

# Trends and Contributing Factors to Road Traffic Accidents in Douala

Ginyu Innocentia Kwalar<sup>1,2</sup>, Verla Vincent Siysi<sup>2,3</sup>, Tanue Elvis Asangbeng<sup>1</sup>,  
Assob Nguedia Jules-Clement<sup>4</sup>, Nsagha Dickson Shey<sup>1,\*</sup>

<sup>1</sup>Department of Public Health, Faculty of Health Sciences, University of Buea, Cameroon

<sup>2</sup>Buea Regional Hospital, South West Region, Cameroon

<sup>3</sup>Department of Internal Medicine and Paediatrics, Faculty of Health Sciences, University of Buea, Cameroon

<sup>4</sup>Department of Laboratory Medicine, Faculty of Medicine and Pharmaceutical sciences, University of Douala, Cameroon

\*Corresponding author: [dsnsagha@gmail.com](mailto:dsnsagha@gmail.com)

Received October 02, 2021; Revised November 05, 2021; Accepted November 12, 2021

**Abstract Introduction:** An estimated 1.2 million people are killed in road traffic accidents each year, and as many as 50 million are injured, occupying 30 percent to 70 percent of orthopedic beds in developing countries hospitals. But there is limited information on the burden of RTA in Douala. **Aim:** The study aims at reporting the epidemiology and pattern of road traffic related injuries in Douala in the Littoral Region of Cameroon using available police and health data. **Methods:** This was a chart review of hospital based and police department records. The records were reviewed over a period of two years in a District hospital in Douala in the Littoral region of Cameroon and over four years in the Police Department in Douala. The data review was done for two months. The records of all patients received in the emergency department of Bonassama District hospital after a road traffic related injury were reviewed for epidemiological variables, type of vehicle involved, severity of injuries, and outcome of the management. For the police records, they were reviewed for epidemiological variables, type of vehicle involved, and the causes of accident. **Results:** A total of 2,062 persons were involved in 818 cases of road traffic accidents reported by the police department. The major causes of road traffic accident (RTA) included poor mastery of driving, over speeding and left driving. From the Police records, RTA involving a vehicle and motorcycle increased dramatically in the four-year period from 0.39 % (8) in 2015 to 5.82% (120) in 2018. A total of 1,883 persons with injuries from RTA were received and managed by the Bonassama District Hospital. Majority, 1,590(84.4%) [95% CI: 82.7%-86.1%] of the injuries that were managed in the health units were sustained from RTA involving the motorcycle. Most, 893(47.4%) [95% CI: 45.2%-49.7%] of the accidents occurred during the night hours. **Conclusion:** The available data in both health and police sectors revealed that there was an increase in the number of RTA in the years under study.

**Keywords:** trends, contributing factors, road traffic accidents, Douala

**Cite This Article:** Ginyu Innocentia Kwalar, Verla Vincent Siysi, Tanue Elvis Asangbeng, Assob Nguedia Jules-Clement, and Nsagha Dickson Shey, "Trends and Contributing Factors to Road Traffic Accidents in Douala." *American Journal of Epidemiology and Infectious Disease*, vol. 9, no. 1 (2021): 24-31. doi: 10.12691/ajeid-9-1-5.

## 1. Background

Road traffic accidents are the leading cause of death by injury and the tenth-leading cause of all deaths globally. An estimated 1.2 million people are killed in road traffic accidents each year, and as many as 50 million are injured, occupying 30 percent to 70 percent of orthopedic beds in developing countries hospitals [1]. Road traffic crashes and injuries constitute major health, economic, and developmental challenges to Low and middle income countries, Cameroon inclusive. Of the estimated 1.2 million people killed in road traffic crashes in 2002, 90% occurred in low- and middle-income countries [2]. Africa has the highest fatality rate in relation to her population (28.3 per 100,000 population

after adjusting for under reporting), which is substantially higher than motorized countries in the world, such as those in North America (12.1 to 16.2 per 100,000 population) [2]. In 2010, concerned about the very high and increasing burden of road traffic crashes around the world, the United Nations General Assembly adopted Resolution 64/255 [3], which proclaimed 2011-2020 the Decade of Action for Road Safety. The goal of the Decade is to reduce the increasing trend in road traffic deaths, and to save an estimated 5 million lives over the period. The Resolution followed the publication of the first Global status report on road safety [4], which had showed, among other major findings, that the African Region had one of the highest rates of road traffic deaths. The African Region remains the least motorized of the six world regions, but suffers the highest rates of road traffic fatalities [5].

In as much as the African Region remains the least motorized, the number of vehicles and motorized 2-wheelers in Cameroon has seen a steady increase. In the Littoral Region alone, the number of registered motorcycles have risen from 3,454 in 2008 to 9,056 in 2018 observing a drop from 2017 which registered 10,319 motorcycles. It attained a peak in 2012 of 12,843 [6-10]. This increase is as a result of a sharp reduction in the prices of motorcycles from millions of Francs CFA in the eighties when only the likes of Yamaha were imported to a few hundreds of thousands of Francs CFA when the market was open to the likes of Nangfan, Kimco etc [11]. The increase rate of unemployment did not make things any bright for the youths who readily turned to this sector for its relatively good earnings they make from there. With this, there has been a resulting increase in the number of accidents from motorcycles and resulting death from the accidents [12].

With this upsurge of vehicles and motorized 2-wheelers, there has been an increase in the number of road traffic accidents. The National Health Development plan 2061-2020 revealed that the contribution of RTA to disease burden in 2013 in Cameroon stood at 3.95%, and its contribution to deaths stood at 4.38% [13]. Though data on epidemiology, pattern and management of injuries in sub-Saharan Africa are scarce and in Cameroon in particular, very few references can be quoted [14,15,16,17]. We therefore, sought to find out from available Police and Health data what the situation was in the recent past.

## 2. Objective

- To describe the epidemiological profile of RTA victims in Douala in the Littoral Region of Cameroon.
- To establish the annual trend of road traffic related injuries in Douala in the Littoral Region of Cameroon using available police and health data.

## 3. Materials and Methods

### 3.1. Study Design

A chart review done at the Bonassama District Hospital and the Regional Unit for Traffic and Circulation for the Littoral Region.

### 3.2. Study Setting

*Douala* is the headquarters of the Wouri Division of the Littoral Region of Cameroon. It is also the largest city in the country. It is situated on the southeastern shore of the Wouri River estuary, on the Atlantic Ocean coast about 130 miles (210 km) west of Yaoundé. According to the 2010 population estimate, its population stood at 3 793 000 [18]. Urban travel is marked by congestion and road congestion, and is mostly provided by informal transport such as motorcycle taxis, shared taxis, 'clandos' and mini-buses [19].

The city of Douala is divided into seven health districts (Akwa, Bassa, Bonabéri, Bonapriso, Bonanjo, Deïdo and

New Bell) and it has more than 120 neighborhoods. These health districts have district hospitals and other private and public health institutions that they send all statistics (including that of RTA) to their respective Health District Service. In each health district the data is sent on a monthly basis and is collected to capture socio-demographic data, number of RTA, outcome of the RTA and the type of transporting means involved. There are about 17 police districts in Douala and all of the Police Districts send information pertaining to RTA to the Regional Unit for Traffic and Circulation found in Bonanjo. This is done manually and a case sheet is prepared using a semi structured reporting format and captures information on socio-demographic data, number of deaths, cause and time of accidents and weather conditions. The information is sent within 72 hours of the accident ideally.

### 3.3. Data Collection Procedure

Authorisation was obtained from the head of the different institutions. For Health, an authorization was gotten from the Regional Delegation for Health, then from the Health District in Bonassama, then from the different Health units. For the National security unit, an authorization was gotten from the Regional Unit for Traffic and Circulation. Then, in collaboration with the persons in charge of statistics, data was collected at the Bonassama District Hospital and at the Statistic Unit of the Police Offices too. A structured form was filled. Data over the last four years was collected (2015 - 2018) for police and for two years (2018 - 2019) for health sector. This was done by the Principal investigator with two field investigators over a period of two months.

### 3.4. Data Collection Tool

A structured form was made for both the health and security sector with the following information gathered.

#### 3.4.1. For Health

A structured form was used which captured information on date, time of accident, socio-demographic data, type of motorized wheeler involved, outcome of accident and category of accident.

#### 3.4.2. For Police

A structured form was used to capture information on date, time of accident, type of motorized wheeler involved, number of persons involved in the accident, outcome of victims, socio-demographic data of driver including license ownership, socio-demographic data of victims and possible cause of accident which could be human, mechanical or environmental.

### 3.5. Operational Definition of Terms

In this study, RTA is defined as an event where there is collision between a vehicle and a motorbike, vehicle, pedestrian, animal or object. Also, death and injury is referred to as the status that was reported by the investigating police or what was captured by the health districts. As for the causes of deaths, it was considered as what was declared either by the police or the health personnel.

### 3.6. Ethical Consideration

An ethical clearance was collected from the Faculty. Then, an authorization was gotten from the Regional Delegation of Health, the District Medical officer of the Bonassama District, the Director of the District Hospital in Bonassama and from the Commissioner in charge of the Regional Unit for Traffic and Circulation. Confidentiality was ascertained by the fact that participant's names were not collected on the sheets.

### 3.7. Data Analysis

Data from the structured forms were coded. It was entered into a data base of EPI Info 7.0 and also analyzed using SPSS version 21 and Microsoft Excel. Data. The causes and characteristics of RTAs were summarized. Categorical variables were presented as frequencies and percentages. To minimize the type II error, the probability value was considered at  $P \leq 0.05$  at a confidence interval of 95%. Chi square test was employed in measuring the

relationship between binary variables.

## 4. Results

A total of 2,062 persons were involved in 818 cases of road traffic accidents (RTA) recorded by the police department between January 2015 and December 2018 in Douala. The total number of accidents increased from 2015 and reached a record high in 2018 (Figure 1). For each type of RTA captured from the police records, there was an annual increase from one year to the next.

The most common type of RTA involved a combination of two vehicles (vehicles versus vehicles) representing 363 (64.7%) [95% CI: 60.6%-68.7%] of all RTA cases in 2018. This was followed by collisions of a vehicle with motorcycle 120 (21.4%) [95% CI: 18.1%-25.0%] and a vehicle with a pedestrian 32 (5.7%) [95% CI: 3.9%-8.0%] occurring in the year 2018. RTA involving a vehicle and motorcycle increased dramatically in the four-year period from 0.39% (8) in 2015 to 5.82% (120) in 2018 (Figure 2).

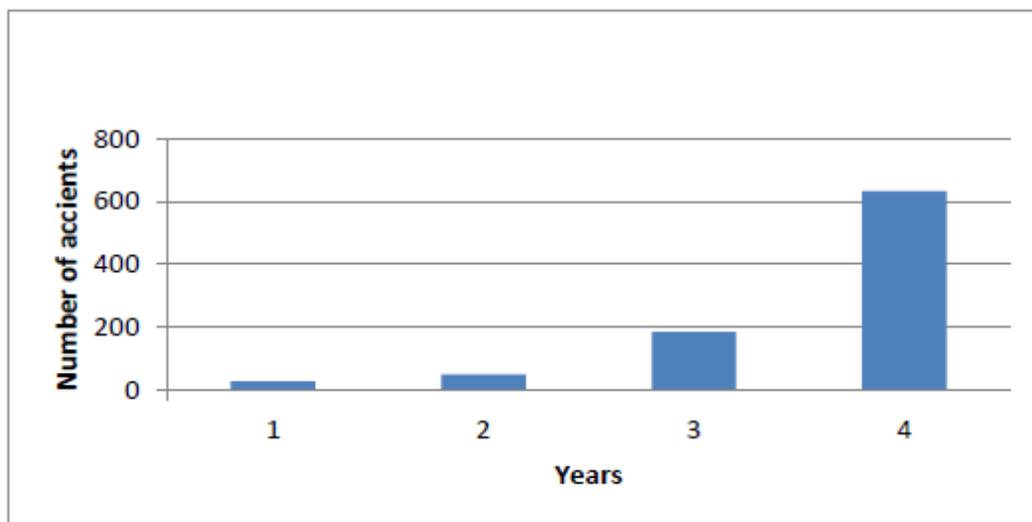


Figure 1. Annual trend in road traffic accident recorded by police stations in Bonaberi and Ndokoti districts of Cameroon from 2015 to 2018

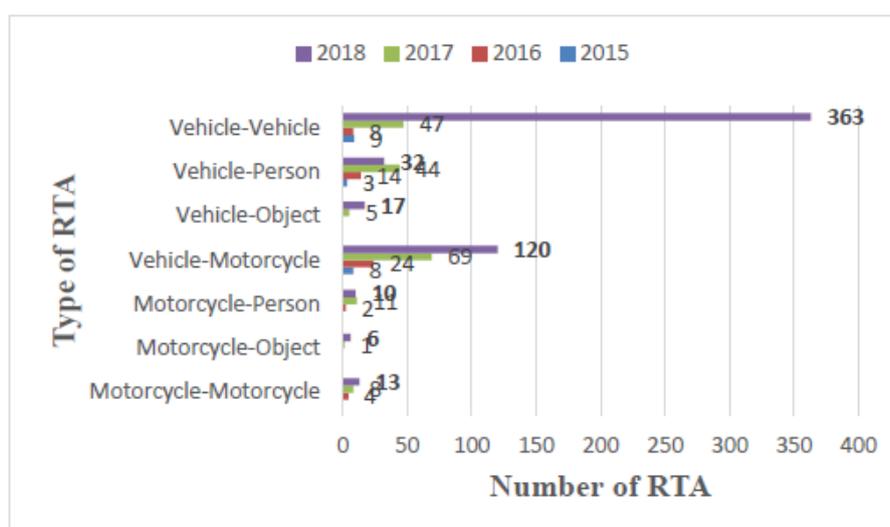


Figure 2. Annual trends in types of road traffic accident (RTA) recorded by police stations in Bonaberi and Ndokoti in Douala, Cameroon from 2015 to 2018

From the review of available records from the Police Department, drivers of the age group of 26 to 35 years and 36 to 45 years were among those involved most in the RTA, 540(36.1%) [95% CI: 33.7%-38.6%] and 451(30.2%) [95% CI: 27.9%-32.6%] respectively. One thousand three hundred and ninety three, 1,393(94.4) [95% CI: 93.1%-95.5%] of the drivers were males. Driving as an occupation was reported by 483(31.7%) [95% CI: 29.4%-34.1%] of those who were driving. Most, 1,254(81.1) [95% CI: 79.1%-83.0%] of the drivers were in possession of the driver's license (Table 1).

**Table 1. Characteristics of Drivers involved in Road Traffic accident victims from Police Records in Douala from 2015 to 2018**

Characteristic	No (%)
<b>Age of driver (years)</b>	
16-25	124(8.3)
26-35	540(36.1)
36-45	451(30.2)
46-55	251(16.8)
56-65	106(7.1)
>65	23(1.5)
Total	1,495(100.0)
<b>Sex of driver</b>	
Male	1,393(94.4)
Female	102(6.8)
Total	1,495(100.0)
<b>Occupation of driver</b>	
Applicant	44(2.9)
Bike riding	180(11.6)
Building	30(2.0)
Business	143(9.2)
Driving	483(31.2)
Engineer	69(4.5)
Finance workers	77(5.0)
Farming	28(1.8)
Health Personnel	22(1.4)
Housewife	32(2.1)
Mechanic	67(4.4)
Students	55(3.6)
Teaching	50(3.3)
Others	266(17.2)
Total	1,546(100.0)
<b>Ownership of driver's license</b>	
No	292(18.9)
Yes	1,254(81.1)
Total	1,546(100.0)

The accidents mostly 589(72.0%), [95% CI: 68.8%-75.1%] involved two persons. Injured cases were recorded in 369(45.1%), of the 818 accident cases. Also, deaths were recorded in 62(7.6%), of the accident scenes. The accidents frequently occurred in the morning period of the day, 315(38.5%) [95% CI: 35.2%-41.9%]. Of the total number of accidents (818) that were recorded, 45.1% (369)

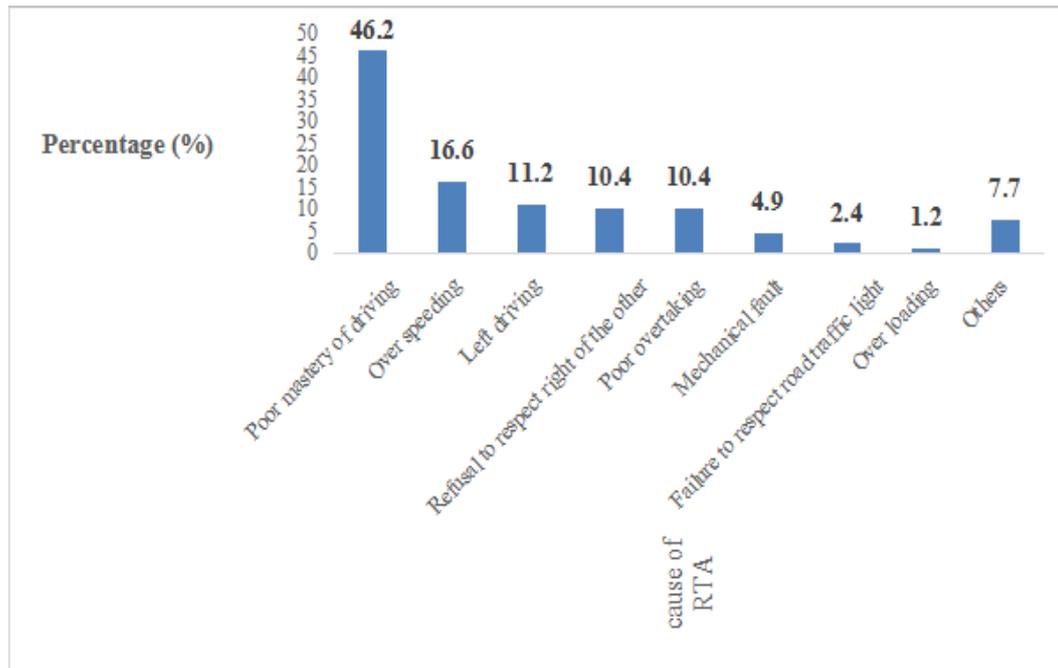
of them had at least one individual who sustained an injury and 7.6% (62) of them had at least one dead. It was also noted that in 97.4% of the cases there were at least two persons involved that were on board at the time of the accident (Table 2).

**Table 2. Description of Road Traffic accidents from Police Records in Douala from 2015 to 2018**

Characteristics	No (%)
<b>Number of persons involved in each accident</b>	
One	21(2.6)
Two	589(72.0)
Three	116(14.2)
Four	47(5.7)
Five and more	45(5.5)
Total	818(100.0)
<b>Number of accidents with injured persons</b>	
None	449(54.9)
One	218(26.7)
Two	90(11.0)
Three	36(4.4)
Four	10(1.2)
Five and more	15(1.8)
Total	818(100.0)
<b>Number of accidents with deaths</b>	
None	756(92.4)
One	51(6.2)
Two	5(0.6)
Three	3(0.4)
Four	2(0.2)
Five and more	1(0.1)
Total	818(100.0)
<b>Time of accident</b>	
Morning	315(38.5)
Afternoon	224(27.4)
Night	274(33.5)
Time Not recorded	5(0.6)
Total	818(100.0)

The causes of RTA captured from the review of records at the police department in Douala revealed that poor mastery of driving was the most frequent cause of RTA, 46.2% [95% CI: 42.8%-49.7%]. Over speeding (16.6%) [95% CI: 14.1%-19.4%] and left driving (11.2%) [95% CI: 9.2%-13.6%] were also frequent causes of RTA (Figure 3).

A total of 1,883 persons with injuries from RTA were received and managed by health facilities between 2018 and 2019 in Bonaberi of Douala. The age group of 26 to 45 years occupied the highest position 53.9% (1015). Majority, 1,276(67.8%) [95% CI: 65.6%-69.9%] of the victims were males. Students, 350(18.6%) [95% CI: 13.8%-17.1%] were the highest recorded RTA injury victims. Majority, 1,590(84.4%) [95% CI: 82.7%-86.1%] of the injuries were sustained from RTA involving the motorcycle. Among the number of victims who reported to the hospital, 78.7% were discharged, 14.7% were hospitalized, 5.7% were referred and 0.8% died (Table 3).



**Figure 3.** Causes of road traffic accidents between 2015 and 2018 in Douala, Cameroon

**Table 3.** Characteristics of road traffic accident victims managed at health facilities in Banaberi between 2018 and 2019

Characteristic of road traffic injury victims	No (%)
<b>Age (years)</b>	
<16	127(6.7)
16-25	439(23.3)
26-35	615(32.7)
36-45	400(21.2)
46-55	170(9.0)
56-65	95(5.0)
>65	37(2.0)
Total	1,883(100.0)
<b>Sex</b>	
Male	1,276(67.8)
Female	607(32.2)
Total	1,883(100.0)
<b>Occupation</b>	
Applicant	64(3.4)
Bike riding	180(9.6)
Business	269(14.3)
Driving	92(4.9)
Hair dresser	35(1.9)
Farming	36(1.9)
Health Personnel	13(0.7)
Housewife	191(10.1)
Student	350(18.6)
Teaching	40(2.1)
Military	13(0.7)
Retired	25(1.3)
Security agent	38(2.0)
Technician	302(16.04)
Others	180(9.6)
Total	1,883(100.0)
<b>Outcome of the patient</b>	
Discharged	1,482(78.7)
Hospitalized	277(14.7)
Referred	108(5.7)
Died	16(0.8)
Total	1,883(100.0)

Most, 893(47.4%) [95% CI: 45.2%-49.7%] of the accidents occurred during the night hours (Table 4).

**Table 4.** Description of Road Traffic accidents from Health Records

Description of Road Traffic Accidents	No (%)
<b>Type of accident</b>	
Motorcycle	1,590(84.4)
Vehicle	289(15.3)
Vehicle-motorcycle	4(0.2)
Total	1,883(100.0)
<b>Time of accident</b>	
Morning	387(20.6)
Afternoon	603(32.0)
Night	893(47.4)
Total	1,883(100.0)
<b>Category of accident</b>	
Mild	1,481(78.7)
Severe	386(20.5)
Fatal	16(0.8)
Total	1,883(100.0)

## 5. Discussion

Given the growing importance of injuries as a public health problem in sub-Saharan Africa and Cameroon in particular, and the limitation of resources available to institute formal surveillance programs, the completeness of available police and hospital data needs to be examined as a potential source of information on injuries. An attempt into the available data in Douala revealed the following. Most (94.4%) of all the drivers were males, and 100% of the commercial bike riders were male, while there was a predominance of males among the accident victims (67.8%) in Douala. This is similar to studies done in Sri Lanka [20]

and India [21], where the percentage of male victims of RTA were found to be 70.6% and 82.3% respectively. World Health Organization (WHO) in 1999 [22] and 2002 [23] also reported similar findings. The high male predominance could be due to the fact that male are more competitive and have a tendency to engage in more risk-taking behavior. The highest type of collision was that involving a vehicle and a vehicle. This was similar to the work of Chador et al in 2017 [24] where he found out the same trend.

During the four year period under study for police records, there was an approximately 15 fold increase in accidents involving motorcycles and vehicles in Douala. This is in contrast to a study in Kenya that showed that Kenya had experienced only a fourfold increase in the rate of road traffic fatalities over the past 30 years [25]. It also relates with other studies that show that over the past two decades there has been a rise in accident fatalities and injuries related to motorcycles [26,27]. Generally, studies are showing an increase in different magnitudes; For instance, the number of reported crashes increased by 62.8 percent (from 6,850 to 10,715) in Ghana between 1994 and 1998 [28]. This very high increase in our study over a relatively short period might be due to a change in the reporting system. Since the police department indicated that it is in 2017 that a different unit was set up for the surveillance of RTAs and new tools were issued for the report and follow up of RTA. Hence, there could have been a lack in getting acquainted with new tools and transferring old records to the new units. It might just also be due to the fact that there has been an increase in the number of motorbikes considering the sociopolitical situation that saw an influx of commercial motorbike riders from the English speaking regions. At the point of accident a majority of the vehicles /motorcycles had at least two persons; this was in sharp contrast with Arif Ali et al who reported a majority of vehicles/motorcycles had only one person at the point when the accident occurred. Poor mastery of driving was gotten as the most cause of accidents. This was in line with the work of Chador et al in 2017 who found out that the most cause of accident in Bhutan was poor or careless driving [24]. But was in contrast with the over speeding noticed by Arif Ali et al in a study carried out in Pakistan [29]. This could be because more than half of the drivers in our study involved in the accidents were neither professional drivers nor riders. Though majority of them owned license, this may raise an eyebrow on the quality of training offered to get a driver's license. In our study, over-speeding was the second cause of RTA being rated at 16.2%. This was far lower than the finding of Satchwell in 2001 where he found out that speeding is a contributing factor in 75% of the traffic fatal crashes in South Africa [30]. Barengo et al in 2006 found out that speeding is a contributing factor in more than 25% of all traffic crashes in Dar-es-Salam in Tanzania between 1999 and 2001 [31]. It has been shown that, higher speed reduces the response time of the drivers of the motor vehicles and increases the severity of the injury, due to the larger amount of energy to be dissipated at contact/impact.

For the classification of the accidents, 7.6% of the accident cases reported at least one dead person which was classified as fatal. It was similar to the findings of Chador et al. It is worth noting that the international

definition of death due to RTA is 'death within 30 days of an RTA' [2]. Our data included only the deaths reported by the police at the time of the accident. Those that died either in the hospital or at home within the 30 days might not have been captured by them. Considering that, most often those that loss their lives due to RTA could be the bread winners of the family, the ripple effects on their dependents cannot be overemphasized. Therefore, the above percentage cannot be considered small.

53.9% of the RTA victims that were attended to in the hospital were between the ages 26-45, similar to the findings of Mefire et al in Limbe-Cameroon but was in great contrast with the work of Lam LT which revealed that more than 80% of the victims were between the ages 14-15years [32]. 67.8% of the victims were males and it was similar but slightly lower than the 70.85% declared by Mefire et al [15] and that of the study of Ngaroua et al [33]. Being a male and being young could be considered as predisposing factors to RTA. This is in line with studies conducted by different individuals [34,35,36,37]. A large majority of the victims were motorcycle users or were hit by a motorcycle. This is similar to the results reported by Ngoroua et al. This could be because motorcycles have become a common means of transportation in both settings. A high percentage of patients were discharged just like the situation of Ngoundere reported by Ngoroua et al [33]. This could be due to the fact that many patients who came to the hospital were mild cases. 0.8% of the RTA victims died in the hospital. This was slightly lower than the 1.4% reported by Kourouma et al in Guinea in 2019 [38]. Most of the victims that reported to the hospital were involved in accidents at night. This was similar to the study by Ali et al in 2010 [29]. This could be due to the fact that in the evening a lot of part time drivers and riders take over the wheels after their regular work.

## 6. Limitations

There were many missing records especially for the Police department. This is because a central unit had been created in 2017 and so data before that was difficult to have. For some of the health and police data, entries had to be discarded because they were not completely filled.

## 7. Conclusion

From the police records there has been an increase in RTA over the last four years. Meanwhile the records showed that there was a fifteen fold increase in accidents involving motorcycles with vehicles within four years. Most accidents were caused by poor mastery of driving by the drivers.

From the health records, most of the victims were young males and the accidents occurred at night.

## Funding

This study was partly supported by the Faculty of Health Sciences of the University of Buea.

## Conflict of Interest

The authors have no conflict of interest to declare.

## Data Availability

All the data supporting these findings are found in the results section of the manuscript.

## Acknowledgements

We are grateful to all health personnel and Traffic police officers who participated in the study. We are also thankful to the research assistants who contributed in the field for data collection.

## References

- [1] Worley, H. (2008). Road Traffic Deaths increase dramatically worldwide - Population Reference Bureau [cited on 9th June 2008]. Available on: <<http://www.prb.org/Home.aspx>>.
- [2] Peden M, Scurfi eld R, Sleet D, Mohan D, Hyder AA, et al. (2004) World report on road traffic injury prevention. Geneva: World Health Organization.
- [3] United Nations. General Assembly Sixty Fourth Session. 2010. Available on [http://www.who.int/entity/violence\\_injury\\_prevention/publications/road\\_traffic/UN\\_GA\\_resolution-54-255-en.pdf](http://www.who.int/entity/violence_injury_prevention/publications/road_traffic/UN_GA_resolution-54-255-en.pdf) [Accessed on Jan 02,2021].
- [4] World Health Organisation. Violence and Injury. 2009. Available on [http://www.who.int/violence\\_injury\\_prevention/road\\_safety\\_status/2009/en/index.html](http://www.who.int/violence_injury_prevention/road_safety_status/2009/en/index.html).
- [5] World Health Organisation. Road safety in the WHO African Region: THE FACTS. 2013. Available on [www.afro.who.int/publication](http://www.afro.who.int/publication) [Accessed on Jan 22,2021].
- [6] Ministry of Transport. Transport Statistics Yearbook, Yaounde: PresPrint Plc; 2014.
- [7] Ministry of Transport. Transport Statistics Yearbook, Yaounde: PresPrint Plc; 2015.
- [8] Ministry of Transport. Transport Statistics Yearbook, Yaounde: PresPrint Plc; 2016.
- [9] Ministry of Transport. Transport Statistics Yearbook, Yaounde: PresPrint Plc; 2017.
- [10] Ministry of Transport. Transport Statistics Yearbook, Yaounde: PresPrint Plc; 2018.
- [11] Interview from Head of Technical Services at the Ministry of Transport, Cameroon. August 2019.
- [12] Sharon AN, Reid SA, Durham J, Abia WA, Victal BL. Patterns of Non-Fatal Road Traffic Injuries in Cameroon: The Case of the Yaounde Injuries Reported in the Year 2011/2012 at Teaching Hospital (Centre Hospitalier et Universitaire De Yaoundé (CHU)). *Journal of Basic and Applied Research International*. 2015; 5: 61-72.
- [13] The Ministry of Public Health: 2016-2020 National Health Development Plan. 2016. Yaounde. PresPrint Plc.
- [14] Sobngwi-Tambekou J, Bhatti J, Kounga G, Salmi LR & Lagarde E. Road traffic crashes on the Yaoundé-Douala road section, Cameroon. *Accident Anal Prevention*, 42 (2):422-6, 2010.
- [15] Chichom Mefire A, Etoundi Mballa GA, Azabji Kenfack M & Juillard C, Stevens K. Hospital-based injury data from level III institution in Cameroon: Retrospective analysis of the present registration system. *Injury*, 44 (1):139-43, 2013.
- [16] Juillard C, Etoundi Mballa GA, Bilounga Ndongo C, Stevens KA, Hyder AA. Patterns of Injury and Violence in Yaoundé Cameroon: An Analysis of Hospital Data. *World Journal of Surgery*, 29, 2010.
- [17] Banthia P, Koirala B, Rauniyar A, Chaudhary D, Kharel T, Khadka SB. An epidemiological study of road traffic accident cases attending emergency department of teaching hospital. *Journal of Nepal Medical Association*. 45 (162): 238-43, 2006.
- [18] Population Stat, Douala, Cameroon Population. Available on [www.PopulationStat.com](http://www.PopulationStat.com) (accessed on 20 September 2021).
- [19] Encyclopedia Britannica.
- [20] Dinesh M. Fernando, Sampath U. Tennakoon, Achini N. Samaranyake & Medhani Wickramasinghe Characteristics of road traffic accident casualties admitted to a tertiary care hospital in Sri Lanka. *Forensic Science Medicine Pathologies*, 13: 44-51, 2017.
- [21] Patil SS, Kakade RV, Durgawale PM, Kakade SV. Pattern of road traffic injuries: a study from western Maharashtra. *Indian Journal Community Medicine*, 33:56-7, 2007.
- [22] World Health Organization. Injury: A leading cause of Global Burden of the Disease. 2000. [http://www.who.int/violence\\_injury\\_prevention/publications/other\\_injury/injury/en/](http://www.who.int/violence_injury_prevention/publications/other_injury/injury/en/). [Accessed 10 Jan 2021].
- [23] World Health Organization. Gender and road traffic injuries. In Department of Gender and Women's Health. 2002. <http://www.who.int/gender-equity-rights/knowledge/a85576/en/>. [Accessed 10 Jan 2021].
- [24] Chador Wangdia, Mongal Singh Gurung a, Tashi Dubaa, Ewan Wilkinson b, Zaw Myo Tunc and Jaya Prasad Tripathy. Burden, pattern and causes of road traffic accidents in Bhutan, 2013-2014: a police record review. *International Journal of Injury Control and Safety Promotion*, 1-5, 2017.
- [25] Odero W, Khayesi M, Heda PM. Road traffic injuries in Kenya: magnitude, causes and status of intervention. *Injury Control and Safety Promotion*. 10 (1-2):53-61, 2003.
- [26] Swaddiwudhipong W, Nguntra P, Mahasakpan P, Koonchote S, Tantriratna G. Epidemiologic characteristics of drivers, vehicles, pedestrians and road environments involved in road traffic injuries in rural Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*.; 25 (1):37-44, 1994.
- [27] Marmor M, Parnes N, Aladgem D, Birshan V, Sorkine P, Halpern P. Characteristics of road traffic accidents treated in an urban trauma center. *Israel Medical Association Journal*, 7(1): 9-12, 2005.
- [28] Afukaar FK, Antwi P, Ofosu-Amaah S. Pattern of road traffic injuries in Ghana: Implications for control. *Injury Control Safety Promotion*, 10: 69-76, 2003.
- [29] Arif Ali, Jaishri Mehraj, Sajid Mahmood, Zahid Mirza and Muhammed Tahir. Frequency of Risk Factors Associated with Road Traffic Accidents of Motorbike in a Big City of a Developing Country. *Journal of the Dow University of Health Sciences*, 4 (2): 68-72, 2010.
- [30] Satchwell, KM. Report to His Excellency – The President of the Republic of South Africa. *Road Accident Fund Commission* 2000
- [31] Barengo NC, Mkamba M, Mshana SM, Miettola J. (2006) Road traffic accidents in Dar-es-Salaam, Tanzania during 1999 and 2001. *International Journal of Injury Control and Safety Promotion* 2006; 13: 52-54.
- [32] Lam LT. A neglected risky behavior among children and adolescents: underage driving and injury in New South Wales, Australia. *Journal of Safety Research*, 34: 315-20, 2003.
- [33] Ngaroua, Neossi N.M, Mbo A.J , Chichom Mefire A , Eloundou N. J. Epidemiology and Pattern of Road Traffic Injuries in Ngaoundéré, Cameroon: a Retrospective Hospital Based Study Prior to the Implementation of a Formal Trauma Registry. *Health Science and Diseases*, 15 (2), 2014.
- [34] Romão F, Nizamo H, Mapasse D, Rafico MM, José J, Mataruca S, Efron ML, Omondi LO, Leifert T, Bicho JM. Road traffic injuries in Mozambique. *Injury Control and Safety Promotion*, 10(1-2): 63-7, 2003.
- [35] Zhou JH, Zhao XC, Wang ZG, Zhu PF, Jian HG, Liu DW, Zhou JL, Liu L. The analysis of epidemiological characteristics of road traffic crashes in a mountain city in western China. *China Journal of Traumatology*, 6 (6): 355-8, 2003.
- [36] Agnihotri AK, Joshi HS. Pattern of road traffic injuries: one year hospital-based study in Western Nepal. *International Journal of Injury Control and Safety Promotion*, 13 (2): 128-30, 2006.
- [37] Suriyawongpaisal P, Kanchanasut S. Road traffic injuries in Thailand: trends, selected underlying determinants and status of intervention. *Injury Control and Safety Promotion*, 10(1-2): 95-104, 2003.

- [38] Kourouma K, Delamou A, Lamah L, Camara BS, Kolie D, Sidibé S et al. Frequency, characteristics and hospital outcomes of road traffic accidents and their victims in Guinea: a three-year retrospective study from 2015 to 2017. *BMC Public Health*, 19: 1022-1034, 2019.



© The Author(s) 2021. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).