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Prevalence and Associated Factors of Road Traffic Accidents among Motorcycle Drivers of Addis Ababa City, Ethiopia

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ABSTRACT

Background: Motorcycle is a type of motor vehicle with two wheels, which is used to transport a passenger and for locomotion. Motorcycle accidents are becoming a public health problem in the developing worlds. Motorcycle injuries constitute a major but neglected emerging public health problem in developing countries. They are among the leading causes of disability and deaths, the main victims being motorcycle drivers, passengers, and pedestrians in the young reproductive age group.

Objective: The objective of this study was to assess prevalence and associated factors of road traffic accident among motorcycle drivers of Addis Ababa, Ethiopia, 2019.

Methods: Cross-sectional study design was used. Across-sectional quantitative study was carried out among 590 motorcycle drivers working in Addis Ababa city from February 19 to March 31, 2019. Multi stage sampling techniques were used. The questionnaire with close-ended question's including Socio demographic variables, driver's characteristics, motorcycle condition, and road traffic accident condition was used. Data collection was conducted at the workplaces of the motorcycle drivers by face-to-face interviewing of motor cycle drivers. EPI info version 7 was used for data entry and SPSS version 21 for analysis. Logistic regression was done to assess the association between the variables.

Result: The study found that the prevalence of road traffic accidents among motor cycle drivers of Addis Ababa city was 33.8% with 95% CI 30.3% to 69.7% during the last one year. Failure to follow the write hand rule was the most reported cause of accident (32.5%), followed by over speed driving (31.5%) and alcohol driving (22.5%), respectively. The occurrence of motorcycle accidents was significantly associated with: Having previous of punishment by traffic police, AOR = 2.871 (95% CI, 1.632, and 5.051), speed driving AOR = 3.730 (95% CI, 2.239, and 6.215), having monthly income, 1000-2000 Ethiopian birr AOR = 0.540 (95% CI, 0.303, and 0.961), and 3001-4000 Ethiopian birr (AOR = 0.426 (95% CI, 0.220, and 0.828) respectively with ($p \leq 0.05$).

Conclusion: The proportion of road traffic accidents among motor cycle drivers was found to be high in the last one year in Addis Ababa, Ethiopia.

Keywords: motor cycle, motor cycle drivers, road traffic accident

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INTRODUCTION

Background

Road Traffic Accident (RTA) can be defined as an accident that occurs on a way or street open to public traffic, resulting in one or more persons being killed or injured, and involving at least one moving vehicle (Hoque *et al.*).

Accordingly, RTAs are collisions between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and geographical obstacles (Wikipedia, 2013). Road traffic accident poses enormous challenges. Globally, 1.3 million fatal and up to 50 million non-fatal injuries are reported (Sleet *et al.* 2011).

Trauma is a major cause of morbidity and mortality in worldwide with the death of majority of victims in road traffic accidents (RTA). According to World Health Organization, more than 90% of deaths occur in low and middle income countries (Toroyan, 2009).

Motorcycle is a type of motor vehicle with two wheels, which is used to transport passenger and for locomotion (Hellen, 2013). According to the U.S National Highway Traffic Safety Administration (NHTSA), an estimated 148,000 motorcycle drivers have died in traffic crashes. Motorcycles made up of nearly 3% of all registered vehicles in the United States in 2008 and accounted for only 0.4% of all vehicle miles traveled. The number of motorcycle accidents in the U.S increased by 1.5% from 2,116 in 1997 to 5,290 in 2008. Considering per mile traveled in 2008, motorcycle drivers were 37 % more likely than drivers of cars to die in a motor vehicle crash and nine times more likely to be injured. This high accident rates are in part attributed due to consumption of alcohol (NHTSA, 2009).

In 2006, in Europe, motorcycle accidents represented 22% of the total number of road traffic accident fatalities. This risk may be influenced by several individual and environmental factors that apply to motor cycle users (Lardelli-Claret *et al.* 2005; Facts, 2008). In Brazil, most of the population makes use of motorcycles to move around. Motorcycles are also used as means of transport and delivery men. Moreover, this means of transport has a lower cost compared to others and is accessible to low-income people who use it as locomotion (Cavalcanti *et al.* 2011).

In France, as in other industrialized countries, although the users of the motor cycles represent less than 2% of the vehicles on the road, but they account for a very high proportion of the individuals who are injured and killed on the roads (MacLeod *et al.* 2010; Moskal *et al.* 2012).

Motorcycle injuries constitute a major but neglected emerging public health problem in developing countries (Rafindadi, 2000). They are among the leading causes of disability and deaths, the main victims being motorcycle drivers, passengers, and pedestrians in the young reproductive age group (Solagberu *et al.* 2006).

Injuries related to motorcycles contribute significantly to the number of road traffic injuries seen. The increase in use of the motorcycles as forms of transport has been attributed to their accessibility, affordability, and an unregulated market in developing countries like Kenya (Nantulya and Reich, 2002; Peden *et al.* 2004). In Nigeria, the prevalence of motorcycle injury ranging from 12.8-60% has been reported in different studies (Okedare, 2004).

According to a report published by the World Health Organization (WHO), Ethiopia has one of the highest traffic accident rates in the world. In 2006, 2,517 people were killed in road traffic accidents in Ethiopia and 24,792 suffered injuries. Ethiopia has 244,257 registered vehicles as of 2007, 29% of these are motorcycles, 34% minibus, vans and 27% of the registered vehicles are trucks, and etc., Ethiopia has a speed limit of 60 km/hr in urban roads but does not have national legislation that requires motorcycles helmet use (Report -W. Traffic Accidents kill in Ethiopia 2006). According to the report from Addis Ababa police commission,only one in three motorcycle drivers wore helmets correctly (IRAP).

Road traffic injuries are the eighth leading cause of death globally and the leading cause of death among young people aged 15–29. Nearly 3,400 people die on the world's roads every day (WHO, 2013). Low-income countries with small numbers of vehicles experience a huge burden of fatalities (Ameratunga, 2006). Ethiopia, according to WHO report, is considered one of the worst countries in the world where road transportation kills and injures a large number of road users every year (WHO, 2009).

A middle aged male is more likely to die from injuries received in a traffic accidents than from any other cause and motor cycle accidents are single the leading cause of death. Motor cycle drivers are about 25 times more likely than passenger car occupants to die in traffic crashes. Currently, motor cycle accidents rank ninth in order of disease burden and are projected to be ranked third in the year 2020 (Mathers, 2008).

About 20% of deaths in RTA are in motor cycle accidents globally. Most of the people were young males who are in the productive period of life. This places a heavy burden on the family, social and medical resources (Facts, 2009). Motor cycle drivers are more vulnerable to RTA and for sustaining injuries. This group of road users does not have a protective shells around them and therefore are more at risk than those inside vehicles (Albalate *et al.* 2010).

Motorcycle drivers are among the most vulnerable road users. Nearly quarters (23%) of the world's road traffic deaths occur among motorcycle drivers. Per mile traveled, motorcycle drivers have a 34-fold higher risk of death in a crash than people driving other types of motor vehicles (Lin and Kraus, 2009). Motorcycle drivers face higher dangers from several different road hazards than do cars and other vehicles (Berecki-Gisolf *et al.* 2015).

Due to the smaller size and less stable nature of the motorcycle, potholes, dead animals, uneven heights between lanes, and other irregularities or unexpected objects in the road pose a serious safety threat to motorcycle drivers. Again, because the motorcycle is not surrounded by a metal case and is likely to be thrown far and hard, such crashes are more deadly than those involving other vehicle types. Motorcycle injuries constitute a major but neglected public health problem in rapidly motorizing LMICs, and the relevant risk factors have not been adequately examined in these countries (Lin and Kraus, 2009). In Malaysia, a study reported that motorcycle drivers constituted about 55-57% of the total number of road accidents and 60% of traffic fatalities (Kareem, 2003).

Several studies in developing countries like southern Nigeria and Uganda have also shown that helmet use by motorcycle drivers is low. Majority of motorcycle drivers have been reported not to wear any protective gear, hence aggravating the risk of getting severe head injuries (Oluwadiya, 2004). Use of alcohol while driving is also a common practice among motorcycle drivers. Asimilar study was done in Nigeria, Ondo State among motorcycle drivers, up to 30% of them engaged in drunk riding (Okedare, 2004). While another study in Oyo State stated that 20.4% of motorcycle driver reported current use of alcohol (Owoaje, 2005).

Injury due to road traffic crashes is a major cause of ill health and premature deaths in developing countries. According a similar study conducted in Kenya among 200 motor cycle drivers, 33% of them were injured and not wearing any protective equipment. Negligence was the most reported cause of crash (33%), followed by slippery roads 21.0% and speeding (17.5%). People injured at night were 5 times more likely to sustain bodily injury compared to those injured during the day (Matheka, 2015).

In Addis Ababa, this risk taking behavior has continued to lead to the occurrence of accidents among motorcycle drivers. However, despite this burden, the public traffic policy responses to this problem have been low, probably because of the lack of local data regarding the problem. No academic studies have focused on motorcycle drivers despite the fact that motorcycles are the mode of transportation within all Ethiopian cities.

Since the majority of motorcycle injuries are preventable, a clear understanding of the prevalence and contributing factors for motor-cycle related road traffic accidents is essential for the establishment of prevention strategies, so this study will give baseline information for researchers and policy makers on road traffic accident prevention strategies and to fill the information gap on RTCs among motorcycle drivers in Addis Ababa, Ethiopia.

There is limited accident data especially scientific work about traffic safety in Ethiopia. Besides, nothing has been said about the quantitative understanding and factors which involve motorcycle drivers' in road traffic accidents.

As a strategy of finding ways of alleviating motorcycle accidents and minimizing their consequences,this study sets out to help in understanding the underlying factors influencing motorcycle accidents with possible solutions in the endeavor to curb the increasing number of injuries

due to motorcycle accidents. Therefore, the findings from this study will be hoped to be beneficial to the; motorcycle drivers, passengers, government, and public.

Above all, it will be hoped that this study would identify new areas of concern within the motorcycle transport sector, which will trigger interest for more research in the area and subsequently lead to insights to transport stakeholders. The study will also enhance motorcycle drivers to use safety measures, and policymakers to create preventive measures, for traffic accidents. General as the research findings, identify the possible ways of how to curb motorcycle accidents.

MATERIALS AND METHODS

Study area

The study was conducted in Addis Ababa, capital city of Ethiopia, which has an area of 530.14 square Kilometer divided into 10 sub cities. According to the 2007 national census, the population of Ethiopia has reached 73,909,355 of which the urban population was 11,956,170 accounting for 16.1% of the total Population. Having a growth rate of 2.1%, the population of Addis Ababa has 2,738,248, which accounts for 32.27% of the total urban population of the country CSA. The expansion of the city, increasing population size coupled with the economic growth has required the respective transport service supply for the increasing mobility needs of the people. The city's population is estimated to be 3 million with the current population growth rate of 2.1%. The city population is estimated to reach 5 million after 10 years.

Addis Ababa is exhibiting high social, economic,and structural change and found to be a fast growing city. Taking into account Addis Ababa's fast growth and to enable the transport sector to play its required role, the government has invested a large resource to construct roads so as to expand the road network (CSA. 2010). Based on data from Addis Ababa City Road and Transport Authority the total number of registered motorcycles that works in Addis Ababa city accounts, 22,838. Addis Ababa has ten sub cities, among them four of them were study areas, namely Lideta, Arada, Kirkos and Nifasilik Lafto sub cities (Beuro Aacrat. Road and Transport Beuro. May 12, 2016).

Study Design and Period

A descriptive cross-sectional study was conducted from February 19 to March 31, 2019.

Source population

The source populations for the study were all motorcycle drivers in, Addis Ababa city, Ethiopia.

Study Population

The study population comprises of those motorcycle drivers in four selected sub cities, namely, Lideta, Arada, Kirkos and Nifasilik Lafto sub cities, who were driving motorcycles in Addis Ababa city 2019.

Sample population

All selected Participants who fulfilled the inclusion criteria and who were driving the motor cycle at the time of data collection from February 19 to March 31, 2019.

Inclusion Criteria and Exclusion Criteria

Inclusion criteria

Subjects in the age group of 18-60 years, considered as acceptable working age and driving at least for one year, a minimum year of exposure was required.

Exclusion criteria

- Ages greater than 60 years old were not included to control the ageing effects.
- Females were not included due to less number of females in motor cycle driving.
- Subjects with driving experience less than one year.

Sample size determination

Sample size was calculated using sample size determination for a single population Proportion. The following formula was used to estimate the minimum number of motorcycle drivers required for the study. Considering the proportion of 50%, 5% marginal error and 95% confidence interval. 5% was added to compensate for non-response rate. Based on this assumption, the actual sample size for the study was computed using the formula for single population proportion as indicated below:

$n = (Z\ \alpha/2)^2\ p\ (1–p)/\ d^2 + 5\%$ non-response.

Where,

n = maximum sample size which represents large population

$Z\ \alpha/2$= standard normal distribution curve value for 95% CI which is 1.96 (where $\alpha = 0.05$)

p = proportion of road traffic accidents among motorcycle drivers (0.5)

d = margin error between the sample and the population (0.05)

$$n = (1.96)^2 \times 0.5\ (1\text{-}0.5) / (0.05)^2 = (3.8416 \times 0.5 \times 0.5) / 0.0025 = 384.$$

Because of the total population size of the study area were greater than 10,000, which was 22,838, we could not apply the population correction formula:

$n = 384$ by adding 5% non-response rate.

Totally 384 + 384 × 0.05 = 384 + 19, nf = 403, Since multi-stage sampling technique was used rather than using simple random technique as a result decreased in precision of data was considered. To increase precision of the data, the calculated sample size was multiplied by 1.5 design effects. Finally, the required sample size became 605.

Sampling method and sampling procedure

Sampling Method

Multistage sampling technique was used to identify those participants of the study.

Sampling procedure

Addis Ababa city administration has 10 sub-cities. First, out of ten sub cities four sub cities, namely: Lideta, Arada, Kiros, and Nifasilik Lafto sub cities were selected using simple random sampling technique. A sampling frame of motorcycle drivers found in four sub cities was obtained from Addis Ababa City Road and Transport Authority Bureau. Secondly, the number of motor cycle divers included in the study from the selected sub-cities was determined using proportion to size allocation technique on the basis of data from Addis Ababa City Road and Transportation Authority Bureau. Thirdly, a systematic random sampling technique was used to select motor cycle drivers who included in the study. Interval (K) value was calculated for each selected sub cities by using the sampling frame of motor cycle drivers from each selected sub cities. To identify the interval (K) value, the total number of motorcycle drivers found in each selected sub-cities divided by to the number of motorcycle divers who were intervened from each selected sub-cities. Finally, the first respondent was selected by lottery method then after every k interval.

Lideta (k_1) = 770/168 = 4, Arada (K_2) = 655/143 = 4

Kirkos (k_3) = 565/123 = 4, Nifasilik (k_4) = 625/136 = 4.

Sampling Procedure

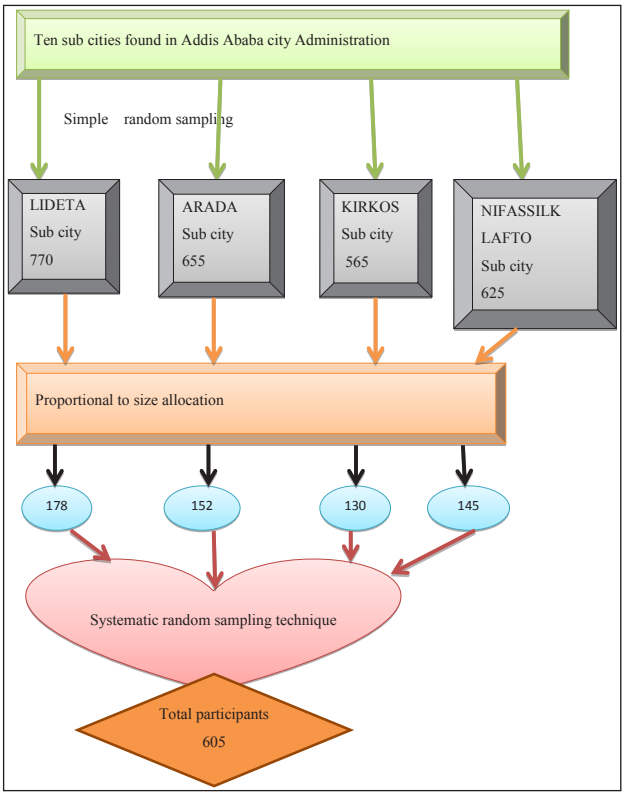

Fig. 1: Schematic presentation of sampling procedure, Addis Ababa, Ethiopia, June, 2018

Variables of the study

Dependent Variable

- Road traffic accidents among motorcycle drivers

Independent Variables

Socio–demographic factors:

- Age

- Educational status
- Marital status
- Religion
- Monthly income
- Family relation
- Environmental factors like rainy weather

Lifestyle factors:

- Chewing chat
- Drinking alcohol

Occupational factor:

- Years of Experience
- License
- Speedy driving

Operational Definition

Prevalence of road traffic accidents: Is defined as the frequency of study subjects who were response experiences of RTA in the past one year.

Driver factors: Driver personal elements /attributes that may contribute to road traffic accidents.

Environmental factors: Aspects of the environment that can influence accidents

Motorcycle: It is a type of motor vehicle with two wheels, which is used to transport a passenger and for locomotion.

Motorcycle drivers: People who transport passengers and messages to set destination area by motorcycle (IJHS, 2013).

Serious injuries: Fractures, concussions, internal injuries, crushing, severe cuts and lacerations, severe general shock, necessitating medical treatment, and any other injury involving removal to and detention in hospital.

Minor injuries: Injuries of a minor nature such as sprains and bruises (NHTSAN, 2008).

Data collection tools and procedures

Data was collected by a standardized questionnaire which adopted from other similar researches done in Uganda and modified as in our situation before the actual data collection. The questionnaire was written in English and translated to the local language Amharic, and then translated back into English to insure its consistency. A data was collected by face-to-face interviewing of motor cycle drivers using closed- ended questionnaires to gather relevant information. Data collection was conducted at the workplaces of the motorcycle drivers. To reduce the loss of respondents, each selected sub-city was visited up to five times. The principal investigator was given half-day training with three data collectors (i.e., three BSC nurses) and two supervisors (i.e., two MSc nurses) prior to data collection. The training includes how to interview respondents, how to collect & record data, and how to supervise the data collectors.

Data Quality Assurance

Pre-testing of the questionnaire was done in Hawassa city with 5% of the total sample size but the respondents were not included in the actual study. The collected data was checked for completeness, accuracy, and clarity. A code was given to each questionnaire so that any identified errors could get traced back to the codes. Super visors were closely monitored data collectors daily during data collection. In addition, the principal investigator together with supervisors was checking the collected data daily.

Data Processing and Analysis

First, the data was checked for completeness, then cleaned and coded before entering to Epi info. Next, data from the completed questionnaire was entered (double entry) in to Epiinfo version 7.2 and transferred in to SPSS version 23 for analysis. Both descriptive statistics and analytical statistical procedures were used. Descriptive statistics like percentage, mean, and standard deviation was used in order to characterize respondents with different variables of interest and tables and graphs were used to present the information.

All explanatory variables with p-value of < 0.2 from the bivariate logistic regression model were fitted in to the multivariate logistic regression model to control the possible effect of confounders and finally the variables which had independent association with road traffic accident among motor cycle drivers was identified on the basis of AOR, with 95% CI and p-value less than 0.05. The variables were entered in the multivariate model using the Backward Stepwise regression method. Model fitness was

checked by using Hosmer and Lemeshow goodness of fit test.

Ethical Consideration

Ethical clearance was obtained from the institutional review board of Department of Emergency Medicine and Critical Care, College of Health Sciences, Addis Ababa University. After this, a support letter was written by TASH to conduct this research in Addis Ababa town. In addition, informed verbal consent was obtained from the respondents before interviewing. Respondents were told about the aim of the study and the confidentiality of the information which they were given. In addition, they were told that they have the full right to withdraw from the study at any time if they feel that uncomfortable.

Dissemination of Results

The findings of this study will be presented and submitted to Addis Ababa University, College of Health Sciences, and Department of Emergency Medicine. In addition, it will be submitted to Addis Ababa Road and Transport Authority and presented in different seminars and attempts will also be made to publish.

RESULTS

Socio demographic characteristics of motor cycle drivers

A total of 605 motor cycle drivers were included in the study, 590 (97.5%) response rates were obtained. The mean age of the respondents was 26.62 (SD ± 5.860) years with the majority of them 316 (75.4%) were between 18 and 24 years of age. The majority of the respondents 424 (71.9%) were single. Regarding to religion majority of the respondents 400 (67.6%) were Orthodox. Related to educational status, 259 (43.9%) were educated to at secondary school level. The average monthly income of the study respondents was 3373.90 (±SD = 1723.993) Ethiopian Birr (ETB) and 182 (31%) the respondents earned 1000-2000 Ethiopian birr per month. About 272 (46.1%) of respondents were supporting their family from their monthly income (table 1).

Table 1: Socio-demographic characteristics among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018 (n= 590)

Variables	Category	Frequency (n=590)	Percent (%)
Age	18-24	268	45.4
	25-29	132	22.4
	30-34	131	22.2
	35-39	45	7.6
	>40	14	2.4
	Total	590	100
Religion	Orthodox	400	67.8
	Muslim	111	18.8
	Protestant	66	11.2
	Catholic	13	2.2
	Total	590	100
Marital status	Single	424	71.9
	Married	140	23.7
	Divorced	21	3.6
	Windowed	5	0.8
	Total	590	100
Number of children	≤2	98	16.6
	3-4	56	9.5
	≥5	9	1.5
	Total	163	27.6
Education	Unable to read and write	28	4.7
	Read and write	101	17.1
	Elementary	110	18.6
	Secondary	259	44
	Tertiary	42	7.1
	Diploma and above	50	8.5
	Total	590	100
Number of family support	1-2	184	31.6
	3-4	272	46.1
	>5	118	20.0
	Total	574	97.7
Monthly income	1000-2000	182	31
	2001-3000	178	30
	30001-4000	97	16
	>4000	133	23
	Total	590	100

Driver characteristics and motor cycle conditions

Majority of the respondents 429 (72.7%) motor cycle drivers had a history of punishment by traffic police.

More than half of the respondents, 323 (54.7%) were engaged in alcohol driving and 273 (46.3%) of the respondents were reported chewing chat and engaged in driving within three hours after chat chewing. According to the current study, the mean of motor cycle drivers experience a year was 3.50 (± 2.793). More than one- third of the respondents 258 (43.7%) had 3-4 years of driving experience.

More than half of the respondents, 354 (60%) were driving more than limited speed and 421 (71%) were driving at night 1-2 pm local time.

Regarding to the using of protective equipment while driving from the total of 590 respondents, 471 (79.8%) use helmet from thus, 200 (42%) use helmet always, 117 (25%) most of the times and 154 (33%) use helmet some a times while driving. Related to driving license, 557 (94.4%) had driving licenses. Respondents who had life insurance were 54 (9.2%) and 91 (15.4%) of the respondents was drive motor cycle with mechanical problems. The reported mean service year of motor cycle was 1.55 (±0.937) (table 2)

Table 2: Motor cycle drivers characteristics and motor cycle conditions in Addis Ababa, Ethiopia, June, 2018 (n= 590).

Variable	Category	Frequency (n=590)	Percent (%)
Life insurance	Yes	54	9.2
	No	536	90.8
	Total	590	100
Use helmet	Yes	471	79.8
	No	119	20.2
	Total	590	100
Drink alcohol	Yes	323	54.7
	No	267	45.3
	Total	590	100
Punished by traffic police	Yes	429	72.7
	No	161	27.3
	Total	590	100
Chew chat	Yes	273	46.3
	No	317	53.7
	Total	590	100
Over speed driving	Yes	354	60.0
	No	236	40.0
	Total	590	100
Driving license	Yes	557	94.4
	No	33	5.6
	Total	590	100
Driving experience	≤2 year	228	38
	3-4 year	258	44
	5-7 year	64	11
	≥8 year	40	7
	Total	590	100
Driving at night time	1-2	421	71
	3-4	153	26
	5-6	16	3
	Total	590	100
Service year of motor cycle	<2	425	72
	3-4	162	27.5
	5-7	3	0.5
	Total	590	100
Mechanical problem of motor cycle	Yes	91	15.4
	No	499	84.6
	Total	590	100

Prevalence of Road traffic accidents among motor cycle drivers

This study found that the prevalence of RTA among motor cycle drivers in the past one year was 200(33.8%) with 95% CI 30.3% to 69.7% were reported (Fig. 2).

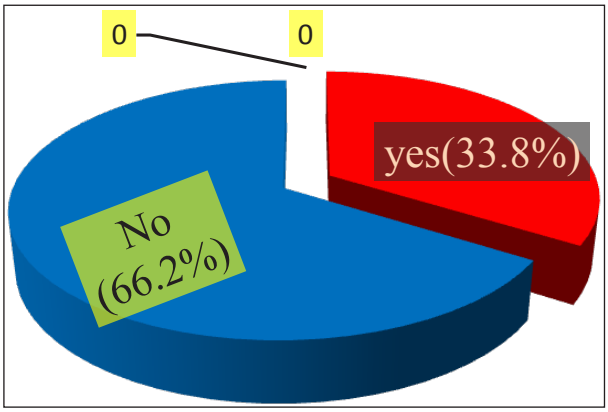

Fig. 2: Prevalence of Road traffic accident among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018 (n= 590)

Among the respondents who had experienced RTA, the reported consequences of the accident were 4 (1.6%) animal deaths, 44 (18.0%) people with serious injuries, 72 (29.5%) people minor injury and, 124 (50.8%) property damage. Regarding to injured group, 99 (70.7%) motor cycle drives, 38 (27.1%) pedestrian, 3 (2.1%) passengers were injured during the accident respectively and 28 (14%) of respondents mentioned rainy weather conditions as one of contributing cause for the occurrence of the accident.

Out of 590 respondents 273 (46.3%) of them chew chat for different reason and drive within 3 hr after chewing chat. The reported reason why they chew chat was, 58 (21.2%) for energize, 91 (33.3%) for pleasure, and 139 (50.9%) to feel free respectively (Fig. 3).

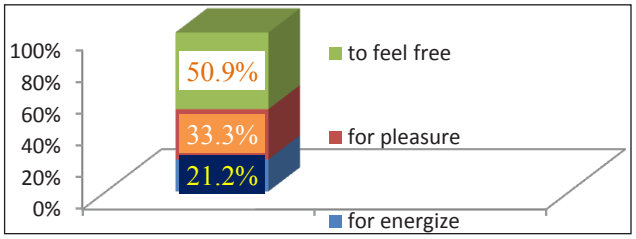

Fig. 3: Reasons for chat chewing among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018

Related to over speed driving from 590 the respondents 354 (60%) of them drive more than limited speed. More than half of the respondents 227 (64.1%) reported that the reasons for speedy driving were to increase income, followed by for short queue 134 (37.8%) and for racing with another driver 16 (4.5%) respectively (Fig. 4).

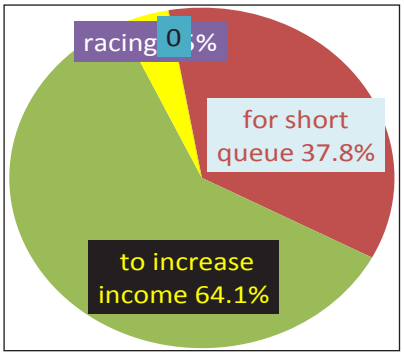

Fig. 4: Reasons for over-speed driving among motor cycle drivers Addis Ababa, Ethiopia, June, 2018

The most reported cause of the accident was failure to follow the right hand rule while driving 65 (32.5%), followed by over speed driving 63 (31.5%) and alcohol driving 45 (22.5%) respectively (table 3).

Table 3: Causes of road traffic accident among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018 (n = 200)

Cause for road	Frequency	Percent (%)
Traffic accident		
Failure to follow right hand rule	65	32.5
Over speed	63	31.5
Alcohol driving	45	22.5
Chat chewing	17	8.5
Pedestrian carelessness	14	7
Mechanical problem of motor cycle	13	6.5
Failure to give way to pedestrian	12	6
Phone use while driving	11	5.5
Quality of road	10	5
Following too close	7	3.5

From the total of 590 respondents 87 (14.7%) of them drive motor cycles with mechanical problems, among them, 27 (31.0%) were drive motor cycles with brake problems, 24 (27.6%) of them drive motor cycles with lighting problems, 14 (16.1%) and 22 (25.3%) respondents drive motorcycles with steer and tire problems respectively.

Related to road trip, among the respondents who experienced RTA (200), 186(93%) of them faced RTA on asphalt and the rest 14(7%) of the respondents experienced RTA on non-asphalt road trip (Fig. 5).

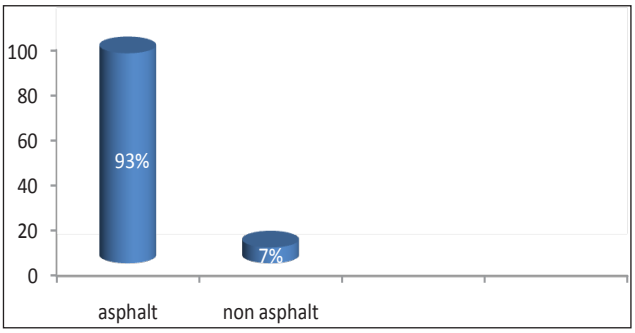

Fig. 5: Road trip condition during an accident among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018

From the respondents who experienced RTA (200), the most reported type of road junctions during the accident was straight 155 (77.5%), two junctions 28 (14%), square 13 (6.5%) and three junctions 7 (3.5%) respectively (Fig. 6).

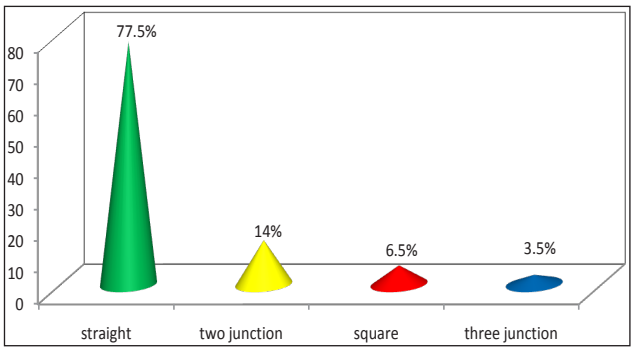

Fig. 6: Road junction condition during accident occurrence among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018

Out of the 590 respondents 80 (24.8%) of them were engaged in driving for most of the time within 3hr after drinking alcohol and 91(33.3%) of them chew chat for most of the time while driving and drove within 3 hours after chewing (table 4).

Table 4: Frequency distribution of alcohol driving, chat chewing, and helmet use among motor cycle drivers in Addis Ababa, Ethiopia, June 2018

Variables	Yes (n=323)	Frequency	Percent (%)
Alcohol driving	Always	21	6.5
	Most of the time	80	24.8
	Some times	222	68.7
	Total	323	100
Chat chewing while driving	Yes (n=273)		
	Always	25	9
	Most of the time	91	33
	Some times	157	58
	Total	273	100

Regarding to the type of collision during the accident, mostly reported collision type was motor cycle with another vehicle 140(70%), followed by collision with obstacle 36(18%), with human pedestrian 29(14.5%) and with animal 3(1.5%) (Fig. 7).

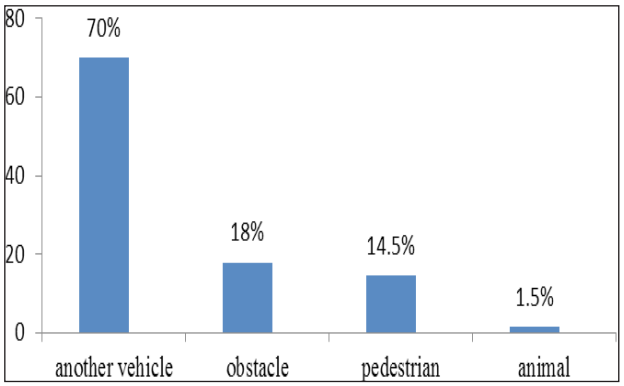

Fig. 7: Types of collision during RTA among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018

From the total of 590 respondents 119(20.2%) were not using a helmet while driving and the most reported reason not to use the helmet was not functional 57(48%), followed by no helmet at all 32(27%),it has no benefit 18(15.1%) and I fed up 12 (10.1%) respectively (Fig. 8).

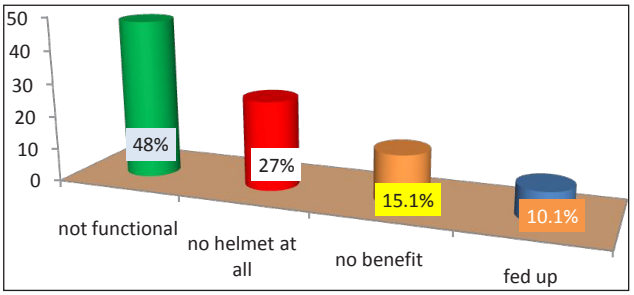

Fig. 8: Reason for not to use helmet during driving motor cycle among a motor cycle drivers in Addis Ababa, Ethiopia, June, 2018

Out of the 590 respondents regarding to phone calls receiving while driving of motor cycle driver, 187(32%) were stop driving and receive the call and 154(26%) of them receive the call with driving motor cycle at normal speed. The rest 147(25%) of them reduced speed while receiving the call and 102(17%) were disconnected ringing while driving the motor cycle (Fig. 9).

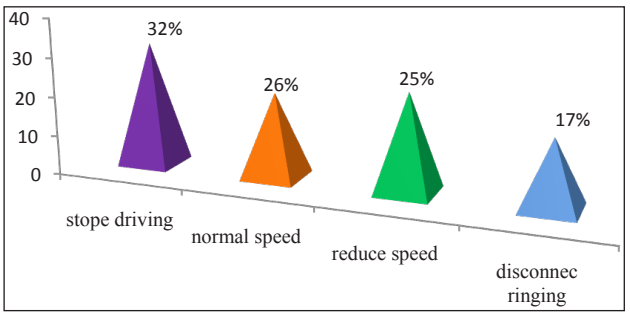

Fig. 9: Phone call receiving while driving among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018 (n=590)

Cross tabulation of prevalence of road traffic accidents within the past one year among motor cycle drivers

This study found that over speed driving, chat, alcohol drinking, history of punishment by traffic police, life insurance, driving experience,and education were significantly associated with the occurrence of RTA in chi square with p value less than 0.05.

The highest prevalence of road traffic accidents was observed among those with age the of 18-24 years, though the difference was not statistically significant ($\chi 2 = 12.383$, $p > 0.05$). The occurrence of accident was higher among those who drank alcohol, 150 (46.4%), than among those who did not, 50(18.7%) the difference was statistically significant ($\chi 2 = 48.871$, $p < 0.05$). Accident rate

was also higher among those who were speeding excessively, 171(48.1%), compared to those who did not, 29(12.3%) and difference was statistically significant ($\chi2 = 80.376$, $P< 0.05$).

Related to the year of driving experience, the accident rate was higher among those who were between 3-5 years of driving experience, and the difference was statistically significant ($\chi2 = 9.009$, $p <0.05$) and a high rate of accident occurrence were experienced among who had a history of punishment by traffic police, 178(41.5%) than who had no history of punishment by traffic police, 22(13.7%) and difference was statistically significant ($\chi2 = 39.223$, $p < 0.05$) (table 5).

Table 5: Cross-tabulation of prevalence of RTA among motor cycle drivers in the past one year in Addis Ababa, Ethiopia, June, 2018 (n = 590)

Variables	Category	Frequency of RTA			P value
		Yes	NO	X^2	
Age in year	18-24	82(30.6%)	186(64.4%)		
	25-29	50(37.9%)	82(62.1%)		
	30-34	56(42.7%)	75(57.3%)	12.383	0.115
	35-39	10(22.2%)	37(77.8%)		
	≥40	2(14.3%)	12(85.7%)		
Marital status	Single	150(35.4)	274(64.6%)		
	Married	43(30.7%)	97(69.3%)	2.148	0.542
	Divorced	5(23.8%)	16(76.2%)		
	Widowed	2(40.0%)	3(60.0%)		
Education	Un able to read and write	14(50%)	14(50%)		
	Read and write	41(46.6%)	60(59.4%)		
	Elementary	31(28.2%)	79(71.8%)	7.821	0.00
	Secondary	81(31.3%)	178(68.7%)		
	Tertiary	15(35.7%)	27(64.3%)		
	Diploma and above	18(36%)	32(64%)		
Monthly income	1000-2000	53(29.1%)	129(70.9%)		
	2001-3000	68(38.2%)	110(61.8%)	4.222	0.239
	3001-4000	30(30.9%)	67(69.1%)		
	>4000	49(36.8)	84(63.2%)		
Insurance	Yes	25(46.3%)	29(53.7%)	3.491	0.002
	No	175(32.6%)	361(67.4%)		
Helmet use	Yes	158(33.5%)	313(66.5%)	0.06	0.801
	No	42(35.3%)	77(64.7%)		
Alcohol drinking	Yes	150(46.4%)	173(53.6%)	48.871	0.000
	No	50(18.7%)	217(81.3%)		
Punish-ment by traffic police	Yes	178(41.5%)	251(58.5%)	39.223	0.000
	No	22(13.7%)	139(86.3%)		
Chat chewing	Yes	134(49.1%)	139(50.9%)	51.04	0.000
	No	66(20.8%)	251(79.2%)		
Over speed driving	Yes	171(48.1%)	183(51.7%)	80.376	0.000
	No	29(12.3%)	207(87.7%)		
Driving License	Yes	186(33.4%)	371(66.6%)	2.148	0.542
	No	14(42.4%)	19(57.6%)		
Driving experience in year	≤2	81(35.5%)	147(64.5%)		
	3-5	93(36.0%)	165(64.0%)	9.009	0.029
	5-7	21(32.8%)	43(67.21%)		
	≥8	5(12.5%)	35(87.5%)		
Service year of motor cycle	≤2	139(32.7%)	286(67.3%)		
	3-4	60(37.0%)	102(63.0%)	0.974	0.614
	≥5	1(33.3%)	2(66.7%)		
Motor cycle mechanical problem	Yes	58(61.7%)	36(38.3%)	0.000	0.521
	No	142(28.6%)	354(71.4%)		

Factors associated with RTA in bivariate and multivariate analysis of logistic regression

Bivariate logistic regression

The major risk factors associated with motorcycle accident in bivariate analysis ($p\leq0.05$) were found to be: Alcohol driving (COR = 3.763, 95% CI: 2.550, 5.488), chat chewing (COR = 3.66,95% CI: 2.557, 5.256), over speed driving (COR =6.670, 95% CI: 4.291, 10.367), driving experience <2 year (COR =3.57, 95% CI: 1.454, 22.5) and driving experience 3-4 years (COR = 3.9459, CI: 1.49, 10.417), having history of traffic police punishment (COR = 4.481, 95% CI: 2.748, 7.307), life insurance (COR = 1.778, 95% CI: 1.011, 3.127), education with elementary school (COR = 0.392, 95% CI: 0.168, 0 .917) and secondary school (COR = 0.455,95% CI:0.168, 0.917). Factors that did not have any relation with road traffic accidents among motor cycle drivers in the bivariate analysis include age, marital status, monthly income, helmet use, driving license, and motor cycle service year (table 6).

Table 6: Bivariate analysis of factors related to road traffic accidents among motor cycle drivers in Addis Ababa, Ethiopia, June 2018 (n=590)

Variable	Category	RTA		COR (95% CI) 95% CI	P value
		Yes	No		
Age	18-24	82	186	1	
	25-29	50	82	1.383 (0.893,2.142)	0.146*
	30-34	56	75	1.694 (1.099,2.611)	0.17*
	35-39	10	35	0.648 (0.306,1.371)	0.257
	40^{+}	2	12	0.378 (0.83,1.727)	0.210
Marital status	Single	150	274	0.821 (0.136, 4.969)	0.830
	Married	43	97	0.665 (0.170, 4.124)	0.661
	Divorced	5	16	0.469 (0.060, 3.648	
	Widowed	2	3	1	

Education	Diploma and above	18	32	0.563 (0.220,1.439)	0.230
	Read and write	41	60	0.683 (0.295, 1.584	0.375
	Elementary	31	79	0.392 (0.168,0.917	0.031**
	Secondary	81	178	0.455 (0.207,0.99)	0.050**
	Tertiary	15	27	0.556 (0.210,1.470)	0.237
	Unable to read and write	14	14	1	
Monthly income	1000-2000	53	129	0.704 (0.438, 1.133)	0.149*
	2001-3000	68	110	1.066 (0.66, 1.860)	0.806
	3001-4000	30	67	0.768 (0.440, 1.339)	0.351
	>4000	49	84	1	
Life insurance	Yes	25	29	1.778 (1.011, 3.127)	0.046**
	No	175	361	1	
Helmet	Yes	158	313	0,925 (0.607, 1.411)	0.719
	No	42	77	1	
Alcohol driving	Yes	150	173	3.763 (2.550, 5.488)	0.000**
	No	50	217	1	
Traffic punishment	Yes	178	251	4.481 (2.748, 7.3070)	0.000**
	No	22	139	1	
Chat chewing	Yes	134	139	3.66 (2.557, 5.256)	0.000**
	No	66	251	1	
Speedy driving	Yes	171	183	6.670 (4.291, 10.3670)	0.000**
	No	29	207	1	
Driving license	Yes	186	371	0.680 (0.334, 1.3870)	0.289
	No	14	19	1	
Driving Experience	<2	82	147	3.57 (1.454, 10.231)	0.007**
	3-4	93	165	3.9459 (1.494, 10.417)	0.0068**
	5-7	21	43	3.419 (1.170, 9.992)	0.025**
	>8	5	35	1	
Motorcycle service year	<2	139	286	0.972 (0.87,10.812	0.982
	3-4	60	102	1.176 (0.104,13.251)	0.895
	5-7	1	2	1	

** Significant at p≤0.2, ** significant at p≤0.05.*

Multivariate regression

Factors associated with RTA by multivariate analysis

To avoid excessive number of variables and unstable estimates in the final model, variables with P-value less than 0.2 in the bivariate analysis were taken in the multivariate analysis. The multivariate binary logistic regression analysis identified that, history of punishment by traffic police, over -speed driving and monthly income with 1000-2000 Ethiopian birr and 3001-4000 Ethiopian birr were significantly associated with RTA among motor cycle drivers. Other factors such as age, helmet use, driving hours, chat chewing, alcohol driving, life insurance, driving experience, driving license, and mechanical problems of motor cycle were not significantly associated with RTA among motor cycle drivers.

The odds of RTA was 2.871 times more likely among motor cycle drivers who had a history of punishment by traffic police than motor cycle drivers who had no history of punishment by traffic police; AOR = 2.871, (95% CI, 1.632-5.051).

The odds of road traffic accident was 54% more likely among motor cycle drivers who had monthly income 1000-2000 Ethiopian birr than motor cycle drivers who had monthly income greater than 4000 Ethiopian birr with; AOR= 0.540, (95% CI, 0.303, 0.961) and the odds of RTA was 42.6%more likely among the respondents who had monthly income 3001-4000 Ethiopian birr with AOR = 0.426, (95% CI, 0.220, 0.828) when compared to these respondents who had monthly income greater than 4000 Ethiopian birr respectively.

The odds of RTA was 3.73 higher among motor cycle drivers who had driven more than limited speed than those motor cycle drivers who had not engaged in over-speed driving; AOR=3.730 (95% CI, 2.239, 6.215) (table 7).

The total model was significant (p=<0.001). All values of the standard errors in the model (0.087) were below 5, which indicated no multi-co linearity among variables. The results of the Hosmer–Leme show test (p = 0.693) indicated the goodness of fit of the model.

Table 7: Multivariate logistic regression of factors associated with road traffic accidents among motor cycle drivers in Addis Ababa, Ethiopia, June, 2018 (n = 590)

Variable	Category	RTA		AOR(95%CI)	P value
		Yes	No	95% CI	
Age	18-24	82	186	1.124 (0.179,7.048)	0.900
	25-29	50	82	1.481 (0.2349.381)	0.676
	30-34	56	75	1.663 (0.265,10.413)	0.587
	35-39	10	35	0.679 (0.97,4.760)	0.697
	40^{+}	2	12	1	
Education	Tertiary	18	32	0.618 (0.193, 1.978)	0.418
	Diploma	41	60	0.709 (0.237, 2.1250	0.539
	Elementary	31	79	0.534 (0.204, 1.401)	0.202
	Read, write	81	178	0.650 (0.254, 1.665)	0.370
	Secondary	15	27	0.149 (0.170, 1.030)	0.058
	Unable read	14	14	1	

Monthly income	1000-2000	53	129	0.540 (0.303, 0.961)	0.036**
	2001-3000	68	110	0.632 (0.361, 1.107)	0.108
	3001-4000	30	67	0.426 (0.220, 0.828)	0.012**
	>4000	49	84	1	
Life insurance	Yes	25	29	1.825 (0.948, 3.514)	0.072
	No	175	361	1	
Alcohol	Yes	150	173	1.590 (0.964, 2.624)	0.069
	No	50	217	1	
Traffic punishment	Yes	178	251	2.871 (1.632, 5.051)	0.000**
	No	22	139	1	
Chat chewing	Yes	134	139	1.581 (0.943, 2.651)	0.082
	No	66	251	1	
Speedy driving	Yes	171	183	3.730 (2.239, 6.215)	0.0008**
	No	29	207	1	
Driving experience	<2	82	147	1.866 (0.567, 6.135)	0.305
	3-4	93	165	1.622 (0.497, 5.294)	0.423
	5-7	21	43	1.538 (0.432, 5.471)	0.507
	>8	5	35	1	

DISCUSSION

In this study, the prevalence of road traffic accidents among motor cycle drivers in the past one year was found to be (33.8%, 95% CI 30.3% to 69.7%) in Addis Ababa, Ethiopia.

The prevalence rate of RTA in this study was less (33.8%), compared to previous study conducted in southern Nigeria, 68%, Rwanda, 73.05%, Uganda, 45.3%, India (56.1%), Brazil 63.6%, Vietnam 62% (15, 31, 33-36). However, the prevalence of RTA among motor cycle drivers recorded in the current study was high when compared to China which is 22.8%. These variations maybe due to differences in methodology, sample size, differences in risk factors for motorcycle accidents between the study settings, the large number of motor cycle drivers in the previous study and their driving habits (Zhang *et al.* 2004; Nzegwu *et al.* 2008).

In this study, more than one- third of the respondents nearly 42% of drivers had a history of at least one traffic punishment reporting, and 72.7% of the total study respondents had received punishment as well. History of punishment by traffic police was found significantly associated with RTA in this study and 2.871 times the risk for experiencing RTA among motorcycle drivers who had a history of punishment by traffic police than who had no history of punishment. AOR: 2.871 (95% CI 1.632, 5.051). This reveals a high level of risky driving among motor cycle drivers, and a persistent habit of violating traffic laws. Therefore, the results of this study may have implications for modifying the type, severity, and enforcement level of traffic violation punishments used in the Ethiopian context. This finding was consistent with a previous study conducted in Kampala city Uganda (Tumwesigye *et al.* 2016).

This study identified an association between over -speed driving and RTA. Increased odds of developing RTA with increased speed of driving were observed among motor cycle drivers. Respondents who engaged in over speed driving were 3.73 times more likely to experience RTA than who did not engage in driving more than limited speed: AOR = 3.73 (95% CI, 2.239, and 6.215). This could be due to the economic status of the motor cycle drivers, road user mix, traffic pattern, density, and legal framework. This study result was consistent with a previous similar study that conducted in Southern Nigeria among motor cycle drivers speed driving was significantly related to RTA, but this study finding was contrary to the finding of the study which conducted in Kampala city Uganda, Brazil and France (Lardelli-Claret *et al.* 2005; Johnson, 2012).

According to the current study, monthly income from 1000-2000 Ethiopian birr and 3001-4000 Ethiopian birr were significantly associated with experiencing RTA. Motor cycle drivers who had monthly income 1000-2000 Ethiopian birr were 54% more likely to experience RTA than motor cycle drivers with monthly income greater than 4000 birr. And motor cycle drivers with monthly income 3001-4000 Ethiopian birr were 42.6% more likely to experience RTA compared to respondents who got monthly income greater than 4000 Ethiopian birr. This might be related to productivity and increasing income, related to that respondents engaged in to dis obeying traffic rules as a result be come more vulnerable to road traffic accidents. This study resulted contrary with study the conducted in Nigeria and Kampala City Uganda. Not many studies have established the influence of monthly income on road traffic injury among motorcycle drivers but a bivariate analysis in a study conducted in Nigeria found that those who had other jobs and income had higher odds of getting road traffic injuries and a similar study conducted in Kampala City, Uganda reported that in a multivariate analysis those who had higher income experienced higher

odds of getting road traffic accident compared to their counterparts (Johnson 2012; Tumwesigye *et al.* 2016).

The mean age of the motor cycle driver in this study was 26.62 (±5.860). Age was not significantly associated with RTA in this study,which is consistent with the result of a similar study which conducted in Brazil (Almeida *et al.* 2016). However, the previous cross-sectional study on prevalence and determinant factors of road traffic accident among motor cycles conducted in Uganda with mean age 46.8 (±8.9) found that age was significantly associated with RTA which is contrary with the result of current study. This is probably due to the age difference between the study groups. According to the current study nearly one- third of the accidents (30.6%) were occurred among motor cycle drivers of age 18-24 years. This might be due to this group of having been attributed to a wide range of activities engaged in by this class of people. They are more likely to have reasons to move from one place to another. They represent the active group that partakes in high risk-taking activities such as over-speed driving and disobedience traffic law (Naddumba, 2004).

The present study, found that helmet use was 79.8% among motor cycle drivers which is lower compared to the a previous similar study conducted in Brazil, 97.4% (Almeida *et al.* 2016). On the contrary, poor helmet use among motor cycle drivers has been recorded in several studies, especially in developing countries. Study conducted among motorcycle drivers in Southern Nigeria, helmet use was less than 10%. These differences in the rate of the helmet use reflect the differences in awareness of the role of helmet and poor enforcement of traffic laws. It could also be due to difference in attitudes to helmet wearing, cost of the helmet, ignorance, to lawlessness, impaired driver vision of motor cycle drivers between these countries (Johnson, 2012).

In the present study, the collision between motorcycles with another vehicle was the common mechanism of injury, followed by collision between a motorcycle with an obstacle and pedestrians, respectively. Motorcycle-vehicle and motorcycle-pedestrian collisions occur commonly because the majority of drivers often ignore safety measures, making them more vulnerable to accidents with other motorized vehicles. In the present study, 26.1% of accidents were occurred during the day time. Increased rate of accidents during the day can be explained by increased traffic density as well as increased human activities in the city during the day time. Similar trend was also reported from study conducted in Rwanda (Ingabire *et al.* 2015).

LIMITATION AND STRENGTH OF THE STUDY

Strength of the study

- This study has reported for the first time the prevalence of RTA among motor cycle drivers in Addis Ababa, Ethiopia.
- Most of the earlier studies concentrate on secondary data-based finding, but this study tried to determine the prevalence and associated factors of RTA among motor cycle drivers by using primary data source.
- Considering multiple factors for the assessment of outcome is also a strength of this study.

Limitations of the study

- The study was based on self-report of the past one-year circumstances of the accident therefore may have been subject to recall bias.
- No study, has been conducted in Ethiopia before this study so the study also lacked a comparison group.

CONCLUSION AND RECOMMENDATION

Conclusion

The prevalence of road traffic accidents among motor cycle accident in the last one year was found to be high. The study found that over speed driving, history of punishment by traffic police, and having monthly income 1000-2000 Ethiopian birr and 3001-4000 Ethiopian birr had a significant association with road traffic accidents among motor cycle drivers. This shows that there are still great deficiencies concerning the implementation of traffic rules and regulation,deficiencies concerning speed limitation in traffic police. These studies inspire policy makers to increase monthly income through improving fuel price and other business centers because monthly income is significantly associated with RTA among motor cycle drivers.

In this context, this research can guide actions that involve this group of workers, generally neglected, and which require attention from urban mobility agencies concerning the supervision, control and implementation of public traffic policies.

Recommendation

Since the majority of motorcycle injuries are preventable, there is a need for legislation against driving, more than limited speed among motorcycle drivers during driving hours and strict enforcement of traffic laws regarding to obeying traffic police law and regular rules with preventive strategies could be necessary to reduce road traffic accidents among motorcycle drivers.

At the individual level: Motor cycle drivers might have obeyed all traffic laws and not engaged in distractive driving habits like over -speed driving. Motor cycle drivers could have a sense of respect for others and for their own lives which is vital in the prevention of RTI's. Pedestrians could be aware road traffic signs and follow the road safety rules.

Media: Advocacy and awareness creation for motor cycle drivers and pedestrians.

Police commission: Further traffic law enforcement for motor cycle drivers in line with speed limitations, controlling risky behaviors while driving and advocacy.

Fire and emergency department: Rapid deployment of pre-hospital service at the scene and possible integration with traffic police department.

Recommendation for further research: Further study with alternative design is recommended to investigate other risk factors of road traffic accidents among motor cycle drivers.

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