increase in the number of vehicles in road traffic is the cause of the risks associated with their use [11]. Except undoubted advantages, it causes a great growth of traffic volume of road network and a constantly increasing demand on traffic and its safety [12]. The negative effect caused by traffic congestion is most notable in the largest cities, where traffic density is relatively high, with characteristically low and often variable speed (acceleration and deceleration) [13]. Therefore, the traffic accident rate is an important criterion in planning, building, renovation, and maintenance of road network.

Various types of vehicles take part in road traffic, from two-wheelers to passenger cars, vans, public transport vehicles, light trucks and others. Traffic statistics confirm that despite the fact that motorcyclists account for a few percent of all road users, they are involved in a disproportionately high number of collisions. This phenomenon has already been the subject of multi-faceted research and analyses [12,13]. They determined the relationship between the age of motorcyclists, engine capacity, type of motorcycle and the probability of a collision. Motorcyclists are associated with aggressive style of driving, speeding, overtaking in prohibited places, or overtaking and passing other road users on their right and left.

Analysis of the causes of accidents also points to another reason. A motorcycle-motor vehicle collision is often a result of the fact that the driver has not noticed the motorcyclist, which is also known as the "looked-but-failed-to-see" phenomenon [12-14]. When deciding to perform the manoeuvre, the driver of the vehicle does not see the danger in the mirror. At the given time, the driver does not observe in his field of view the rapidly approaching motorcycle. This is the case also in situations where a road user fails to give way to a motorcyclist coming from the opposite direction. This happens even if the road user is looking in the direction of the approaching motorcycle; however, his sensory perception does not treat the image of the motorcycle as a threat. This behaviour is often due to a very common incorrect assessment of the speed of the motorcycle and its distance from the vehicle [15], on account of their small frontal area [14].

## Methodology

The research methodology includes the study design, population of the study, sampling method, data collection and analysis.

### Study Design

In this study, we selected a Descriptive, Cross-Sectional design to identify and describe the factors associated with the occurrence of road traffic accidents among commercial motorcycle riders in Kenema City, Eastern Sierra Leone.

## Population of the Study

The study targeted all parties related to motorcycle accident (i.e. the riders and passengers) residing within Kenema municipality. Approximately, 65% of the residents found in the municipality were from the 8 sections of Nongowa Chiefdom (Gbo-Kakajama, Gbo-Lambayama, Dagbanya, Dakpana, Kagbado Njeigbla, Kagbado Kambuima, Kona Fweiya and Kona Kpidibu) enjoy services provided by motorcycles.

## Sampling Method

Simple Random and Stratified Non-Probability Sampling Method was employed.

## Sample Size

The total population for this study was one hundred and twenty (120) people including passengers and motorcyclists. Of the total population for the study, 60 respondents were contacted from each of the two categories mentioned and were chosen from all the eight (8) sections in Nongowa Chiefdom.

## Types of Data Collected

Information from both primary and secondary sources was collected. The primary source of data was obtained through questionnaire administered to respondents, that is, motorcycle riders and passengers. Questionnaires were administered to respondents after the whole purpose of the research study had been carefully explained to them. Secondary data was collected from several textbooks, articles, journals, and internet which formulated literature. All materials used were duly acknowledged.

## Data Collection Instruments

The instruments used in data collection were interview and questionnaire. Data for the research was collected mainly through the administration of questionnaire to respondents. However, due to the peculiarity of the study area, the researcher occasionally conducted interview with respondents. The questionnaires administered were divided into three sections. Each section tackled one research question. All sections of questionnaires contained open and closed-ended questions. The questionnaire comprised of background questions about gender, age, education, and questions related to occurrence and causes of motorcycle accidents, etc. Structured questions and some dichotomous questions were asked to collect the information from the respondents. Questions were very specific with a fixed range of options. The structured questionnaires used multiple-choice questions while the unstructured questionnaires were used to seek independent opinion of respondents.

## Data Analysis

Questionnaires were utilized as the main instruments for data collection. The data from these questionnaires was analysed using arithmetic (percentages, proportions, etc.). Tables are used for the systematic arrangement of data in rows and columns. Data from these tables were later interpreted into suitable figures. Figures like pie charts and bar charts were used to aid readers grasp the analyses easily.

## Results

### Demographic Information of Respondents

This area of the analysis deals with the:

- Sex of the respondents
- Age of the respondents
- Level of education of the respondents
- Marital status of the respondents
- Occupation of the respondents

Sex	Rider	Passenger	Total	Percentage (%)
Male	61	27	88	73.3
Female	-	32	32	26.7
Total	61	59	120	100

**Table 1:** Sex of Respondents

Table 1 shows the analysis of sex of respondents. It is revealed that 73% of the respondents are male (consisting of 61 riders and 27 passengers), while 27% of the respondents were female (consisting of 32 passengers only). From the analysis, it is revealed that males dominate motorcycle riding while the majority of motorcycle passengers were females.

Age	Rider	Passenger	Total	Percentage (%)
Below 18 years	2	4	6	5
18-25 years	18	15	33	27.5
26-40 years	32	23	55	45.8
Above 40 years	9	17	26	21.7
Total	61	59	120	100

**Table 2:** Age of Respondents

Table 2 above represents the age of respondents, which reveals that 5% of the respondents were aged below 18 years (consisting of 2 riders and 4 passengers), 27% were in the age bracket of 18 to 25 years (consisting of 18 riders and 15 passengers), while 46% (32 riders and 23 passengers) were in the age bracket of 26 – 40 years and 22% (9 riders and 17 passengers) were aged above 40 years.

Level	Rider	Passenger	Total	Percentage (%)
Illiterate	7	3	10	8.3
Primary	14	-	14	11.6
Secondary	38	19	57	47.5
Tec/Voc	-	6	6	5
College/University	2	31	33	27.5
Total	61	59	120	100

**Table 3:** Level of education of respondents

Table 3 above shows that 8% of respondents (consisting 7 riders and 3 passengers) were illiterate, 12% (14 riders only) had attained primary education, 48% (38 riders and 19 passengers) had attained secondary education, and 5% of passengers only had attained Tec / Voc education, while 28% (2 riders and 31 passengers) had attained college / university education. It would be deduced that the majority of people related to motorcycle transportation were those respondents with at least a secondary school education.

Marital Status	Rider	Passenger	Total	Percentage (%)
Single	49	31	80	67
Married	12	28	40	33
Total	61	59	120	100

**Table 4:** Marital Status

Table 4 above indicates that majority of respondents were single 67% (consisting of 49 riders and 31 passengers), while 33% (12 riders and 28 passengers) were married.

Occupation	Rider	Passenger	Total	Percentage (%)
Student/Pupil	8	24	32	26.6
Civil servant	-	18	18	15
Trader/Farmer	3	8	11	9.2
House wife	-	5	5	4.3
Driver/Rider	50	-	50	41.6
Unemployed	-	4	4	3.3
Total	61	59	120	100

**Table 5:** Occupation of respondents

Table 5 above shows that 27% of respondents (consisting 8 riders and 24 passengers) were students/pupil, 15% of passengers were civil servants, 9% (3 riders and 8 passengers) were either traders/farmer, 4% of passengers were house wives, 42% of were riders and 3% were passengers.

## Causes of Motorcycle Accidents

This part of the analysis includes the:

- a. Ownership of crash helmets among both passengers and riders
- b. Helmet usage among passengers and riders
- c. Formal driver/rider training
- d. Ownership of drivers' license
- e. Motorcycle maintenance interval
- f. Incidence of drinking/smoking among riders
- g. Factors responsible for motorcycle accident

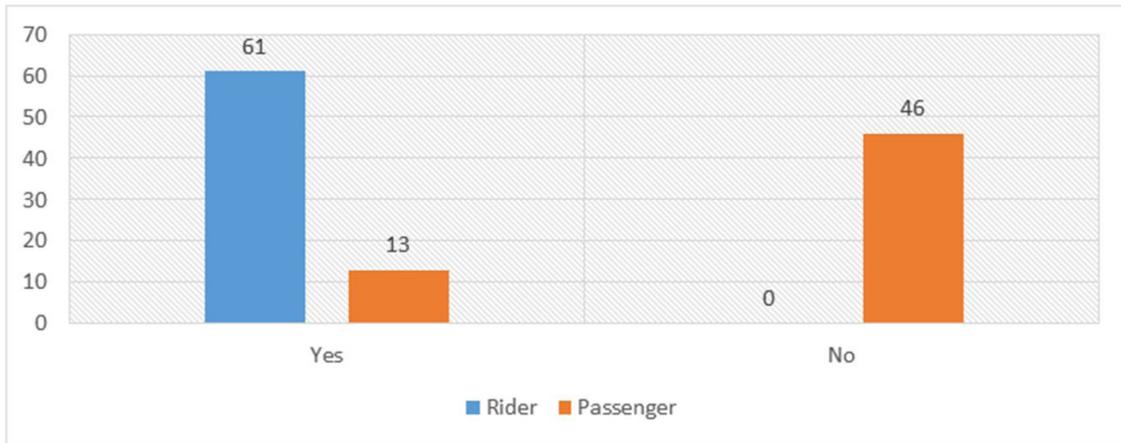


Figure 1: Ownership of Crash Helmet

Figure 1 indicates that all the motorcycle riders owned crash helmet, while 22% of passengers (13) owned crash helmet and 78% (46) of passengers do not own crash helmet.

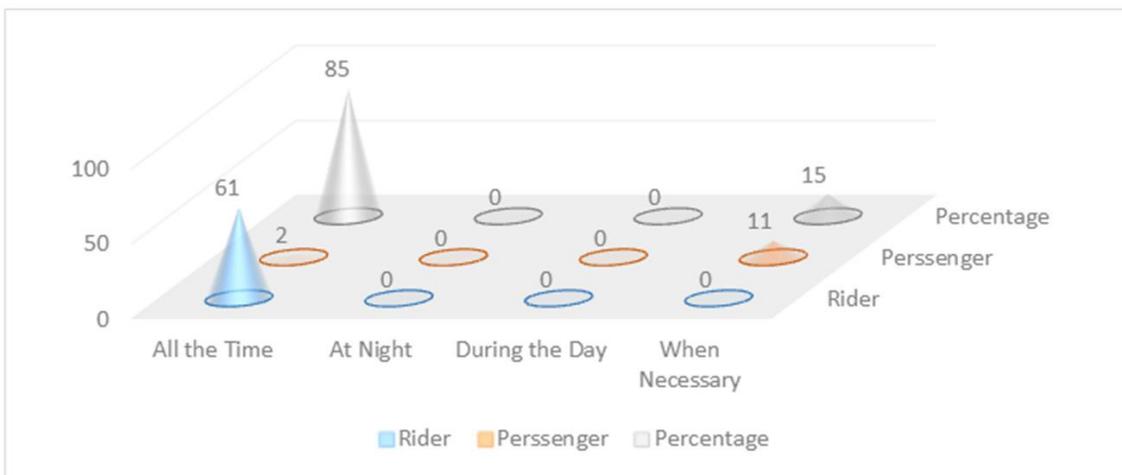


Figure 2: Helmet Usage

Figure 2 above shows that 85% of respondents (61 riders and 2 passengers) used their helmet all the time, while 15% of passengers used their helmet only when necessary.

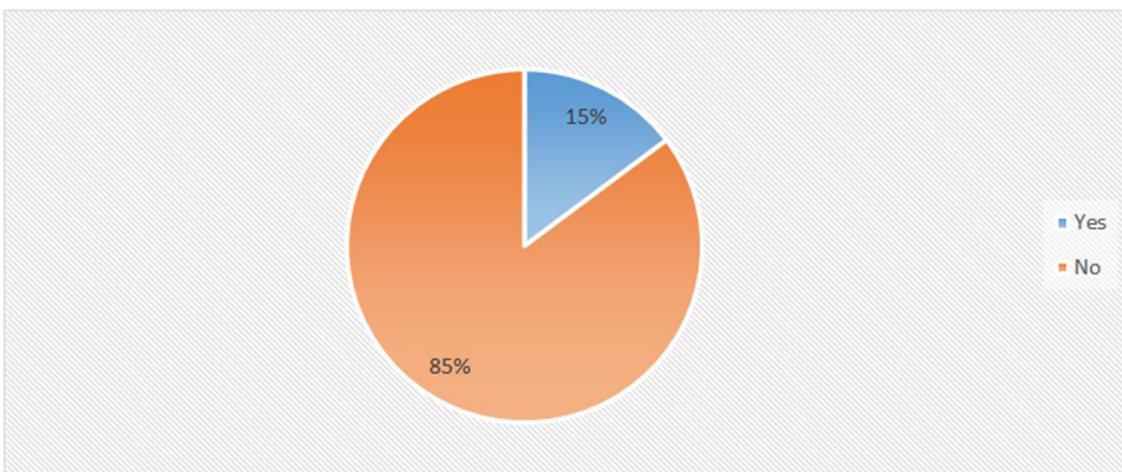
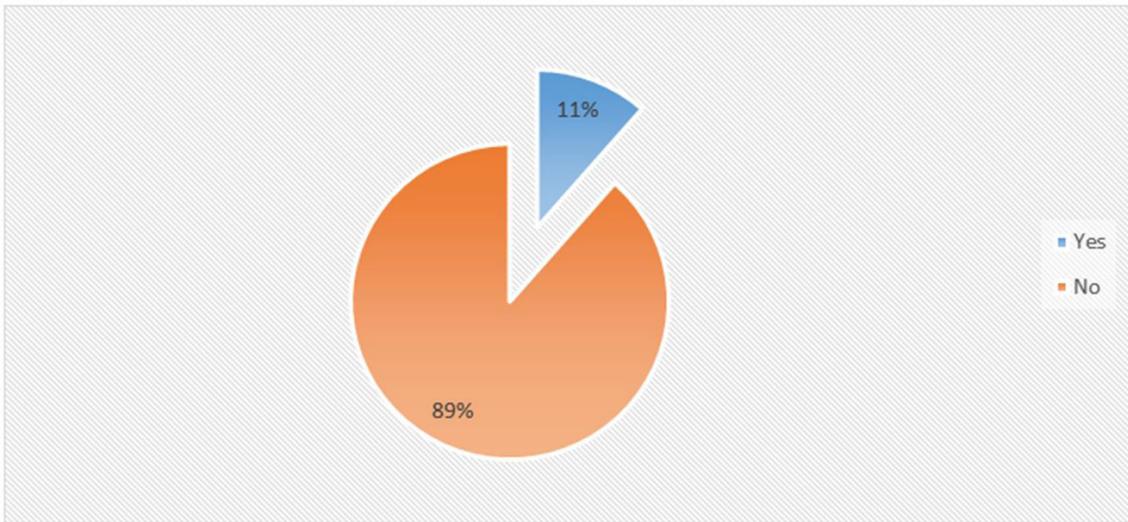


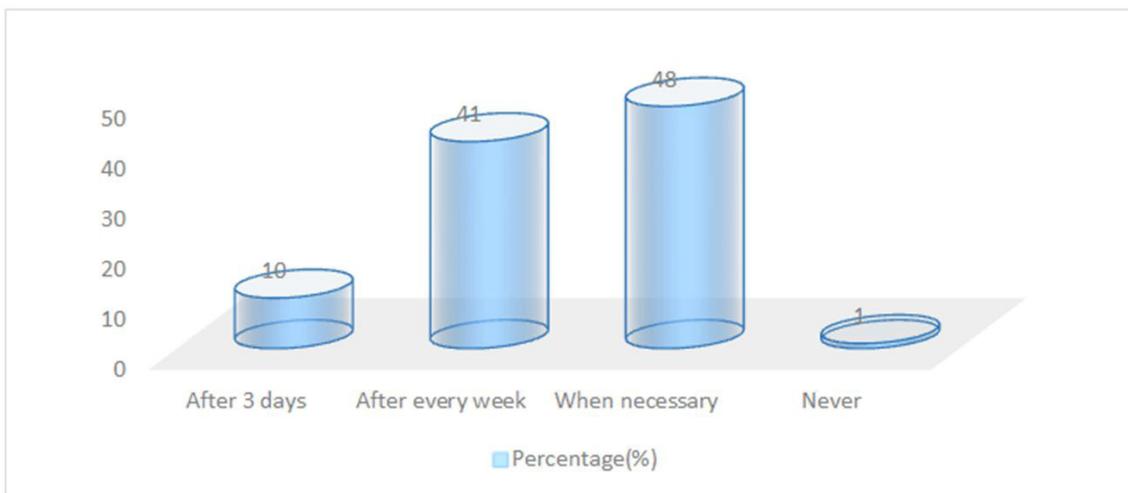
Figure 3: Formal Driver/Rider Training

Figure 3 revealed that the majority of riders did not go through any formal driver/rider training before starting to ride motorcycle, while only 15% went through formal training.



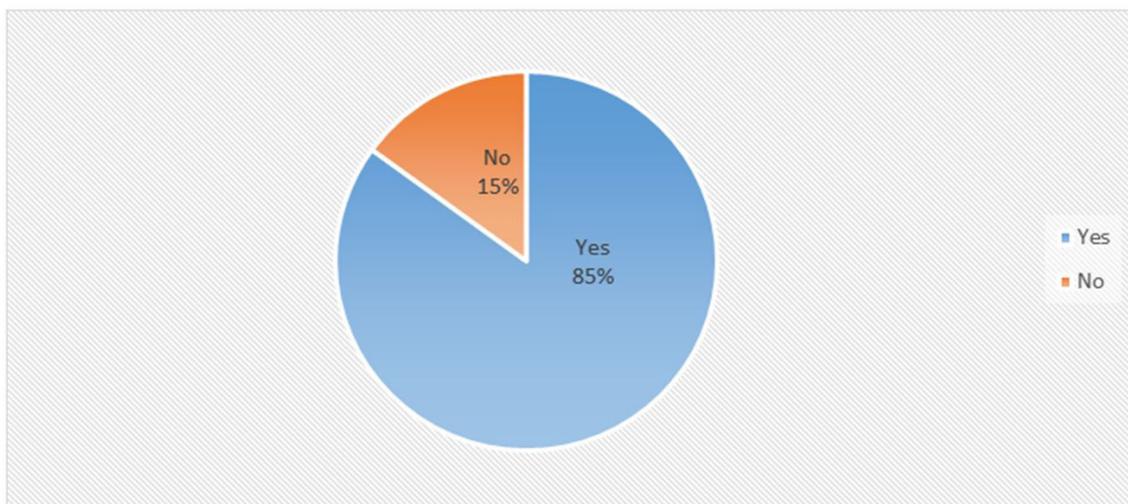
**Figure 4:** Ownership of Driver's License

Figure 4 shows that majority of the riders (89%) do not own driver's license, while only 11% owned driver's license. All of those who did not have a driver's license admitted it was due to the expensive cost of procuring one.



**Figure 5:** Motorcycle Maintenance interval

From Figure 5 above, it could be seen that 10% of riders carry out maintenance on their motorcycles after every three days, 41% carry out maintenance after every week, while 48% carry out maintenance when necessary and 1% admitted they never carry out maintenance until their motorcycle becomes faulty and cannot be used.



**Figure 6:** Incidence of Drinking/Smoking

Figure 6 shows that 85% of riders either drink alcohol or smoke cigarettes, while 15% neither drink alcohol nor smoke cigarettes.



Figure 7: Reason for Drinking/Smoking

Figure 7 shows the responses given by respondents when they were asked to reveal the reasons they smoke/drink. 54% of the respondents revealed that they drink/smoke to forget their problems; while 31% revealed it was to feel good/high and 15% drink/smoke for the endurance to ride.

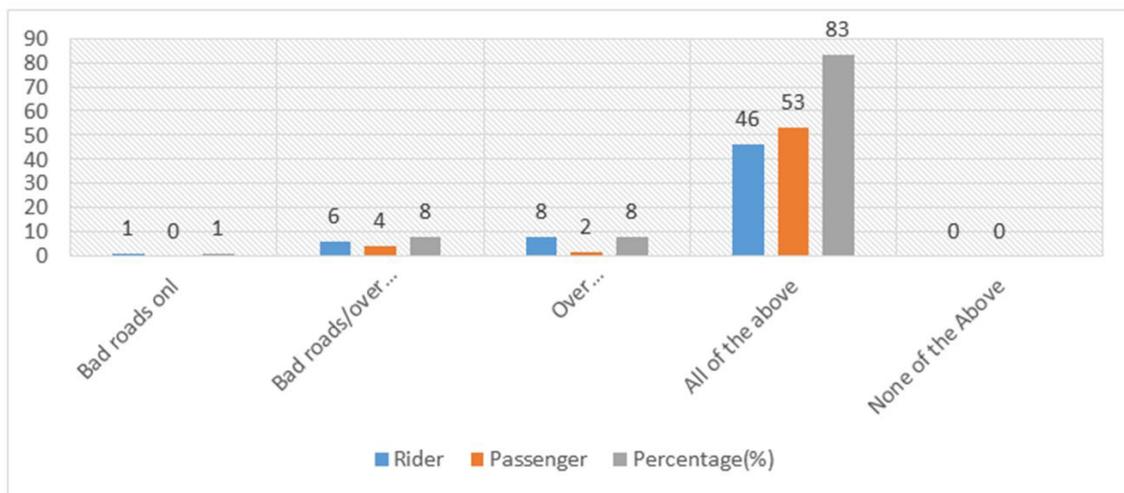


Figure 8: Factors Responsible for Motorcycle Accidents

Figure 8 shows that 83% of respondents (consisting 46 riders and 53 passengers) believed that all the above factors (Bad roads, over speeding, over loading, pedestrians, traffic officers harassment, passengers and the attitude of other riders) are responsible for motorcycle accidents, while 8% (6 riders and 4 passengers) believed bad roads and over speeding are responsible for motorcycle accidents; while another 8% (8 riders and 2 passengers) believed over-load, pedestrians and traffic officers’ harassment are responsible for motorcycle accident and 1 % of riders believed that bad roads alone is responsible for motorcycle accident.

### Effects and Treatment of Motorcycle Accidents

This part of the analysis includes the:

- a. Involvement in motorcycle accident
- b. Frequency of involvement in motorcycle accident
- c. Incidence of motorcycle injury
- d. Body part affected in motorcycle accident
- e. Treatment of accident victims
- f. Place of treatment
- g. Reasons for non-treatment
- h. Payment of hospital bill
- i. Report of accident occurrence
- j. Authority accident reported to
- k. Presence of residual pain
- l. Riders’ eye test
- m. Reasons riders undergo eye test
- n. Reasons for non-testing of the eye

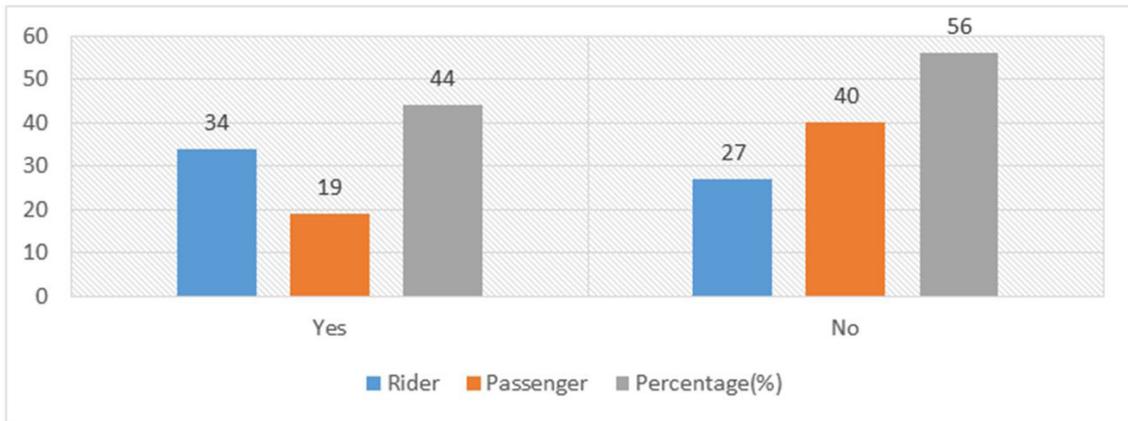


Figure 9: Involvement in Motorcycle Accidents

Figure 9 revealed that 44% of respondents (consisting 34 riders and 19 passengers) have been involved in motorcycle accidents, while 56% (27 riders and 40 passengers) had never been involved in motorcycle accidents. This shows that the incidence of motorcycle accident is mostly high among the riders and low among the passengers. This may probably be because motorcycle riders spend more time in contact with the motorcycle than the passengers who only use it when they need to be transported.



Figure 10: Frequency of Involvement in Motorcycle accident

Figure 10 shows that 92% of respondents (30 riders and 19 passengers) had involved in motorcycle accidents at least once but not more than thrice, while 8% of riders had been involved in motorcycle accident more than three times but less than eight times.

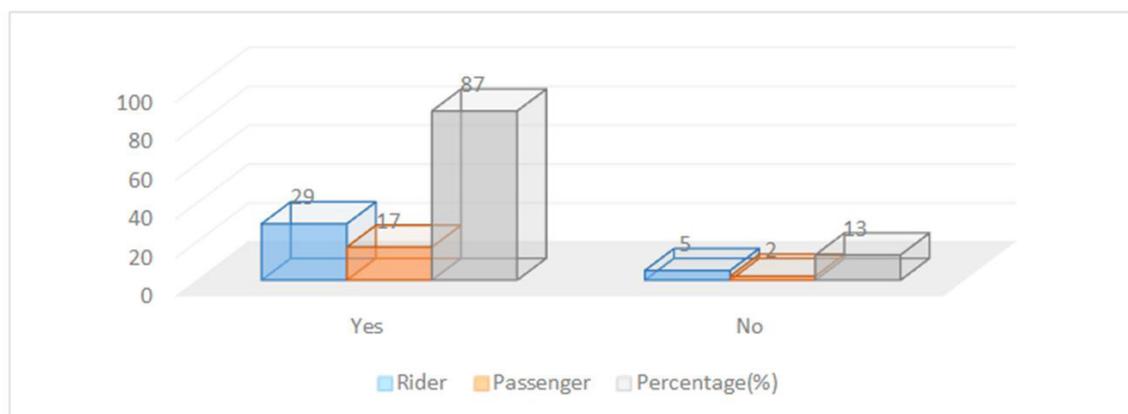


Figure 11: Incidence of Motorcycle Injury

Figure 11 shows that 87% of respondents (consisting 29 riders and 17 passengers) have sustained injury as a result of motorcycle accidents, while 13% (5 riders and 2 passengers) did not sustain injury when involved in motorcycle accidents.

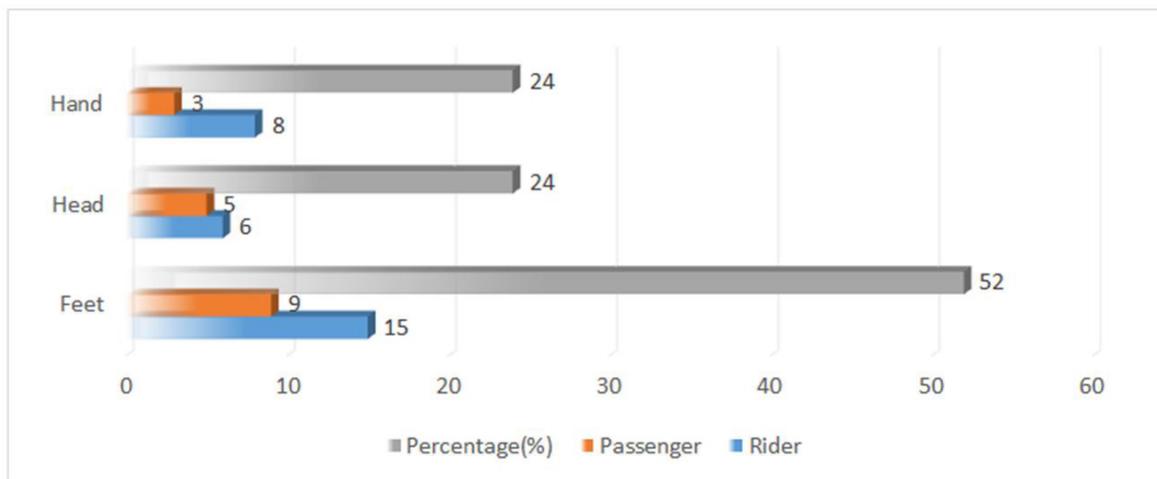


Figure 12: Body Part Affected as a Result of Motorcycle Accidents

Figure 12 revealed that 52% of respondents (15 riders and 9 passengers) had their feet injured in motorcycle accidents, while 24% (6riders and 5 passengers) had their head affected or injured and 24% (8 riders and 3 passengers) had their hands injured.

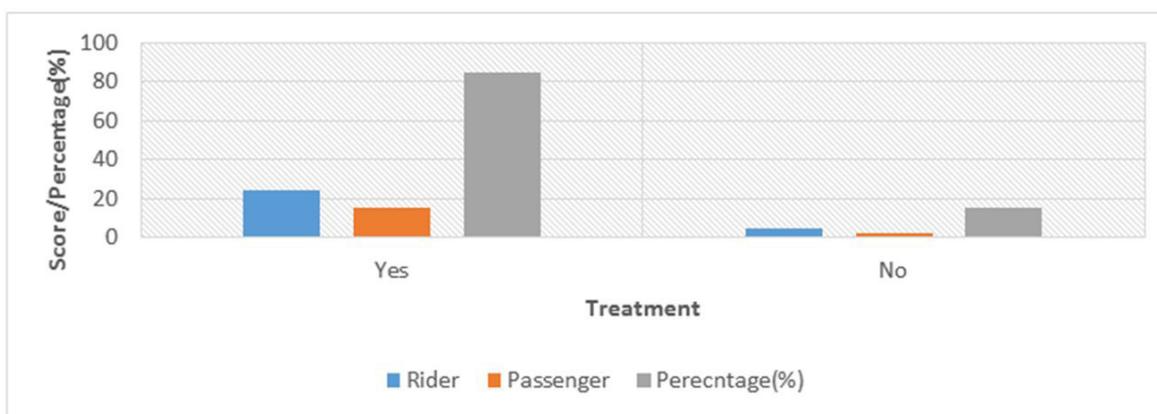


Figure 13: Treatment of Accident Victims

Figure 13 indicates that 85% of respondents (24 riders and 15 passengers) were treated when involved in motorcycle accidents, while 15% (5 riders and 2 passengers) did not get treatment when they were involved in motorcycle accidents.

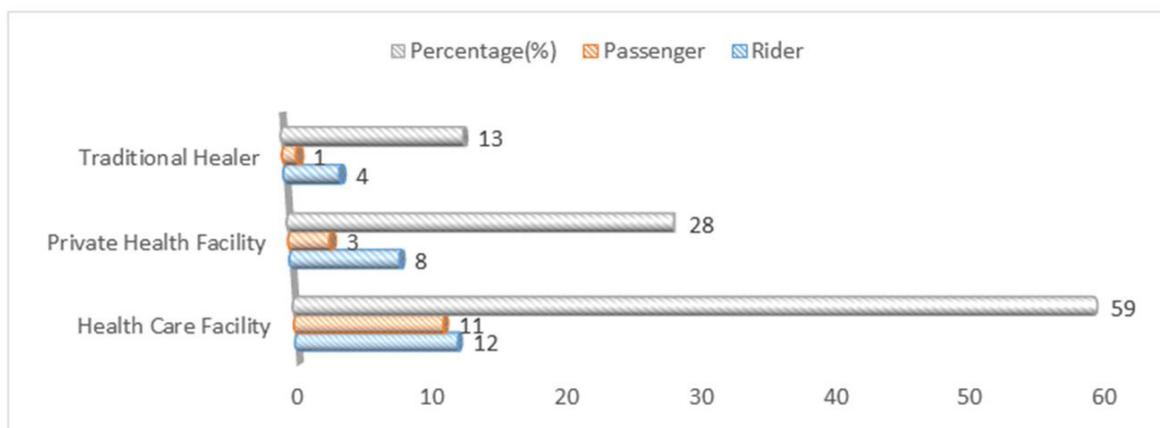


Figure 14: Place of Treatment

Figure 14 above shows that 59% of respondents (12 riders and 11 passengers) were treated in a health care facility, while 28% (8 riders and 3 passengers) were treated in a private health facility and 13% (4 riders and 1 passenger) went to traditional healers when involved in motorcycle accidents.

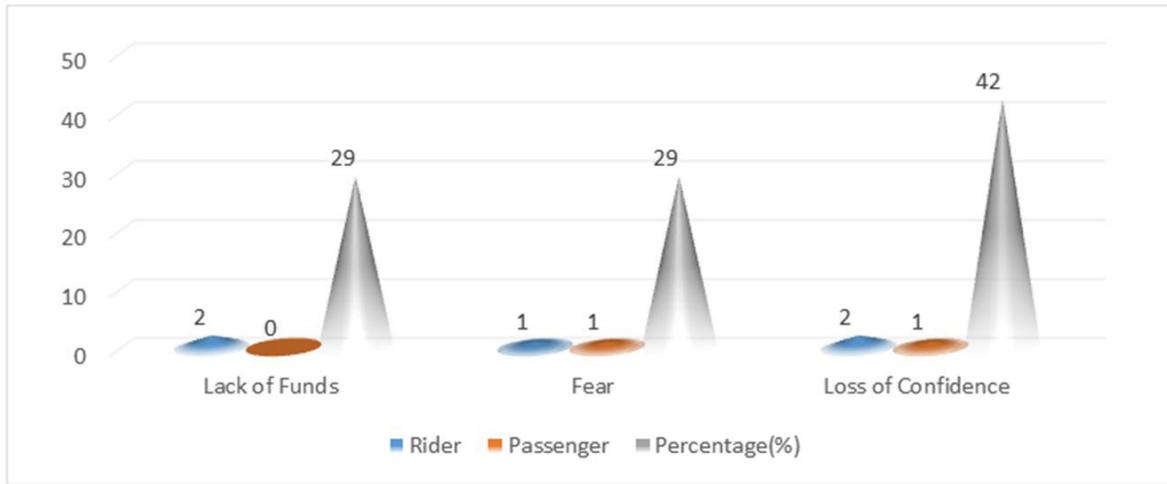


Figure 15: Reason for Non-Treatment

Figure 15 shows that 29% of riders failed to have treatment because of lack of funds, 29% (one rider and one passenger) failed to do so out of fear and 42% (2 riders and one passenger) due to loss of confidence in health care providers.



Figure 16: Payment of Hospital Bill

Figure 16 shows that 69% ( 18 riders and 9 passengers) had their hospital bills paid by the rider(s) involved in the motorcycle accidents, while 5% revealed the bills to be paid by the passengers themselves and 23% (5 riders and 4 passengers) had their hospital bills paid by their families.

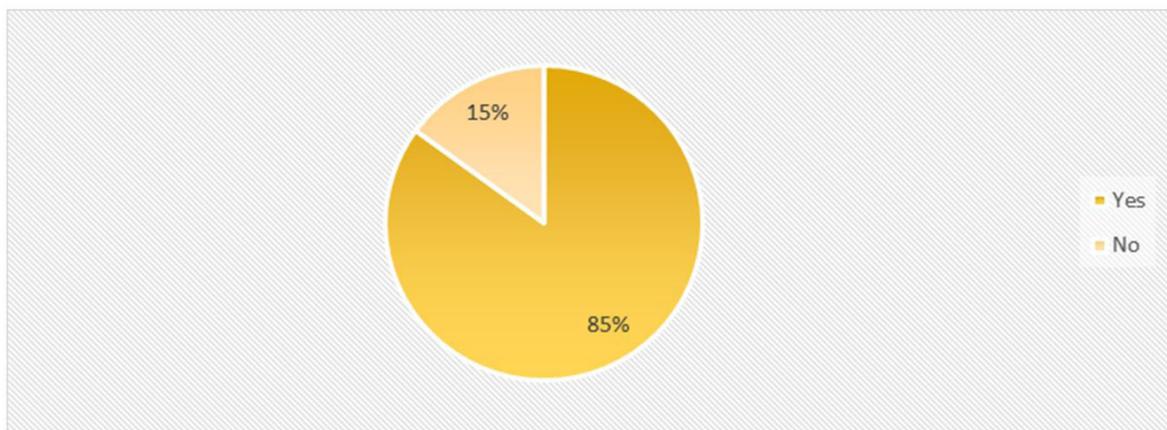


Figure 17: Report of Accidents

Figure 17 revealed that 85% of respondents (26 riders and 19 passengers) reported their motorcycle accidents, while 15% of the respondents (all riders) did not report their motorcycle accidents.

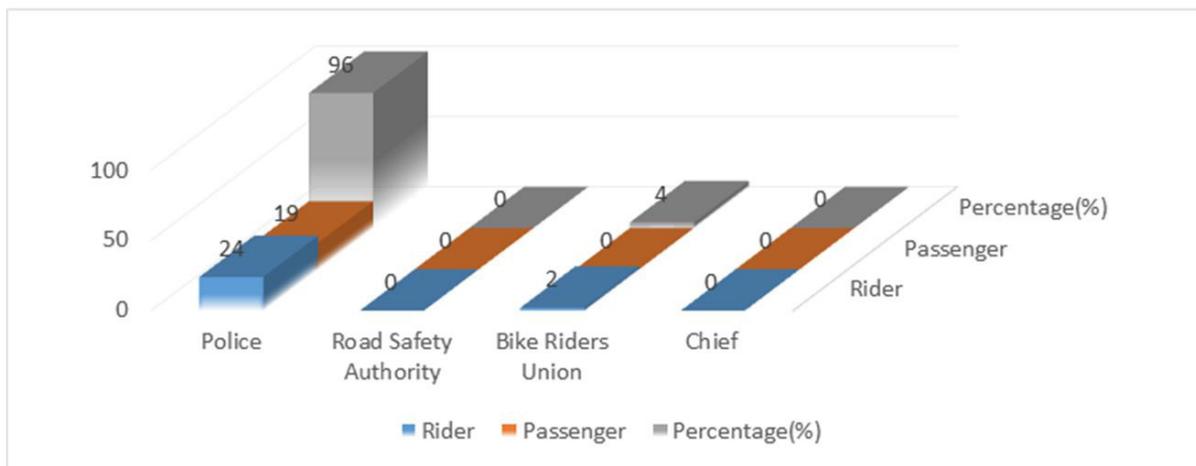


Figure 18: Authority Accident Reported to

Figure 18 shows that 96% of respondents (24 riders and 19 passengers) reported the incidence of their motorcycle accidents to the police and 4% of riders reported their motorcycle accidents to the Bike Riders Union Authority.

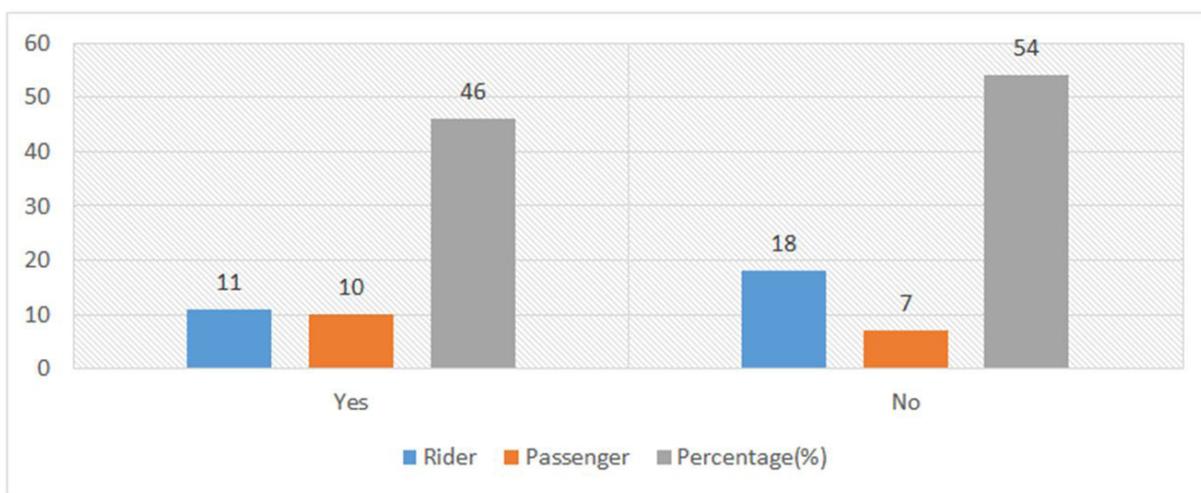


Figure 19: Presence of Residual Pain

As illustrated in Figure 19, when the respondents were asked about the presence of any residual pain as a result of the motorcycle accident, 46% of the respondents (11 riders and 10 passengers) revealed the presence of residual pain while 54% (18 riders and 7 passengers) revealed no knowledge of the presence of any residual pain as a result of the accident.

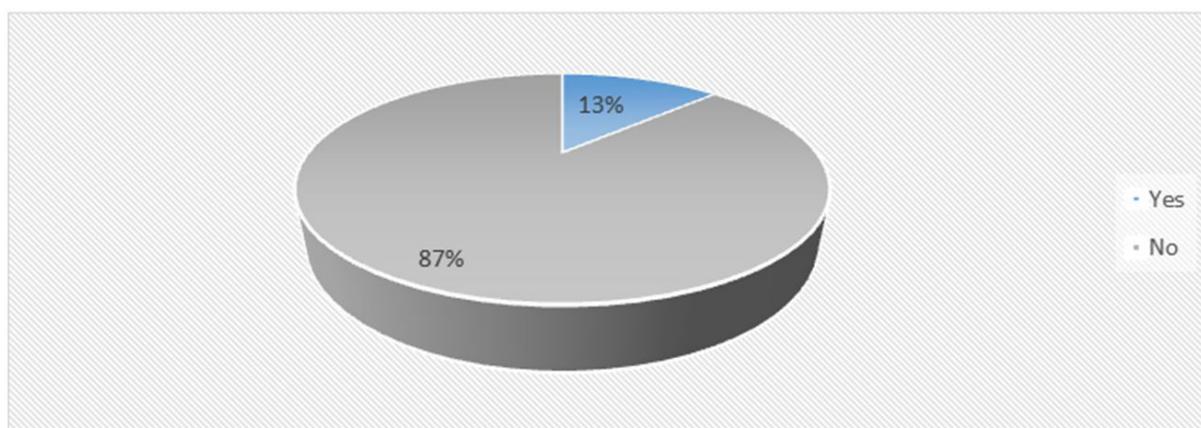


Figure 20: Riders' Eye Test

When asked whether they have taken an eye test, 87% of the riders revealed they have never taken an eye test while the minority of the riders (13%), have taken an eye test. This is shown in the Figure 20 above.

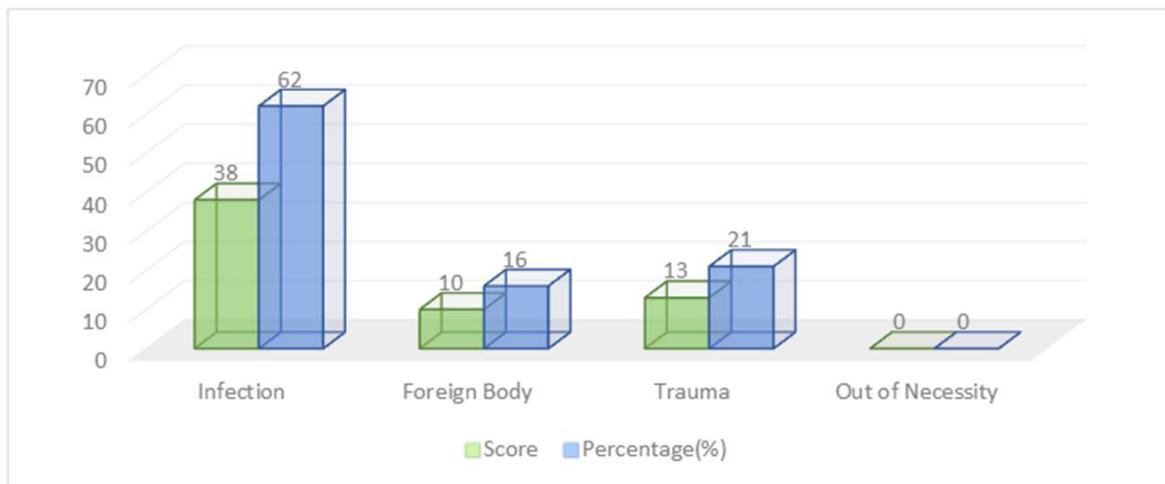


Figure 21: Reasons Riders Undergo Eye Tests

Of the riders who have taken eye tests, and as represented in the diagram above, 62% did it as a result of eye infection(s), 16% underwent eye test(s) because of the presence of foreign bodies in the eye while 21% did eye tests because of trauma to the eye (Figure 21).

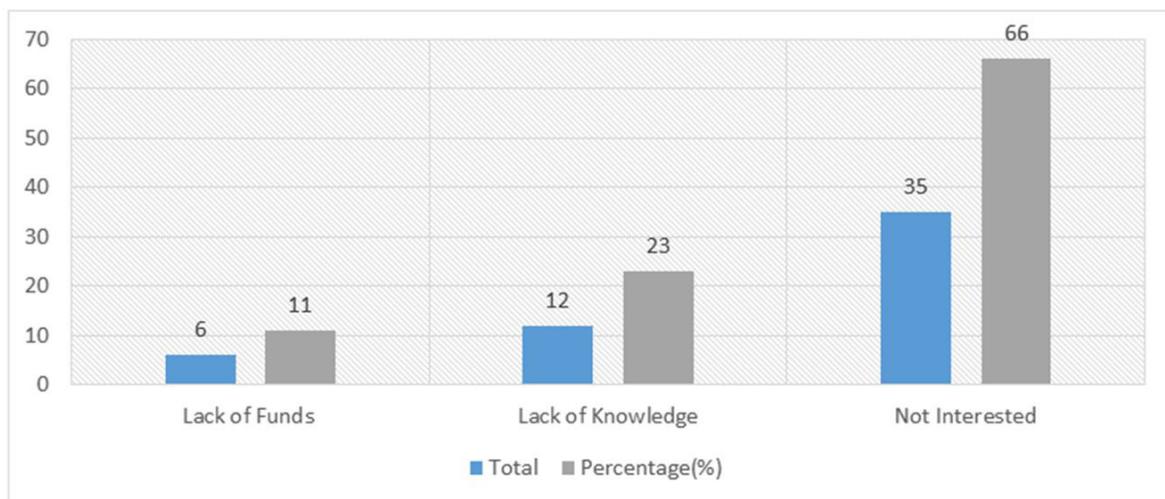


Figure 22: Reasons for non-regular Eye testing

Of those riders that have never undergone eye tests, 11% cited a lack of fund as the reason why they have never done so, 23% claimed it was due to a lack of knowledge about such tests while 66% clearly stated it was because they were not interested in taking an eye test (Figure 22).

## Discussion of Findings

This study focuses on the factors associated with the occurrence of road traffic accidents among commercial motorcycle riders in Kenema City, as noted from the analysis of findings, the study found that majority of motorcycle riders in the study area are within 26 and 40 years of age, these categories of people are in their early adulthood and middle adulthood years and are characterized by high driving risky behaviours, always in a hurry and aggressive, this finding was in support of earlier findings of [16-18] that age of motorcycle riders was a determinant factor associated with occurrence of road traffic accidents among the commercial motorcyclists. The finding of this study corroborate the existing finding of [19] that commercial motorcyclists are more dominated by male than their female counterparts as revealed in this study were all the respondents of riders were male (100%).

The level of formal education of the respondents reveals that 38 (62%) of commercial motorcyclist are secondary school drop-outs while 14 (23%) are primary school dropped out, 2 (3%) were college/university students and 7 (11%) do not have any formal education, this may account for high level of ignorance among them as most of the motorcyclists cannot interpret road traffic regulations or signs. It was in support of finding of [18]. The study reveals that 52(85%) of the respondents do not undergo former training before commencing commercial motorcycle riding; among the respondents 09 (14.8%) who revealed they undergone training reveals they received only trained for one week. This was in line with the existing studies of [16,17]. This may account for why the rate of accidents among commercial motorcyclist was on the increase because there was not enough adequate training given to the commercial motorcycle riders before embarking on riding expeditions. Factors associated with the occurrence of road traffic accident among commercial motorcyclists have been found to include: over-speeding, wrong overtaking, bad roads, mechanical defect, alcoholic intake, and overloading. This assertion agreed with the previous studies of [20-23] respectively.

Data collected through the research shows that there are a variety of effects associated with motorcycle accidents. These effects included severe injuries, long term deformities and mortality. It is also revealed that both passengers and motorcyclists alike are victims of motorcycle accidents. However, the incidence of motorcycle accidents among riders is greater than the incidence of such accidents among passengers. This could be because riders spend more time on motorcycles than the passengers they carry. Therefore, any sensitization drive geared towards awareness-raising on motorcycle accidents should mostly be targeted towards the riders themselves.

## Conclusion

Based on the objectives that directed the study, it was concluded that there were many factors associated with the occurrence of motorcycle accidents which ranged from the individual errors, environmental factors as well as mechanical factors. However, it was concluded that the most prominent factors causing motorcycle accidents were bad roads, over-speeding, over-loading, pedestrians, traffic officers' harassment and attitude of other riders. Other factors also causing motorcycle accidents included drinking/smoking by motorcycle riders, riders talking (on phones or to passengers) while riding (thereby dividing their attention) and riding without proper attire or gears.

## Acknowledgement

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## References

1. Ameratunga S, Hajar M, Norton R (2006) Road-traffic injuries: confronting disparities to address a global- health problem. *Lancet* 367: 1533-40.
2. Andrews CN, Obusingye OC, Lett R (1999) Road traffic accident injuries in Kampala. *East Afr Med J* 76: 189-94.
3. Dandona R, Kumar GA, Dandona L (2006) Risky behavior of drivers of motorized two wheeled vehicles in India. *J Safety Res* 37: 149-58.
4. Elliott MA, Christopher J Baughanb, Barry F Sextonb (2007) Errors and violations in relation to motorcyclists crash risk. *Accid Anal Prev* 38: 491-9.
5. Falco A, Piccirelli A, Girardi D, Dal Corso L, De Carlo NA (2013) Risky riding behavior on two wheels: The role of cognitive, social, and personality variables among young adolescents. *J Safety Res* 46: 47-57.
6. Houston D, Richardson L (2008) Motorcyclist fatality rates and mandatory helmet- use laws. *Accid Anal Prev* 40: 200-8.
7. Jacobs G, A Aeron Thomas, A Astrop (2000) Estimating global road fatalities. TRL Report Transport Research Laboratory, London, United Kingdom.
8. Kulanthayan S, Umar RS, Hariza HA, Nasir MT, Harwant S (2000) Compliance of Proper Safety Helmet Usage in Motorcyclist. *Med J Malaysia* 55: 40-4.
9. Kulanthayan S, See LG, Kaviyarasu Y, Nor Afiah MZ (2012) Prevalence and determinants of non-standard motorcycle safety helmets amongst food delivery workers in Selangor and Kuala Lumpur. *Injury* 43: 653-9.
10. Law TH, Noland RB, Evans AW (2009) Factors associated with the relationship between motorcycle deaths and economic growth. *Accid Anal Prev* 41: 234-40.
11. Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, et al. (2004) World report on road traffic injury prevention, World Health Organization, Geneva.
12. J Caban, R Karpiński, D Barta (2018) 11th International Scientific and Technical Conference on Automotive Safety, Casta Papiernicka, Slovakia.
13. A Kalasova, J Mikulski, S Kubikova (2016) Challenge of Transport Telematics: 16th International Conference on Transport Systems Telematics (TST2016), Katowice Ustron, Poland.
14. L Cernicky, A Kalasova (2015) The Application Of Telematic Technologies In Slovakia –The Possibility Of Improving Road Safetyin The Slovak Republic. *Sci J Silesian Univ Technol Ser Transp* 86: 5-11.
15. R Jurecki, M Poliak, M Jaskiewicz (2017) Young Adult Drivers: Simulated Behaviour in a Car-following Situation. *Promet traffic & Transportation* 29: 381-90.
16. Lin MR, Kraus JF (2009) A review of risk factors and patterns of motorcycle injuries. *Accid Anal Prev* 41: 710-22.
17. Solagberu BA, Ofoegbu CK, Nasir AA, Ogundipe OK, Adekanye AO, et al. (2006) Motorcycle injuries in a developing country and the vulnerability of riders, passengers, and pedestrians. *Inj Prev* 12: 266-8.
18. Thomson GA (1980) The Role Frontal Motorcycle Conspicuity Has in Road Accidents. *Accid Anal Prev* 12: 165-78.
19. Horswill MS, Helman S (2001) A comparative approach to differential accident liability: Motorcyclists versus car drivers. In *Behav Res Road Safety*.
20. Williams MJ, Hoffman ER (1979) Motorcycle conspicuity and traffic accidents. *Accid Anal Prev* 11: 209-24.
21. Wong JT, Chung YS, Huang SH (2010) Determinants behind young motorcyclists' risky riding behavior. *Accid Anal Prev* 42: 275-81.
22. World Health Organization (2006) Helmets: A Road Safety Manual for Decision-makers and practitioners.
23. World Health Organization (WHO) (2014) World report on road traffic injury.