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ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2015; 1(11): 541-549
www.allresearchjournal.com
Received: 19-08-2015
Accepted: 21-09-2015

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Incidence of Road Traffic Crashes and Pattern of Injuries among Commercial Motorcyclists in Naivasha Town

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Abstract

Background: Commercial Motorcycling has become a popular mode of transportation in Kenya, in both rural and urban areas since early 1990's, but traced to 1960s. In Kenya, however, its related injuries cause significant morbidity and mortality. Many road users have viewed their presence in the roads as the cause of congestion, confusion, fear, and decreased safety in the road system. Motorcyclists are at high risk of road traffic accidents and the attendant injuries, but are greatly neglected and few community-based studies have investigated the problem in Kenya.

Objectives: The primary objectives were; to determine incidences of injuries among the commercial motorcyclists, pattern of crashes among motorcycles and determine the risk factors associated with commercial motorcyclist's crashes and injuries.

Study design and Methods: Population based, cross-sectional study involving 166 commercial motorcyclists. Cluster, systematic and simple random sampling methods were used to select bicyclists at sites. Questionnaires were administered to the commercial motorcyclists

Results: One hundred sixty six male commercial motorcyclists were interviewed; all the sampled cyclists consented to participate in the study. The mean age of the respondents was 29.4 were aged 26-30 years and 66.8% were aged 21-30 years. Nearly three quarters (72.3%) of the participants were married. One hundred and fifty five (93.4%) did not go beyond secondary school. Abuse of alcohol and cigarette and overloading, were individually analyzed; they accounted for 28.7%, 18.1% and 8.5% of the causes of road traffic accidents in each of the respective (40.4%) of motorcyclist had been involved in accidents with other motorcyclists, 20 of the motorcyclists (14.2%) were involved in accidents with pedestrians. 12.1% were involved in motor vehicle accidents.

Conclusion: Commercial motorcyclists are men aged below 40years; they are highly exposed to crashes and injuries due to their interaction in the traffic system, since motorcyclists cyclists riding in, traffic mix feel unsafe and fearful. Therefore, it is very dangerous to ride in a mixed system because there is increased risk of crashes or accident. There are poor traffic law enforcement mechanisms in Kenya. There is need to integrate this economic activity in the road system while minimizing risks to crashes and injuries.

Keywords: Naivasha, Incidence, Crash, Injuries, Commercial Motorcyclists

1. Introduction

Road traffic injuries contribute significantly to the burden of disease and mortality throughout the world, but particularly in developing countries [1]. Currently about 3,300 lives are lost daily due to road crashes globally, with an estimated 20-50 million sustaining injuries annually [2]. Road traffic injuries are the leading killer of the most economically productive group (15-25 years) in the world [3]. With increasing modernization in many developing countries, road traffic deaths are increasing and traffic deaths are projected to become the third most important health problem by 2020 [4].

About 45 million motorcycles are produced annually globally, with the growth rate in Africa, being between about 12-30% [5]. In China in 2004, it was estimated that more than 67 million motorcycles were registered in the country [6]. Due to rapid motorization and other factors in developing countries the problem is increasing rapidly [7]. Motorization rates rise with income [8], and a number of LMICs experiencing growth have seen a corresponding increase in the number of motor vehicles (Ghaffar *et al.*, 1999) [9]. In some LMICs, this growth has been led

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by an increase in motorized two-wheeled vehicles, one of the least safe forms of travel, which has resulted in concurrent increases in related injuries^[10].

In Kenya motorcycle registration increased by 2324.87% in 2009 from about 3,759 units in 2005^[11]. In 2010, about 9,000 motorcycles entered into the transport sector every month and by December 2010, the registered number of motorcycles had surged to nearly 200,000 from 91,151 in December 2009^[12]. The emergent boom of commercial motorcycle in major urban centers in the country raises serious safety concerns requiring urgent government intervention.

The use of motorcycles in Kenya as a means of transport dates back in the 1960's where bicycle taxis were used to transport people and smuggled goods across the Kenya – Uganda border. From 1990's the bicycles are being replaced by light engine motorcycle (50-80cc)^[5, 13]. The popularity of this mode of transport can be attributed to the following reasons; they are a quick means of transport especially for short distances in cities and towns, they are efficient in mitigating traffic jam delays in the cities and they are available throughout the day and night hours. (Philipo *et al.*, 2010)^[14].

Injuries to motorcyclists are an important but neglected public health concern. Motorcycles' riders have the highest public health burden expressed in disability adjusted life years lost. Many developing countries are facing the problem of a rapidly increasing fatality and disabilities due to injuries with the vulnerable groups bearing the brunt of it^[1, 15-17]

Motorcycle accidents, among other types of road accidents, form a fatal category of motor traffic accidents^[18]. The reported prevalence of motorcycle injuries varies around the world, from 22.8% in China^[10] to as high as 62% in Vietnam. In Nigeria, prevalence ranging from 12.8-60% have been reported in different studies^[10, 17-19] and in Kenya 39.4 %.

Of the total traffic fatalities reported, global motorcycle mortality rates were highest in Thailand, Cambodia, Indonesia, Malaysia, France, USA and México at 70, 63, 61, 58, 25, 11, and 6% respectively^[10, 17]

Solagrebu and colleagues reports that the motorcyclists are vulnerable on the road and represent an important group to target to curb the road carnage^[17]. The risk of dying from a motorcycle crash is 20 times higher than from a motor vehicle crash^[16, 17]. This is due mainly to the fact that the motorcycle itself provides virtually no protection in a crash^[18] The causes of motor cycle accidents are human, environmental errors and defective vehicles^[5, 19].

The motorcyclists tend to over-speed and over load their motorcycles for quick returns. They are known to be reckless, in disciplined and lack respect for other road users. The majority of the motorcyclists don't wear any protective gear, hence aggravating the risks of getting severe head injuries^[20].

The existing evidence regarding commercial motorcycle-related injuries has many shortcomings when attempting to estimate the current burden of motorcycle related injuries. Much of the a priori research has focused on crash and injury patterns, helmet use, limited geographic regions and majorly hospital based, and areas outside Kenya, or was conducted over a decade ago.^[21-26] (Johnson, 2012; Sangowawa, 2007; Etukamana, Aliocuglu *et al.*, 2008; Adogu *et al.*, 2009; Oluwadiya *et al.*, 2004; Solagberu *et al.*, 2006;). Therefore this study will be carried out with a view to establish the

incidences and pattern of commercial motorcycle injuries in Naivasha town Kenya.

2. Materials and Methods

Study Area

The study was conducted in Naivasha town. It is a middle-sized cosmopolitan town 100km North West of Nairobi. It is midway between Nakuru and Nairobi. It is a secondary town of about 70000 people in low-income settlements rapidly developing in association with the local floriculture industry. According to the 2009 census the municipality has a population of 376243 people distributed around Lake Naivasha and surrounding hills. The main low-income settlements include Karagita and Mirera with a total population of 55000 people, Kamere with 11000 and Kasarani with 12000 people. The male to female population is equally distributed within 10 year gap age groups with 0-10 years male: female population in percentage being (50:40%) 11-20 (50:49%), 21-30 (49:51%), 31-40 (52:47%) 41-50 (52:47%), and 50 and above years being (48:51%). Commercial motorcyclists account for 95% of the transport system, they are preferred due to their convenience and affordability as compared to four wheeler public vehicles otherwise known as 'matatus'. The operations of commercial motorcyclists have similarities across different regions, therefore the study results will reflect the gravity of the public health concern in different regions across the country. The major types of commercial transport in the town are minibuses and motorcycles.

3. Methods

A descriptive cross sectional design was used. Using an interviewer-administered questionnaire, information was collected on the respondents' socio-demographic characteristics, alcohol consumption, motorcycle-riding experience, occurrence of road traffic accidents in the year preceding the study and injuries sustained. The questionnaire was designed in English and translated into Kiswahili and back translated into English to ensure that original meanings were retained. Consent was obtained from the leaders of motorcyclists' association to conduct the study and informed consent from the individual motorcyclists before the administration of the questionnaires.

Data was coded entered using SPSS version 20, frequencies were generated and the Chi square was used to test associations between categorical variables. Logistic regression analysis was also carried out; the level of significance was set at $p < 0.05$.

4. Results

One hundred sixty six male commercial motorcyclists were interviewed; all the sampled cyclists consented to participate in the study. The mean age of the respondents was 29.4 were aged 26-30 years and 66.8% were aged 21-30 years. Nearly three quarters (72.3%) of the participants were married. One hundred and fifty five (93.4%) did not go beyond secondary school. Sixty one point five percent (61.5%) had been working as commercial motorcyclists for not more than six years in the study.

Motorcyclists of ages between 26 and 30 years and married were most involved in road traffic accidents they represented 48.4% of the motorcyclists' accidents. Respondents of ages between 31 and 35 represented 34.4% of the accidents, while those of ages between 21 and 25, and 36 and above year

represented 8.6% each, of all the commercial motorcyclists accidents.

Motorcyclists with 3 or more years of riding experience were most involved in road traffic accidents.

Table 1: Demographic characteristics of respondents

Age in years	No.	%
21-25	32	19
26-30	79	47
31-35	52	33.3
36 – 40	3	0
<i>Educational level</i>		
Primary	97	58.3
Secondary	58	35.1
Technical college	11	6.6
<i>Marital status</i>		
Single	21	12.6
Married	120	72.3
Divorced	25	15.1
<i>Riding Experience in years</i>		
Less than 3	41	24.6
3-6	63	37.9
6-10	38	22.9
More than 10	24	14.6
Total	166	100

Accident involvement

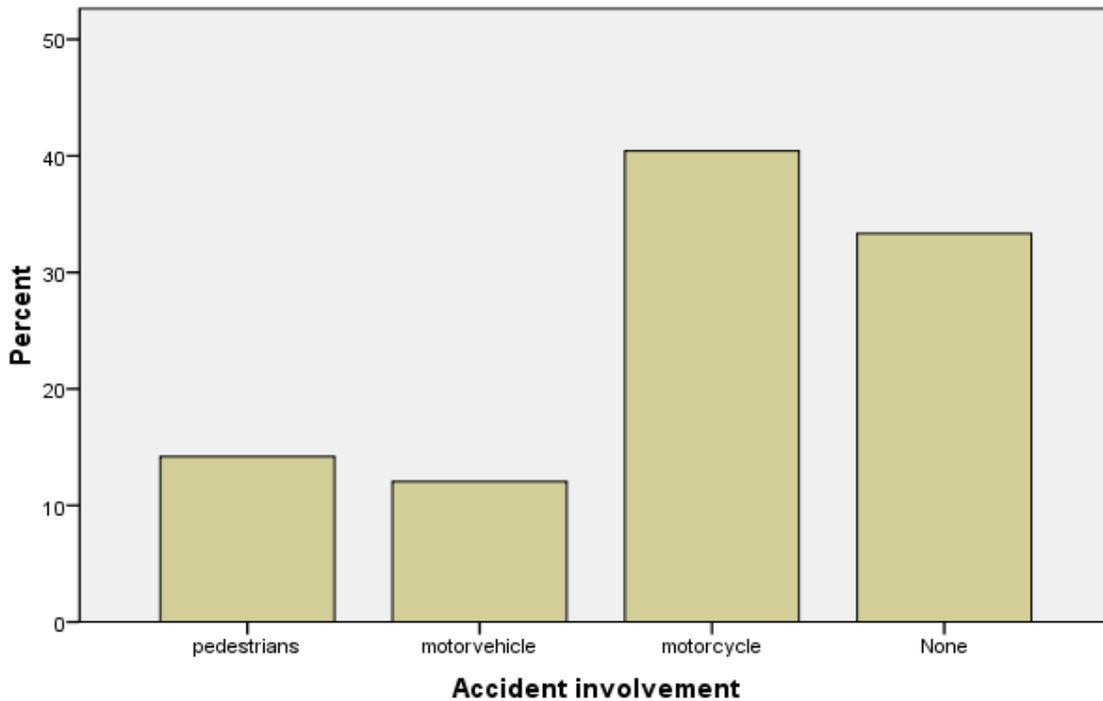


Fig 1: Accident involvement between Commercial Motorcyclists and other road users

Fifty seven of the motorcyclists (40.4%) admitted to have been involved in accidents with other motorcyclists,. 20 of the motorcyclists (14.2%) were involved in accidents with pedestrians. 17 (12.1%) were involved in motor vehicle accidents. 72(33.3%) of the motorcyclists are yet to be involved in road traffic accidents, an interview with one of the heads of commercial motorcyclists association attributed the non-accident involvement to the high number of new motorcyclists who had just joined the business and were yet to encounter an accident.(Figure 1).

Table 2: Type of Crash

Type of Crash	No	%
Motorcyclist and motorcyclist	57	60.6%
Motorcyclist and pedestrian	20	21.3%
Motorcyclist and motor vehicle	17	18.1%
Total	94	100%

Accidents involving motorcyclists with other motorcyclists resulted in the highest number of injuries at 57, this accounted for 60.6% of all injuries sustained. Pedestrians and

motor vehicles accidents accounted for 21.3% and 18.1% respectively (Table 2).

Table 3: Injury Disposition

Nature of injury	total	Total in Percentage
musculoskeletal	52	55.3%
Lower limbs	29	30.9%
Upper limbs	1	1.1%
Head	12	12.7%
Total	94	100%

Musculoskeletal injuries present the highest form of reported injuries amongst motorcyclists. In this study they accounted for 55.3% of all injuries sustained by motorcyclists, while injuries to the head, lower and upper limbs accounted for 12.7%, 30.9% and 1.1% respectively.

Nature of accident verses Injury sustained

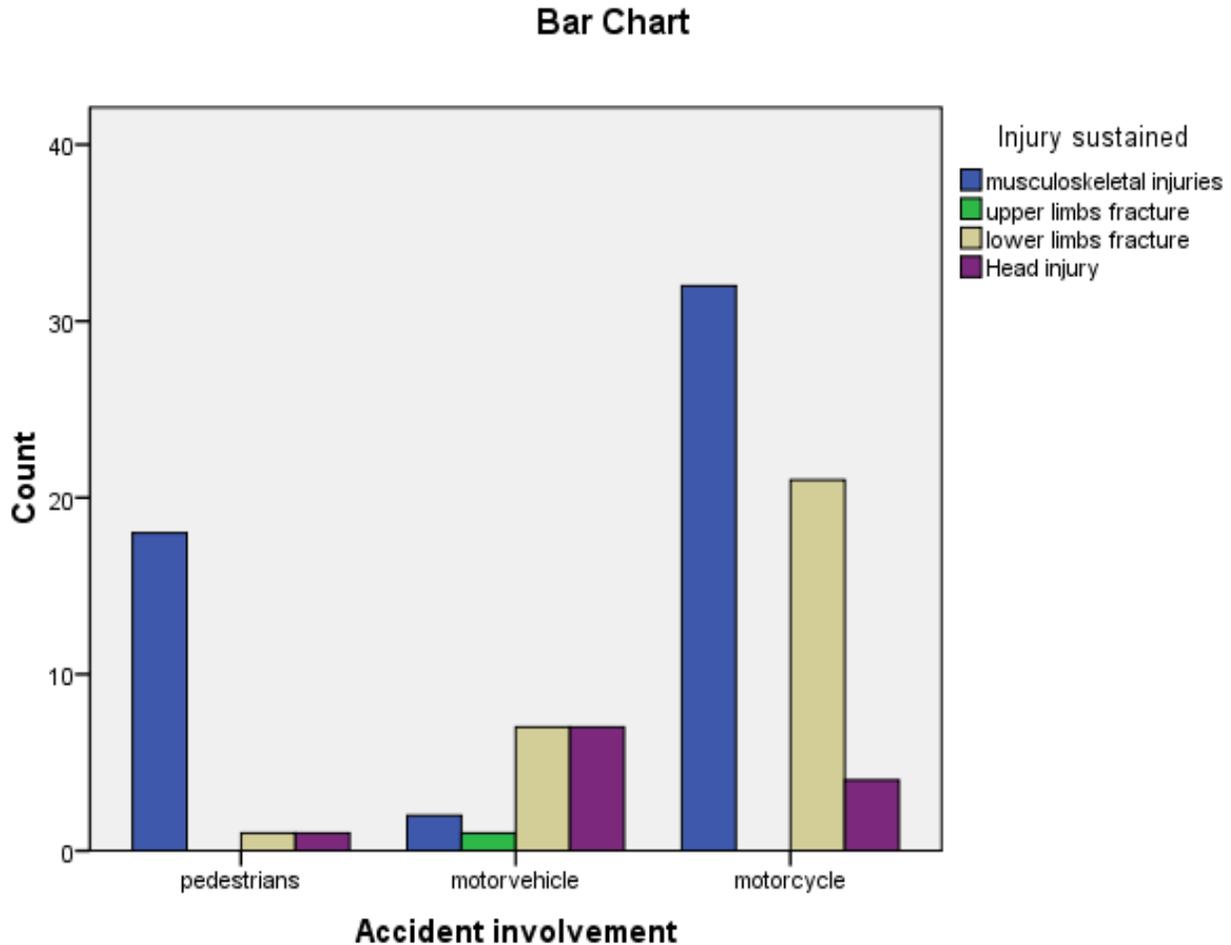


Fig 2: Nature of accident and injury sustained

32(61.5%) of the musculoskeletal injuries were from accidents involving commercial motorcyclists with their counterparts, while 18(34.6%) and 2 (3.8%) of musculoskeletal injuries were from accidents involving motorcyclists with pedestrians and motor vehicles respectively.

21 (72.4%) of injuries to the lower limbs were from accidents involving motorcyclists with other motorcyclists. Motorcyclists involved in accidents with motor vehicles and with pedestrians accounted for 7 (24.1%) and 1(3.4%) of injuries to lower limbs respectively.

7 (58.3%) of head injuries resulted from accidents between commercial motorcyclists and motor vehicles, 4 (33.3%) were from accidents with other motorcyclists, while 1(8.3%) from accidents with pedestrians.

Causal factors

Table4: showing causal factors verses accidents caused

	Total	
	Number of accidents	percentage
poor motorcycle maintenance	3	3.2%
poor road design(narrow)	37	39.4%
Over speeding	40	42.6%
improper road use by pedestrians(obstructions)	11	11.7%
lack of the use of protective cloth and equipment	3	3.2%
Total	94	100.0%

Bar Chart

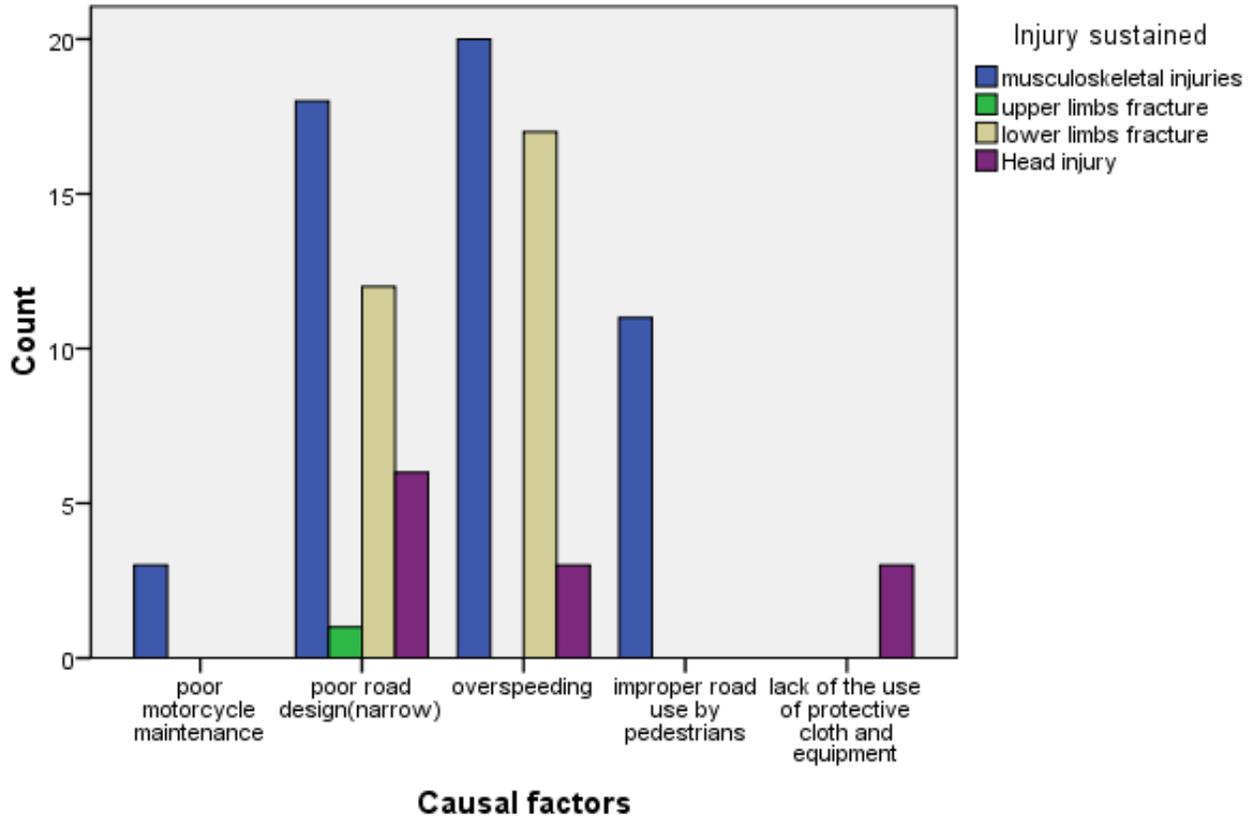


Fig 3: showing causal factors verses injury sustained

Human factors

Over speeding (42.6%) and pedestrians’ obstruction (11.7%) were the leading causes of road traffic accidents among commercial motorcyclists in terms of human error. These two factors accounted for 38.5% and 21.2% of all the musculoskeletal injuries.

Table 5: showing drug abuse and overloading against accidents caused

Contributing factor	Total Number of accidents	Total in percentage
alcohol	40	28.7%
cigarettes	26	18.1%
overloading	12	8.5%
none	63	44.7%
total	141	100%

Abuse of alcohol and cigarette and overloading, were individually analyzed; they accounted for 28.7%, 18.1% and 8.5% of the causes of road traffic accidents in each of the respective case. The relationship between these three factors and increase in commercial motorcyclists RTAs was further tested using chi square test, P value of 0.03 was obtained for abuse of drugs showing its relation to increase in commercial motorcyclists’ RTA. A P value of 0.23 for overloading proved that it was not directly related to increase in road

traffic accidents when compared with accidents involving commercial motorcyclists who carried one passenger per trip. 8.5% of the motorcyclists admitted to carrying more than one passenger once in a while especially when a parent and a child were passengers or two individuals who could not travel individually.28.7% of the motorcyclists admitted to be taking alcohol in the evening after work and thought this would not directly affect their operations during the day. Stringent law enforcement has ensured commercial motorcyclists adhere to the use of helmets (85.1%) and reflective jackets (89.4%). Use of reflectors was still at a low of 42.6% and needed to be encouraged.

On average, the commercial motorcyclist serviced their motorcycles at least twice a month, with 12.8% servicing the motorcycles depending on the functional need, 34.8% serviced on a monthly basis while 52.5% after a fortnight. Vehicular factors therefore have a minor contribution to road traffic injuries among commercial motorcyclists in Naivasha owing to the fact that 65.5% of the 141 respondents had been involved at least in one form of road traffic accident, with only 3.2% of the commercial motorcyclists stating poor motorcycle maintenance as a cause to road traffic accidents. In this study, 39.4% of the road traffic accidents involving commercial motorcyclists are attributed to poor road design (Table 3)

safety measures and interventions

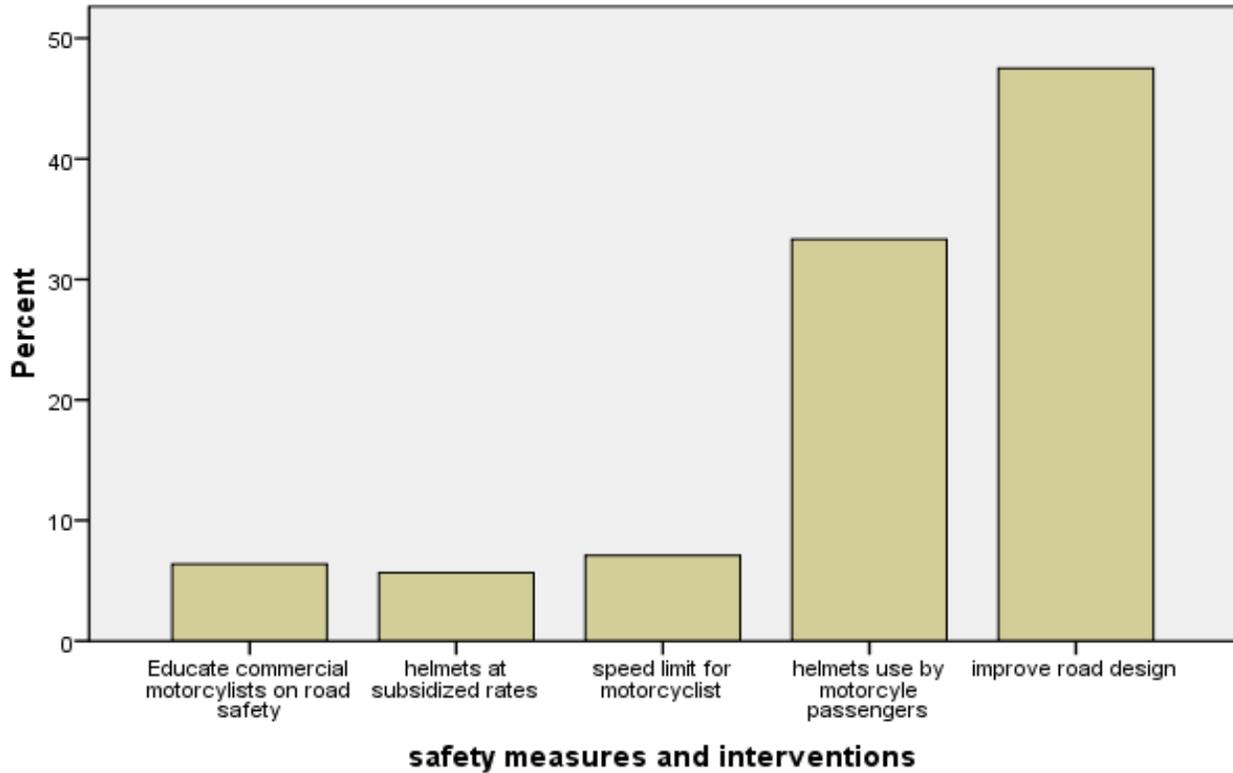


Fig 5: Safety Measures and Interventions

Naivasha town is characterized by poorly designed roads, 47.5% of the interviewed commercial motorcyclists suggested improvement of the road network to accommodate them and setting up of waiting bays as a way of minimizing road traffic accidents, 33.1% suggested the enforcement of laws that will ensure the passengers wore helmets, 7.1% suggested setting and enforcing laws that will govern against over speeding among commercial cyclists while 6.4% and 5.7% of the motorcyclists suggested educating new recruits on the road safety laws governing commercial motorcyclists and subsidizing the prices of helmets to ease their access to both the motorcyclists and their passengers as one of the ways to minimize road traffic injuries in the motorcyclists population. (Fig. 5).

5. Discussions

Road traffic injuries, death has been increasing in the last two decades resulting into significant morbidity and mortality due to increases motorization (8). Commercial motorcycles have become major form of public transportation in developing countries. This mode of transportation has introduced attendant risk of road traffic crashes being higher among this group of vulnerable road users. The study found out that commercial Motorcycling sector is dominated by the male gender. There was no single female found working within the sites covered in this survey. Consequently the sample was composed entirely of men. This could be attributed to the nature of the work, partly due to the time and energy involved in riding the whole day on a daily basis.

The incidence of crashes and injuries was highest amongst commercial motorcyclists male aged between 24 and 38

years, this is in consistence with a study by Bachani and colleagues ^[27]. that found persons between the ages 15 and 35 years were the most affected. Similarly a study by Odero and colleagues had similar findings with the most affected population being between 15 and 44 years of age ^[28]. Findings from other studies conducted in developing countries indicate that this age group is at greatest risk of being involved in road traffic crashes. These individuals are also often the heads of households, and their mortality could have potentially long-term implications on not only the financial sustainability of the family but also their social well-being. Furthermore, this analysis reveals that RTIs (and related fatalities) continue to increase in Kenya, with motorcyclists (both riders and passengers) as well as pedestrians among the most affected ^[27].

Regarding the type of collision, over half 60% of the motorcyclists who had accidents reportedly collided with other motorcyclists. This was very high compared to another study by Owaoje, 2012 which reported that collision of motorcyclists by motorcyclists were reported by 27.9% ^[29], it is even much higher percentage than those reported by the University of Benin and Ife studies in which only 7 and 8.7% of the accidents respectively involved other motorcyclist ^[30]. Collisions with motor vehicles were reported by 18.1% of commercial motorcyclists this was however lower compared to a study in Nigeria which reported about one third of the motorcyclists who had accidents collided with motorcars ^[29]. Similarly Umbese and Okukpo in a study conducted among patients seen in the University of Benin Teaching Hospital reported that 36% of accidents were due to collisions with other motor vehicles ^[30].

This study found pedestrians to be the second most vulnerable to road traffic accidents after the commercial motorcyclists and also one of the causes of commercial motorcyclists RTAs, this recalls previous studies that had similar findings that RTIs (and related fatalities) continue to increase in Kenya, with motorcyclists (both drivers and passengers) as well as pedestrians among the most affected [27]. Studies carried out by [27] blamed a majority of motorcycle accidents on the motorcyclists while other studies found road traffic injuries among motorcyclists, their passengers and pedestrians to account for 46% of all road traffic related injuries [5]. Other previous studies conducted majorly in western Africa among victims of motorcycle accidents reported 10-22% involvement of pedestrian [29]. Musculoskeletal injuries present the highest form of reported injuries amongst motorcyclists. In this study they accounted for 55.3% of all injuries sustained by motorcyclists, lower limbs accounted for 12.7%. Lower-leg injuries – either from direct contact with the impacting vehicle or as a result of being crushed – contribute substantially to morbidity [31].

The high rate of accidents among motorcyclists is attributed to the use of motorcycle as the major mode of transport in Naivasha, another factor is the narrow roads which are shared by the motorcyclists, pedestrians and motor vehicles. The motorcyclists have no designated areas to pick and drop their passengers, exposing themselves, the passengers and pedestrians to accidents. The roads were not constructed with motorcyclists in mind.

It is well established that speed is a major risk factor for road traffic crashes and resulting injuries and fatalities. One study examining the effect of speeding has shown that even a 1 km/h increase in vehicle speed can lead to as much as a 3 percent increased risk of a crash resulting in an injury [27]. Over speeding is still characteristic of commercial motorcyclists, this coupled with the lack of a comprehensive structure in place to ensure motorcyclists comply to stipulated speed limits and poorly designed roads has kept RTA and related injuries among commercial motorcyclist constantly high. According to the Kenya law (Section 70 of Cap 403) the speed limit in urban areas, built up areas and near schools is 50km/h. It is 110km/hr major roads. No such laws have been formulated for commercial cyclists. Speeding drivers or owners of speeding cars are responsible for any penalties that may accrue in the event of a violation. It must be stated that for most parts of the country road conditions are such that speeding is not even realistic. There are far too many potholes, roads are poorly designed roads with sharp curves and often unnecessary, illegal and unauthorized road bumps.

Drug abuse and overloading among commercial motorcyclists were found to be low and were not obvious causes of road traffic accidents. Use of alcohol, cigarette smoking, and psychoactive Substance abuse impair the judgment of the drivers and their ability to correctly interpret events.³² Alcohol is one of the most important risk factors for serious and fatal injuries, contributing to approximately one third of all deaths from accidents. One study showed that the speed of the vehicle at the time of collision is high when blood concentration of alcohol is high. Alcohol use is a risk factor for road traffic accidents and fatal injuries [33, 34]. In Benin, 39.4% of the riders consume alcohol regularly, while 30% use alcohol in Lagos and Ile-Ife [35]. However, on Pakistani roads where some effort is made to enforce no

drink driving rule, only 10% of truck driver were found using alcohol [35].

Strict law enforcement on overloading and abuse of alcohol and other drugs has ensured motorcyclists do not carry more than one passenger in a trip and do not abuse drugs, with a number of them admitting to have stopped consuming alcohol in order to engage in the commercial motorcycle business. 8.5% admitted to carrying more than one passenger once in a while especially when the concern passengers were dependent on each other as it would be in the case of a mother and a child. A study on boda-boda habits in central and Rift Valley indicated that less than one third of riders use helmets. This is so despite the fact that studies show that correct use of motorcycle helmets decrease the risk and severity of injuries by about 72 percent and decreases likelihood of death by up to 40 percent [36].

Helmets cushion the motorcyclist and his passenger from head injuries at the time an accident. Reflective jackets improve visibility. The use of helmets by the commercial motorcyclists has greatly improved to 85.1% this is in contrast to a study carried out by Bachani and colleagues [27] found that only a third of commercial cyclists wore the helmets. The motorcyclists do not use personal protective devices largely because regulatory agencies did not enforce their use [35]. Three percent of the okada riders use crash helmets. None of the okada riders in Igboora used crash helmet. However Oginni and colleagues [35] found that 23.8% of riders in Ile Ife and Lagos, Nigeria used crash helmets. Also about a third of motorcyclists in Kenya used crash helmet. [27]

The use of helmets by the passengers is still low with less than 2% wearing them. Helmets usually made of a rigid fiberglass or plastic shell, a foam liner, and a chinstrap, have been the principal countermeasure for preventing or reducing head injuries from motorcycle crashes. Based on police reports, helmets reduced the risk of motorcycle deaths by 29% during 1972–1987 [37] and their effectiveness increased to 37% during 1993–2002 possibly due to improvements in helmet design and materials [36]. After adjusting for age and crash characteristics, non helmeted riders were 2.4-times more likely than those wearing a helmet to sustain brain injuries or skull fractures [38]. On the other hand use of reflective jacket has improved to 89.4% up from 63% according to Bachani and colleagues. Besides helmets, the use of reflector jackets is the lowest among operators in other parts of the country. This situation becomes extremely dangerous at night when boda-boda operators risk being hit by moving vehicles or they themselves knocking someone down because they are invisible. It is even worse when the boda-boda is ridden with lights off. The improvement is attributed to the ministry of public health and sanitation together with the World Health Organization that have initiated campaigns for creating awareness on the use of protective equipment among commercial motorcyclists in Naivasha. Strict law enforcement with hefty penalties for breaking the laws was also stated by commercial motorcyclist to have contributed to this phenomenon.

In this study motorcycle maintenance was found not to be directly related to the occurrence of accidents with more than half the motorcyclists servicing the motorcycles at twice in a month. A lot still needs to be done to improve on the roads which according to this study at 39.4%. was the second leading cause of RTIs after over speeding. Due to the narrowness of the roads, the motorcyclists have to compete

for vehicular space with motor vehicles. An interview with one of the leaders of motorcyclist association revealed that apart from the road being narrow, poor sewerage system poses a public health concern forcing the motorcyclists to ride through raw flowing sewage, though the matter has been raised with the district administration, little has been done to address the problem. The commercial motorcyclists have no waiting bays designated for dropping and picking their passengers, they pick and drop them randomly, and this increases vulnerability to accidents both to them and the passengers. The wet weather makes the already narrow roads slippery, increasing the chances of commercial motorcyclists being involved in accidents. This emphasizes findings from previous studies by (Owoaje, 2009) that bad roads are the second most commonly mentioned cause for road accidents. In other studies it was found that most roads in Kenya are constructed to accommodate motor vehicles with no reservations for motor cyclists forcing them to compete for vehicular space with the motorists exposing them to higher risks of accidents. There are no adequate road signs to direct the motorcyclists and other road users on how to operate more safely on the roads. (Odero *et al.*, 2009).

The findings in this study show an improvement in the use of protective equipment by commercial motorcyclists which has been brought about by awareness created by stakeholders in the health sector, however there is more that needs to be done in enforcing laws that will ensure use of protective equipment by motorcycles' passengers. There should be implementation and enforcement of laws that will safeguard speed limits among commercial motorcyclists. Stakeholders in the road construction industry should be brought on board to ensure future road construction and renovations have reservation for motorcyclists.

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