Characterizing Traffic Offenses in Addis Ababa, Ethiopia: Case Study in Arada Sub-city

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Abstract: Addis Ababa, the capital of Ethiopia, is undergoing a period of substantial growth. However, the road transport system faces major challenges. The level of road traffic crashes is increasing from time to time as the number of vehicle population and urbanization increases. Systematic analysis of available data from a different perspective and implementation road safety policy to reduce traffic crashes are interesting work in the coming years. Factors that are responsible for road traffic accident are categorized into driver error, pedestrian, road environment and the vehicle factor. Driver error and noncompliance of drivers with road traffic rules and regulations is the main factor for road traffic crashes which accounts for approximately 90%. This study aimed to know the characteristics, most common traffic offenses, their magnitudes and trends on the roads of Addis Ababa city, particularly in Arada sub city from November 2014/15 to November 2016/17 GC. The Traffic offence data in Arada Sub city, vehicle population details and driver population details in the Addis Ababa city were collected. Proportions, frequencies and descriptive statistics were used to analyze the data. Results indicate that the amount of traffic offenses over a three - year period increased by 13.7% and decreased by 2.4% for male and female drivers respectively. In addition, male traffic offenders (95.6%) outnumber women traffic offenders (4.4%) by a wide margin in traffic violations as compared to licensed male (85.6%) and female (14.4%) drivers in the city. Traffic flow obstruction (12.9%), disrespecting prohibited signs (11.3%), illegal parking (8.5%), overloading (8.2%) and driving while talking on the phone (7.8%) were most commonly occurring traffic offenses. Stricter measures and educations on road safety awareness need to be reinforced.

Keywords: Traffic Offenses, Road Safety, Descriptive Statistics, Drivers

1. Introduction

Transport plays a major role in long-term economic growth if transport system is sustainable and powerful. However, transport infrastructure and roads produce the opposite result unless relevant considerations are taken to road safety. About 1.25 million people lose their life each year as a result of road traffic crashes out of which 90% of road traffic deaths occur in low- and middle-income countries, yet these countries have just 54% of the world's vehicles [1]. In developing countries, the situation worsens due to lack of adequate infrastructure and poor traffic management [2].

Human, Vehicle, roadway and environmental factors are the basic cause of road traffic crashes globally. Failing to obey traffic rule and regulations is human behavior which might lead drivers to traffic crashes [3]. Driver's error and noncompliance of with road traffic rules and regulations is the main factor of road traffic crashes. In Africa, human related factors cause greater than 75% of road traffic accidents. In Ethiopia and Egypt more than 80% of road traffic accident occurs due to human related factors [4].

Less strict enforcement of traffic laws is likely to encourage dangerous driving behavior. Studies show that there is a strong relationship between road accidents and traffic violations [5, 6]. Identification of traffic offenders can help policy makers, planners and traffic safety officials concentrate their efforts on specific group identified.

Ethiopia is the second most populated and one of the low-income countries in Africa. Traffic crash statistics show that

in Ethiopia, 79%oftrafficcrashesoccurredonasphalt roads and only 19% on unpaved roads. Unpaved road covers 86.13 of the road networks [7].

Addis Ababa, the capital of Ethiopia, is undergoing a period of substantial growth. However, the road transport system faces major challenges; the level of road traffic crashes is increasing from time to time as the number of the vehicle population. Based on Federal police commission reportineightyearsfrom2009/2010-2016/2017, 3,095 fatalities, 10,429 serious injuries have occurred [7]. For the year2014/15-2016/17 above all the regions of the country, Addis Ababa City shares the majority of traffic offenses above 60% of traffic offenses in the country [8]. The Addis Ababa City is the center having about 56% vehicle population [9].

Every country has its own road traffic rules and regulations which should be respected by everybody for the safety of their own and there exists the government organ keeping these rules and regulations, whether respected by drivers, pedestrians and other concerned or not including the society too. But nowadays, these road rules and regulations are not obeyed as expected. This disrespecting of road traffic rules and regulation increases the chance of occurrences of road traffic crashes.

Similarly, the Addis Ababa City has its own road rules and regulations which should be applied for all drivers in the city. However, the majority of the city's drivers are not performing according to the rules and regulations of the city in every day of their driving activities. Even though, the city's police commission is working on drivers as they have to perform as the traffic rules and regulations, the number of Traffic Agencies in the city are increasing from time to time, which in turn increases the chance of occurrence of road traffic crashes. Apart from a traffic police piece reports on traffic offenses in the city, no more is known about the trend, magnitudes and characteristics of these traffic offenses. Literatures on differences in traffic offenses by vehicle and driver characteristics, associations of driver's and vehicle's characteristics and traffic crash involvements and attitudes of traffic offenders towards unsafe driving behaviors were very few in the city.

Therefore, these initiated there searcher to study the characteristics, trends and magnitudes of traffic offenses in Addis Ababa City and differences in traffic offence types of vehicle characteristics.

The study will put the issue with the following research questions;

1. What is the trend, magnitudes and characteristics of traffic offenses in Addis Ababa City, the case of Arada sub-city?
2. What are the most common traffic offenses occurring in the Arada sub - city?
3. Who are the most vulnerable groups to traffic offenses?
4. What are the associations of drivers and vehicle's characteristics and traffic offence involvements?

The main objective of this research is to analyze traffic offenses and to know and understand the associated factors/groups.

It is expected that the results of this study assist researchers and professionals to understand the most common traffic offenses in the city. In addition, the characteristics of traffic offenses, magnitudes and trends in the city are identified. On the other hand, identification of traffic offenders can lend a hand policy makers, planners and traffic safety managers concentrate their efforts and provide interventions for specific groups identified.

2. Materials and Methods

Addis Ababa city was used as a study area and simple random approach has been followed to select case study area. Quantitative approach was used, using secondary traffic offence data of Arada sub-city for 3-year period i.e. November 2014/15–November 2016/17. The data on traffic offenses containing the age of offenders, gender, type of offence, vehicle type by their codes and month in which traffic offence occurred were collected from Arada sub city traffic police department. Similarly, data on vehicle population with details like vehicle type and their corresponding population, their assigned code and their purpose, licensed driver related information like age and gender was gathered. Descriptive statistics in the forms of tables, charts, graphs and frequency/proportions/ distributions were carried out to interpret the results.

Table 1. Vehicle Identification by code and letter combination.

No	Type of plate	Description	Code
1	Taxi plate	issued for vehicles engaged in taxi transport services	1
2	Private plate	for private motor cars for personal, family purposes	2
3	Commercial plate	Vehicles registered as commercial use, business cars	3
4	Government plate	issued for vehicles owned by government agencies	4, ET
5	Religious/civic society	for vehicles owned by the red cross, religious, NGOs	5
6	Temporary plate	To be issued for vehicles for temporary use	T
7	Transferable plate	issued for any inventory vehicles owned by a manufacturer, for temporary	TR
8	Special Equipment	To be issued for any special mobile equipment	SE
9	Police plate	To be issued for vehicles owned by police	POLICE
10	Embassies, International organizations and Aid plate	a) for vehicles of "UN" personnel with diplomatic status b) To be issued for vehicles owned by" UN" and the personnel thereof c) for vehicles of "AU" personnel with diplomatic d) for vehicles owned by "AU" and the personnel thereof e) for vehicles of diplomatic corps f) for vehicles of aid institutions' personnel with diplomatic status	CD, UN, AU,

No	Type of plate	Description	Code
		g) for vehicles of aid institutions and personnel thereof Indicates vehicles engaged in cross country commercial road transport service or owned by the Federal government agencies	

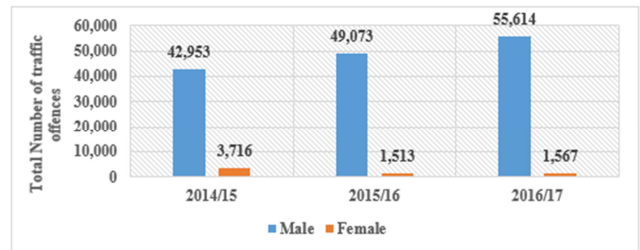Source: Addis Ababa City Road and Traffic Management Agency.

Data Description

1) *Age*-is the age of traffic offenders and given in 3 crude intervals. These age interval is 18-30 years, 31-50 years and above 50 years. These age category was done by Addis Ababa city driver licensing Authority.
2) *Gender*-is gender of traffic offenders.
3) *Month*-month in which traffic offence was made.
4) *Vehicle Code*- Vehicles were represented by different codes (numbers and numerals) given by Federal Minister of Transport on their plate and the plates were colored with different colors for different types of vehicles as shown on table 1above.

3. Results and Discussions

In the Arada sub - city, over three years, about 154,436 (95.6% by male) traffic offenses have occurred, caught by enforcement bodies, and fined. This number shows the traffic offenses caught, registered and fined.

a) Traffic offenses by gender

Below, figure 1, is the total number of traffic offenses for the three years (from 2014/15 to 2016/17GC.) by gender. Overall, 46,669 (30.2%) in 2014/15, 50,586 (32.8%) in 2015/16 and 57,181 (37%) in 2016/17 were registered and showed an increment. The number increased by rate of 8.3% and 13.04% in 2015/16 and 2016/17 respectively. There is surprising result that the rate was decreasing by 2.4% for female traffic offenders and increasing rate of 13.7% for male traffic offenders. Generally, combining male and female traffic offenders, the number of traffic offenses increased by rate of 10.7%.

Figure 1. Total number of traffic offenses over 3 years (2014/15-2016/17) by Gender.

Table 2 below shows the gender composition in the overall number of traffic offenses. From the table, male showed a higher proportion in total number of traffic offenses over the study period. Among the licensed male drivers, 24.04% of them are traffic offenders. Similarly, 5.87% of the licensed female drivers have committed traffic offenses. This seems to suggest that male drivers are more reckless than female drivers and are often caught on the wrong side of traffic laws. This might be due to the cause that professional driving jobs are dominated by male drivers. It is worth nothing that female involvement in paid employment (or self-employment) is low in Ethiopia. In addition, kilometers travelled per annum by women as drivers are more probably lower than men. The findings of this study were also supported by [10] and [11] whereby the number of fines and accident was greater among male and higher tendency to traffic violations. In addition, males are more involved in dangerous driving behaviour than female [12].

Table 2. Traffic offenders and licensed drivers by gender (from 2014/15GC to 2016/17GC.).

Gender	Number of traffic offenders (A)	%	Number of licensed drivers (B)	%	(A/B) %
Male	147,640	95.6	614,228	84.15	24.04
Female	6,796	4.4	115,672	15.8	5.87
Total	154,436	100	729900	100	21.15

Source: Addis Ababa City Road and Traffic Management Agency (licensed drivers up to September, 2018).

b) Traffic offenses by age

Table 3 below shows traffic offenses by age of offenders. The traffic offence database (report format from the sub-city divided the age of traffic offenders only into 4 crude interval categories; these are; less than 18 years, 18-30 years, 31-50 years and above 50 years). As it can be seen from the table, drivers of 18-30years share 22.35 in total licensed population but they share 35.8% in traffic offenses. However, drivers aged above 50 years share 20.01% in total licensed population and have a share of only 15.1%. Comparing these results across these age categories, the age category of 18-30 years has highest involvement in traffic offenses. These age categories represent younger age groups who are aggressive drivers and the results of this study are also in line with the study by [13, 14].

Table 3. Comparison of licensed drivers' population and traffic offender's population by Age.

Age	Licensed Drivers population	Traffic Offenders Population
18-30 years	163,134 (22.35%)	55,289 (35.80%)
31-50 years	420,714 (57.64%)	75,828 (49.10%)
above 50 years	146,052 (20.01%)	23,319 (15.10%)
Total	729,900 (100.00)	154,436 (100.00)

c) Traffic offenses by code of vehicles

Table 4 below shows the proportion of vehicles in Addis Ababa City by their codes and the total numbers of traffic offenses by vehicle codes was shown. Vehicles coded 1 were overrepresented (from 6.2% of the total vehicle population to 22.4% in traffic offence involvement) in traffic offence. These vehicle types are taxi which is used commonest public transport services and higher mileage and travel repetition on a specific route. In addition, most the drivers on this vehicle type were hired as a driver and face a higher workload. Hence, this might be the cause behind their higher involvement in traffic offenses. Whereas vehicles coded 4 (government vehicles) and 6 (religious vehicles, civic society vehicles, temporary plate vehicles, transfer plate vehicles, special equipment, vehicles and police plate vehicles) have less involvement in traffic offenses. These vehicle types have less mileage per annum in the city. Most of them travel either from home to offices, from office to office or from office to home as their main purpose is to process government and/or civil society related issues. Therefore, they may have fewer movements in the city and drivers are improbable to involve in traffic offenses.
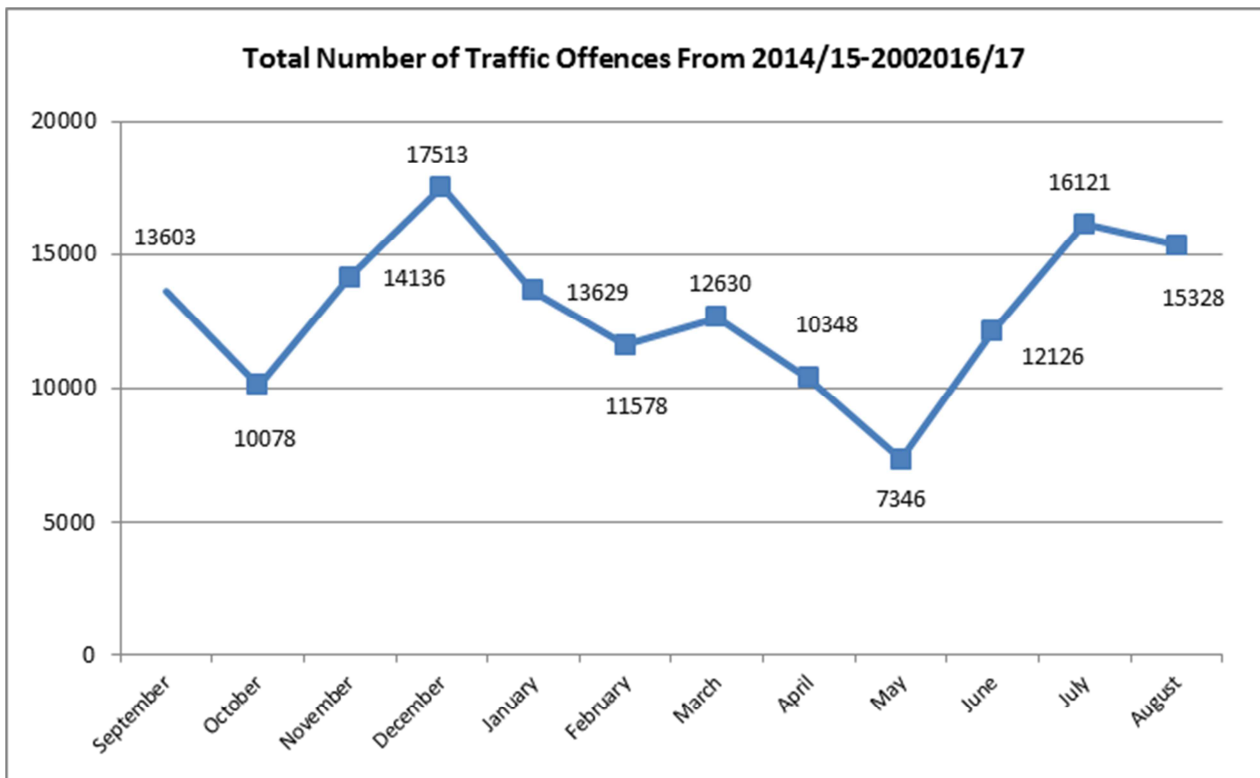
Table 4. Comparison of Vehicle code and traffic offender's population by codes of vehicles.

Code of vehicles	Vehicle population	Percentage (%)	Traffic offender's population	Percentage (%)
1	30,159	6.2	34,593	22.4
2	172,778	34.8	48,802	31.6
3	231,072	46.5	67,180	43.5
4	24,519	4.9	21,62	1.4
5	3,930	0.7	772	0.5
Others (6)	34,315	6.9	928	0.6
Total	486,773	100.00	154,436	100.00

d) Traffic offenses by months of a year

In figure2 below the monthly variation of traffic offenses were illustrated. The number of traffic offenses was maximum in the months of December and minimum in the months of May. May is the month with the lowest traffic offenses over the 3 years with only 7000 male offenders and 346 female offenders. It might be the cause that it is the hottest month in the city and which didn't give comfort for all movements, especially for pedestrian to make movement from place to place is this month and this month is also characterized by having three public holidays like international labor day (May 1), Freedom day, (May 5), Derg Downfall Day, (May 28), on which no –government works, reduced human movements and with weekend days included is where traffic flow decreases greatly. Hence, this might be the reason behind lowest traffic law offenses in the month. On the other hand, in December, highest number of traffic offenses were recorded and this result needs further study.

Figure 2. Monthly variation of traffic offenses over 3 years.

The Most Common Traffic Offenses

The most common (top-25) traffic offenses over the study period were identified and shown in figure3 below.

Figure 3. The most common traffic offenses of Arada sub city over 3 years (2014/15 -2016/17).

As shown in figure 3; traffic flow obstructions, which includes the activities of drivers on road that causes the disturbance to the flow of traffic (12.5%), disrespecting prohibited signs (9.8%), and parking on prohibiting signs (8.9%) are the most committed traffic offenses for the reported period. The other fourth and fifth major traffic offenses are overloading (8.23%) and using a mobile phone while driving (7.9%). These are the top five traffic offenses and they constitute about 47.63% of all traffic offenses. This finding was supported by [15], in which disrespecting prohibited traffic signals, but the study identified speeding, drink driving, using inappropriate driving license, license plate destroyed/not displayed as the most common traffic violations. In addition, illegal stopping, violating traffic signals and distracted driving were identified as the most common traffic violations [1], in China, Beijing. Therefore, enforcement activities should give greater concern for these major traffic offenses.
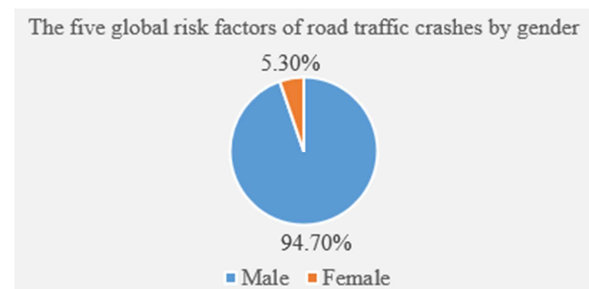
Involvement in Road Traffic Crashes Risk Factors

In the next figure4, the levels of risk factors of road traffic crashes identified by [11, 16] were shown. From the five identified risk factors, red-light running was the highest traffic offenses occurring in the sub-city and data on speeding was not available at the time of study. The other highest risk factor that was recorded as traffic offenses are failing to wear a seat belt (1628) and drink driving (797) traffic offenses.

Figure 4. Levels of Global risk factors of road traffic crashes.

As shown on figure 5, from the total number of risk factors involved, about 94.7% were recorded by male traffic offenders. The risk factors by age variation of offenders were not included in this study because of unavailability of age group corresponding this risk factors in the traffic offence database.

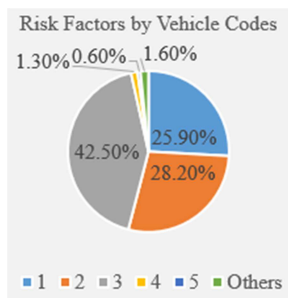*Figure 5. The five Risk Factors of Road Traffic Crashes by Gender of Traffic offender.*

Figure 6. *Risk factors by codes of Vehicles.*

It can be seen from the above figure6 that commercial and business vehicles with a code 3 share the maximum; about 43% in involvement of risk factors but 46.5% in total licensed drivers in the city. The other offending type vehicles which are code 2 vehicles, include mostly of automobiles and family vehicles constituting about 28.2% to 34.8% in total licensed driver population. Vehicles coded with number 1 in which taxi vehicles are included, share about 26%, but their share ofthe total licensed driver population was only 6.2%. This shows that vehicles coded 1 or Taxi vehicles have higher involvement in the five risk factors of road traffic crashes than vehicles coded 2 and coded 3. The other types of vehicles are coded 4, code 5 and other codes like T (transferable vehicles), ET (Federal government owned vehicles), CD (vehicles of diplomats), UN (United Nations vehicles), and Police with 1.3%, 0.6% and 1.6% respectively.

4. Conclusions

In this study, specific characteristics of traffic violations in the context of Ethiopia investigated and assessed. The number of traffic offence increasing from time to time. Traffic violation is frequent among male drivers between the age of 18 and 30. Regarding type of vehicles, Code 1 vehicles (mainly taxi) were more involved in both total traffic offense and risk factors, whereas government vehicles (coded 4), vehicles represented by Temporary plate, International organizations and Aid plate and Police were less involved both in total traffic offenses and risk factors of road traffic crashes. Traffic flow obstruction, disrespecting prohibited signs, illegal parking, overloading and driving while talking on phone were the most commonly occurring traffic offenses in Addis Ababa.

Using the results of this study, Addis Ababa City Traffic police Commission, Addis Ababa City Road Traffic Management Agency, and Road Safety professional can control the increasing percentages of traffic offenses by introducing necessary changes in road infrastructures, educating targeted driver groups, vehicles type and society. Strict measures and education on road safety awareness need to be reinforced [17].

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