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The Causes of Road Traffic Accidents in Bahir Dar City, Ethiopia

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Abstract
Road traffic accidents are a major global socio-economic problem, affecting all people of the world regardless of age, sex, wealth etc. This study has the major objective of assessing the causes of road traffic accident in Bahir Dar city. Both primary and secondary data sources were used. Cross-sectional survey with utilization of both qualitative and quantitative approaches was used. About 155 samples were drawn randomly from pedestrians and drivers sample groups using stratified random sampling technique. Inferential statistics was used to analyze the data and interpret the results. Step by step analyses of Binary Logistics Regression Model reveal poor pedestrians manner in giving priorities to vehicles where necessary (p–value=0.000), drivers' irregular use of seatbelt while driving (p–value=0.009), failure of drivers in giving priorities to pedestrians as required by the law (p–value=0.045) and drivers use of excessive driving speed (p–value=0.001) as the main determining factors for the occurrence of road traffic accident in the city. With regard to the types of vehicles that commit frequent accident, motor cycles, pickups particularly those that can carry up to ten quintals, public vehicles especially those having 12 seats and taxi 1 and 2 (Bajaj and mini bus taxis) were the major and frequent accident agents. Unless immediate actions to revert the problem are taken, it will worsen in the coming future as motorization and population of the city are growing altogether.
Keywords: Causes, Road Traffic Accidents, Pedestrians, Drivers, Bahir Dar, Ethiopia

1. INTRODUCTION

1.1 Background of the study

In Africa over 80per cent of goods and people are transported by roads (ECA, 2006), and in Ethiopia road transport accounts for over 90per cent of all the inter-urban freight and passenger movements in the country (Atnafseged, 2000). Transportation is one of the basic requirements for the proper functioning of societies as its demand is highly related to the movement of people from one place to another. Therefore, transportation has a direct impact on the day-to-day activities of people especially, in large cities where the distance to be traveled is too far to cover on foot or by bicycle within a reasonable time. Cities in the developing nations are not only showing a rapid population growth, but also a change in their residents' way of life. This obviously implies that there is a need for a corresponding expansion of infrastructure and services. But due to inadequate road networks, slow road construction and maintenance, rapid traffic growth, shortage of parking space in the narrow streets, as well as ineffective traffic management and enforcement, there is rapid growth of road traffic accidents. This problem is mainly manifested in most of the cities of African nations (Mekete, 2004). Since every activity of humankind has its own consequences, positive or negative, transport is not an exception to this fact. The constraints associated with transport include the risk of traffic congestion, traffic accident, pollution, noise, and the like (Rallis, 2009). Thus, this study focused on the causes of road traffic accidents of Bahir Dar city.

1.2 Statement of the Problem

Ethiopia is one of the developing countries with a very low motorization level, 1.7 vehicles per 1,000 people in 1996/7 (Girma, 2000), and the most recent data show 2 vehicles per 1,000 people in 2001 (UN, 2001). Despite having a very low road network density and vehicle ownership level, Ethiopia has a relatively high accident record.

Bahir Dar, one of the main cities of Ethiopia and is the capital city of the Amhara National Regional State. The city serves as a cross–flight junction point to *Gondar*, *Lalibela* and *Axum*, have all contributed a lot to Bahir Dar's rapid urbanization. Its location along the main roads, the tourist sites of monasteries within the islands of Lake *Tana* and *Tis Issat* Fall of Blue Nile are additional factors for the growth of the city. The city is also interconnected to other cities of the country through a very long asphalt roads; which runs people's socio-economic activities using different vehicles such as taxis, privately owned cars, governmental cars, bus (city and intercity), Bajaj[1], and cycling (both motor and bicycle). The most common and convenient way of traveling in the city is using bicycle. Taxis and Bajaj also provide efficient transportation services Philip

[1] Bajaj: Indian two and three wheeler manufacturing company. Bajaj auto manufactures and sells motorcycles. It is derived from the Indian industrialist, philanthropist and independence fighter, Jamnalal Bajaj (1884-1942)

(2009). Intercity bus service is provided by the Selam Bus Line Share Company and Sky Bus Transport System which operates daily to and from the city (Sutter, 2013).

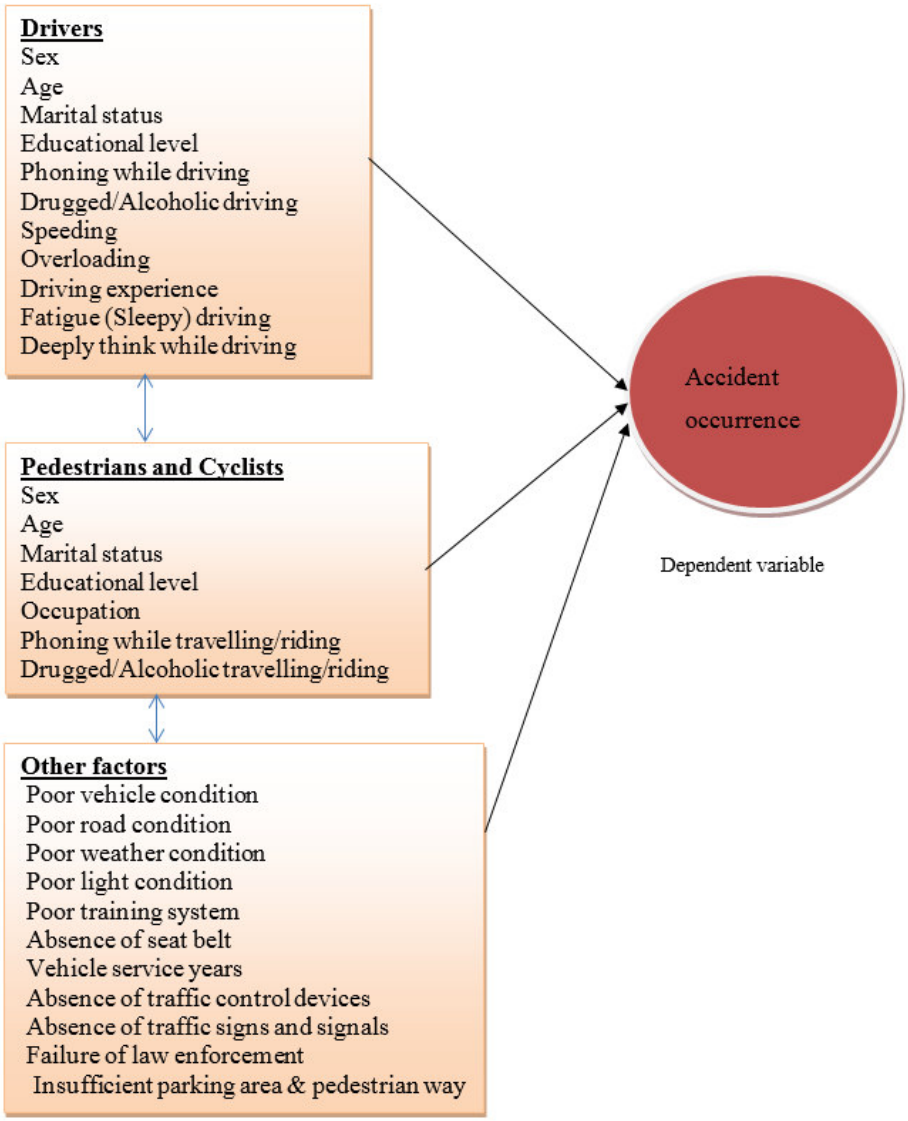
In connection with the above facts, traffic volume is becoming huge and is increasing from time to time; as a result of which and other factors, road traffic accidents have increased over the years and are becoming a common day to day phenomenon resulting in loss of life, human suffering, destruction of properties and the environment. This observation is supported by Bahir Dar special zone traffic police (2003) accident statistics which shows that 347 accidents occurred in the years between 1996 and 2002 (gives an average of 49.57 RTA per year), which cost $ 127,229 for property damage only. The number of victims treated in hospital, health center and clinics also show upward trend. Bahir Dar special zone health department reported that in the last three years (2000–2002) only 3,188 road casualties received medical treatment as in-patients and out-patients (Yayeh, 2003).

Much research has not been done on the issue while the accident is worsening every time as the road traffic rules are being violated by the road users. So, this study scientifically explored the causes of road traffic accidents that are occurring in the city and try to fill the gaps by providing solutions to the problem.

1.3 Research Objective

The general objective of the study is to analyze the causes of road traffic accidents in Bahir Dar city, Ethiopia.

1.4 Conceptual and Analytical Framework



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2. MATERIALS AND METHODS

2.1 Description of Study Area

Bahir Dar is special zone and capital city of Amhara National Regional State (ANRS), which is located approximately 578 km north-west of Addis Ababa, having a latitude 11°36'N and longitude of 37°23'E (EMA, 2008). The average daily temperature is 19℃ and the daily rain fall is variable extending from 3mm in the month of February to 438mm in the month of July (NMA, 2014).

Bahir Dar has a total area of 28km^2 or 11sq. mi (EMA, 2008). The city contained 17 *kebeles* which have recently been reduced to 9 *Kebeles* plus 3 satellite cities and 4 rural *kebeles* added by the ANRS proclamation that enlarges the city's boundaries (Mathewos, *et.al*, 2011).

The total population for Bahir Dar was 96,140 in 1994, of whom 45,436 were men and 50,704 women (CSA, 1994). These population increases explosively to 221,991 within 13 years in 2007 having 108,456 men and 113,535 women; 180,174 or 81.16 per cent are urban inhabitants, the rest of population are living at rural *kebeles* around Bahir Dar. At the city of Bahir Dar alone, there are more than 150,000 inhabitants; the rest of urban population is living at *Meshenti, Tis* Abay and *Zege* city which are part of Bahir Dar special zone (CSA, 2007).

2.2 Methods of Data Collection

Both primary and secondary data sources are used. Cross–sectional survey with utilization of both qualitative and quantitative approaches was used. The population is divided in to two heterogeneous groups: the one that uses machine and the one that uses their pedal for travelling from one place to the other. Then samples are drawn randomly from these sample groups using stratified random sampling technique. Records of road traffic accident situations which occurred for the last four years (2011–2014) were taken from Bahir Dar city administration traffic police office for the triangulation and accomplishment of the questionnaires.

2.3 Sample Size Determination

For populations that are large, greater than 10,000, Cochran (1963) developed the Equation: $\boldsymbol{n} = \frac{\boldsymbol{z^2 * p(1-p)}}{\boldsymbol{d^2}}$ to determine the sample size in which samples are drawn from the sampling frame as cited by Glenn D. Israel, (1992).

Where:

- $\boldsymbol{n}$ - Sample size required for the study
- $\boldsymbol{z}$ - Critical value (=1.96) for the 95per cent confidence level, the amount of uncertainty that one can tolerate. Most researchers recommend 95per cent confidence level.
- $\boldsymbol{p}$ - Proportion of people expected to have the basic knowledge about the problem (occurrence of road traffic accidents in this case).

So, this raw survey data enabled to take the p value as 10per cent (=0.1).

- d - Margin of error that can be tolerated: it is the discrepancy between the sample size and the population. The recommended value is 5per cent (=0.05).

Substituting all these values to the above Cochran formula produced a total sample size (n) of: $\mathrm{n} = \frac{\mathrm{z}^2 * \mathrm{p}(1-\mathrm{p})}{\mathrm{d}^2} = \frac{1.96^2 * 0.1(1-0.1)}{(0.05)^2} = 138.2976$

10 per cent of the sample size is added to the sample size to offset the possible non-respondents and again 2 per cent of it is added to counterpart the design effect in selecting sample groups from the sample frame, making the total sample size taken for this survey 155.

$$\Longrightarrow \mathrm{n} = \left(138.2976 + \frac{10}{100} * 138.2976 + \frac{2}{100} * 138.2976\right)$$

$$= 138.2976 + 13.82976 + 2.765952$$

$$=154.89331 \approx \mathbf{155}.$$

Then Yemane Taro's formula is used to calculate the samples that should be taken from each sub-group: $\mathrm{n}_1 = \frac{\mathrm{N}_1}{\mathrm{N}} * \mathrm{n}$

Where n_1= sample selected from each sub-group

N_1= Actual number of people found in each sub-group

n = Total sample size selected for the study from the sample frame

N= Total population of Bahir Dar.

Because it is believed that drivers and pedestrians are the two independent parties that are highly involved in every road traffic accident scenario, the survey also took the two groups as a sampling frame and samples are drawn accordingly from them. Although the proportion of drivers to be taken as a sample based on

the formula is as indicated in table 3.12, since every road traffic accident involves motorized vehicle, the number of driver samples is deliberately increased from 20 to 100.

Table 3. 1 Proportion of Sampled People

No	Sample frame	N_1	n_1
1	ans	135,157	135→55
2		20,271	20→100
		N=155,428	n=155

Source: Bahir Dar city road and transport office, 2014; Bahir Dar city education office, 2014; CSA of Ethiopia, 2007; Bahir Dar city municipality, 2014.

2.4 Methods of Data Analysis

Inferential statistics were used to analyze the data and interpret the results. Logistic regression was used to predict the occurrence or non−occurrence of road traffic accident based on values of a set of categorical predictor variables. The Hosmer−Lemeshow test statistic (having hypothesis of H_0: the model fits well and H_1: the model poorly fits the data) was used to indicate whether the model adequately fits the data or not. And it can be determined by comparing the p−value at a certain df with the α−value: if the p−value is greater than α-value , then there is enough evidence not to reject the null hypothesis that the model fits well otherwise not and to determine whether or not it is possible to proceed to Binary logistic regression model. The odds and odds ratio results from analysis of data by Binary logistic regression method are the basis of the test result interpretation.

3. RESULTS AND DISCUSSION

3.1 Inferential statistics: Drivers' response on contributing factors of RTA

Inferential statistics are statistics which are used to make inferential statements about a population. These statistics rely on the use of a random sampling technique which ensures that a sample is representative of the population at large. They differ from descriptive statistics, which describe only the data itself in statistical terms (Gabrenya, 2003).

Chi-square (χ^2) test of association The chi−square test of association assumes that for variables having **p−value** less than the **α−value** (**0.05**), the null hypothesis can be rejected at that specified level of significance and there will be sufficient evidence to conclude that there were significant relationship between those explanatory variables and the dependent variable, otherwise not.

Hypothesis: (H_0: There is no association between the occurrence of accident and the different independent variable categories; H_1: There is association).

Table 1. Statistical inference: Association of the occurrence of accident with different independent variables, 2014

Pearson Chi-Square (χ^2) for the variable:	Value	df	Asymp. Sig. (2-sided)
Drivers' sex	2.397[a]	1	.122
Drivers' age	3.026[a]	3	.388
Drivers' educational level	7.105[a]	4	.130
Drivers' marital status	9.422[a]	3	**.024**
Drivers' license level	21.995[a]	11	**.024**
Driver's experience	1.336[a]	4	.855
Vehicle's service years	1.659[a]	4	.798
Parking area of vehicles	6.105[a]	2	**.047**
Drivers approximate average driving speed	21.028[a]	2	**.000**
Drivers giving priorities to pedestrians	14.852[a]	2	**.001**
Pedestrians' manner in giving priorities to vehicles	21.338[a]	2	**.000**
Drivers' feeling of seeing pedestrians on major roads	10.336[a]	3	**.016**
Perception of road traffic accident problem in the city	.772[a]	2	.680
Being stopped for violating traffic rules & regulations	21.898[a]	1	**.000**
Types of offenses the drivers have been stopped	4.724[a]	5	.451
Seeing a drunk driver driving	.718[a]	1	.397
Using seat belts	9.019[a]	2	**.011**
Using mobile phone while driving	1.561[a]	3	.668
Rating traffic police commitments to their duty & responsibility	6.254[a]	2	**.044**
Trusting current drivers' training & testing situation	3.329[a]	1	.068
Getting on work education/training about road safety	.032[a]	1	.858
Pedestrians impaired by drug/alcohol while using road	4.065[a]	3	.255
Pedestrians failed to look properly while traveling	3.392[a]	3	.335
Pedestrians using wrong crossing of the road	16.474[a]	2	**.000**
Pedestrians failed to keep their left side of the road	16.199[a]	2	**.000**
Pedestrians sending animals or objects to the road	7.616[a]	3	.055
Pedestrians chatting or playing on the road	5.409[a]	3	.144

Source: Own survey

Based on the assumption, as we can see from table 1, the ρ−value of the variables: sex (0.122), age (0.388), educational level (0.130), drivers' experience (0.855), vehicle's service years (0.798), perception of road traffic

accident problem in the city (0.680), types of offenses the driver has been stopped (0.451), seeing a drunk driver driving (0.397), using mobile phone while driving (0.668), trusting current drivers' training & testing situation (0.068), getting on work education/training about road safety (0.858), pedestrians impaired by drug/alcohol while traveling (0.255), pedestrians failed to look properly (0.335), people sending animals or objects to the road (0.055) and pedestrians chatting or playing on the road (0.144) are greater than the specified α-value (0.05). So, we have enough evidence not to reject the null hypothesis and to conclude that there are no statistical association between each of the independent variables mentioned above and the occurrence of road traffic accident. They are not statistically significant. On the other hand, the ρ-values for the other variables: such as drivers' marital status (0.024), drivers' license level (0.024), parking area of vehicles (0.047), drivers approximate average driving speed (0.000), drivers giving priorities to pedestrians (0.001), pedestrians' manner in giving priorities to vehicles (0.000), drivers' feeling of seeing pedestrians on major roads (0.016), being stopped for violating traffic rules & regulations (0.000), using seat belts (0.011), rating traffic police commitments to their duties & responsibilities (0.044), pedestrians using wrong crossing of the road (0.000) and pedestrians failed to keep their left side of the road (0.000) are less than the $\alpha-$value as a result, the null hypothesis is rejected and concluded that there is an association between the occurrences of road traffic accident and each of the above stated independent variables.

Binary logistic regression analysis ***The major decisions involved in constructing the Binary logistic regression model were deciding what explanatory variables to include in the model equation that would be the best fit to the data set. Because the Binary logistic regression models are used based on assumptions, and any deviations from this assumption might result in incorrect analysis and conclusion (Cullagh, 2002). Therefore, only Binary logistic regression models that satisfy assumptions and having models that fit statistic were chosen.***

The Chi-square, χ^2-crosstab results for age, educational level, marital status, drivers' license level, drivers' experience, vehicle's service years, parking area, types of offense in which the driver have been stopped, phone usage, traffic police commitments, drivers impaired by alcohol, pedestrian fail to look properly, pedestrian fail to keep their left side of road, people sending animals/objects to the road and pedestrian chatting or playing on the road have 1 to 6 cells (16.7per cent to 70.8per cent) expected counts less than 5. This means that the minimum expected cell frequencies of 5 which will make the χ^2-test acceptable in order to proceed to Binary logistic regression have been violated. The χ^2- crosstab results for sex, average driving speed, drivers giving priorities to pedestrians as required by the law, pedestrians manner in giving priorities to vehicles when necessary, seatbelt usage, and pedestrians wrong crossing of the road showed 0 cells (0.0per cent) have expected counts less than 5 that can be considered in the Binary logistic regression analysis. On the other hand, though the variables; drivers' feeling of seeing pedestrians on major roads, drivers' being stopped by traffic police and drivers' perception of road traffic accident problem showed 0 cells (0.0per cent) expected counts less than 5, but they are more of qualitative that can be explained under the descriptive part using percentage. In addition, variables that showed 0 cells (0.0per cent) having expected counts less than 5 and need a 2x2 crosstab table, such as whether or not drivers seeing drunk driver driving, whether or not they trusting the current drivers' testing and training system, and drivers getting on work education/training about road safety do not have statistical relationship with the occurrence of road traffic accident as their $p-$values are greater than the $\alpha-$value as such they are overlooked in the Binary logistic regression model analysis.

Hosmer-Lemeshow test it assesses whether the predicted probabilities match the observed probabilities. P > 0.05 means the set of independent variables will accurately predict the actual probabilities of the dependent variable (Bian, 2002).

Table 2. Hosmer-Lemeshow test

Step	χ^2	df	Sig.
1	0.000	1	1.000
2	6.655	5	0.248
3	8.475	6	0.218
4	10.036	7	0.187

Source: Own survey

The test result from table 2 above at the fourth step (χ^2=10.036 with df=7, and p=0.187) indicated that the fitted Binary logistic regression model was statistically significant and it is possible to analyze the model further.

Results of binary logistic regression The results of the determining powers of the independent variables on the dependent variable, occurrence of road traffic accident that dominates the interaction effects among each other is revealed by table 3 below.

Table 3. Variables in the Binary Logistic Regression Model

Steps	Variable	β	$S.E$	Wald	df	Sig.	e^{β}	95% C.I. for e^{β}	
								Lower	Upper
Step 4[d]	Pedestrian Manner			19.278	2	.000			
	Very good	-2.783	.895	9.662	1	.002	.062	.011	.358
	Good	-2.528	.630	16.130	1	.000	.080	.023	.274
	Seatbelt use			9.477	2	.009			
	Always	-.122	.728	.028	1	.867	.885	.213	3.688
	Sometimes	1.751	.712	6.048	1	.014	5.760	1.427	23.241
	Priority to pedestrian (1)	-1.046	.540	3.756	1	.045	.351	.122	1.012
	Average speed			13.795	2	.001			
	Average speed(1)	-1.712	.461	13.795	1	.000	.181	.073	.445
	Average speed(2)	-22.137	1.515	.000	1	.999	.000	.000	
	Constant	1.148	.597	3.705	1	.054	3.152		

a. Variable(s) entered on step 1: Pedestrian manner.
b. Variable(s) entered on step 2: Seatbelt use.
c. Variable(s) entered on step 3: Priority to pedestrian.
d. variable (s) entered on step 4: Average speed.

Source: Own survey

The result of Binary logistic regression analysis is given in Table 3 above. The table showed the coefficients, their standard errors, the Wald test, associated p−values (Sig.), the odds and the 95per cent confidence interval of the coefficients. To give interpretation about the coefficients of the predictor variables, the p-value is compared with the α−value (0.05) level of significance and if the p−values are less than 0.05, then at least one predictor is significantly associated with the response. Therefore, the results obtained as can be revealed in table 3, the p−values for pedestrians' manner in giving priorities to vehicles where necessary, drivers' use of seatbelt while driving, drivers' giving priorities to pedestrians as required by the law, and approximate average driving speed were less than 0.05 in the Binary logistic regression model. But the p−values for the other variables were greater than 0.05 and are not included in the model. Thus, there were enough statistical evidence to conclude that the relationship between occurrence of road traffic accident with pedestrians manner in giving priorities to vehicles where necessary, drivers' use of seatbelt while driving, drivers' giving priorities to pedestrians to pass first as required by the law, and drivers approximate average driving speed and are the determining factors for the occurrence of road traffic accident in the city.

Interpretation of the odds ratio step by step analysis of the Binary logistic regression model in table 3 reveal that the faults committed by drivers took the higher percentage than the other factors. Drivers irregular use of seatbelt while driving, drivers failure to give priorities to pedestrians to pass first as required by the law, and their very high driving speed which are categorized under drivers fault are the three possible reasons among the possible four according to the model implying that drivers fault accounted to 75per cent of the causes.

Controlling for the other explanatory variables, the estimated odds of 0.062 and 0.080 for very good and good pedestrians' manner respectively in giving priorities to vehicles where necessary means that pedestrians who are very good and good in giving priorities to vehicles to pass first where necessary are less likely to be a cause for road traffic accident to occur than that of pedestrians who are poor in giving priorities to vehicles to pass first.

The p−value of using seatbelt while driving is 0.009 (which is much less than 0.05) indicating that at least one category are statistically significant. Therefore, keeping all other independent variables constant, the estimated odds of drivers who always use seatbelt while driving is 0.885 and it indicates that drivers who always use seatbelt while driving are less likely to cause road traffic accident occur than drivers who never use seatbelt. On the contrary, drivers who sometimes use seatbelt while deriving (estimated odds=5.759) is more likely (5.759 times greater) than drivers who never use seatbelt in terms of causing road traffic accident occur.

The estimated odds of drivers giving priorities to pedestrians always to pass first as required by the law is 0.351 and it means that drivers who gave pedestrians always the priority to pass are less likely to cause road traffic accident occur than those who gave sometimes.

The last determining factor for the occurrence of road traffic accident in Bahir Dar city, *i.e.* the approximate average driving speed of drivers, the odds ratio of drivers whose average driving speed is less than 30km/hr and between 30−50km/hr are −1.712 and −22.137, respectively. Drivers whose approximate average driving speed is less than 30km/hr is less likely to cause road traffic accident occur than drivers whose approximate average driving speed is greater than 50km/hr. Similarly, drivers whose approximate average driving speed is between 30−50km/hr is less likely to cause road traffic accident occur than drivers whose approximate average driving speed is greater than 50km/hr. Or the other way round, drivers whose approximate

average driving speed is greater than 50km/hr are 1.712 and 22.137 times greater in causing road traffic accident to occur than drivers whose approximate average driving speed are less than 30km/hr and between 30−50km/hr, respectively.

This is in line with what a study by a member of the Swedish Medical University of Lund, Road Traffic Accident in Ethiopia: magnitude, causes and possible interventions, published in the Advances in Transportation Studies journal, suggested by examining Ethiopian police records that between 2003 and 2007, 76per cent of fatal accidents were due to driver error, 6per cent due to vehicles defect, 5per cent due to pedestrian error, 2per cent due to road defect and the balance due to other causes (Persson, 2008).

3.2 Vehicles that Caused Road Traffic Accident Frequently

Four years accident data obtained from Bahir Dar traffic police commission office data archive were examined and summarized to identify the types of vehicles that caused road traffic accident frequently. The accident phenomena recorded in the last four years were categorized under three groups: namely persons killed, persons injured and properties damaged by the specific vehicle with their rank. The results of the analysis are summarized below under table 4.

Table 4. Dead and injured people and damaged property with their ranks, 2011-2014

Vehicles	Dead person	Percent	Rank	Injured person	Percent	Rank	Damaged property	Percent	Rank
Bicycle	1	0.8	13	10	1.9	12	15	2.8	11
Motor cycle	9	7.0	6	108	20.6	1	97	17.8	1
Automobile	7	5.4	7	26	5.0	7	17	3.1	9
Sitationwagen	6	4.6	8	20	3.8	8	31	5.7	7
Bajaj and Taxi	13	10.1	3	88	16.8	2	80	14.7	3
Public (12 seats)	28	21.7	1	73	13.9	3	68	12.5	4
Public (13−45 seats)	6	4.6	8	20	3.8	8	21	3.9	8
Public (> 45 seats)	6	4.6	8	8	1.5	14	4	0.7	13
Pick up (10Q)	21	16.3	2	73	13.9	3	85	15.6	2
Lorry (11−40Q)	10	7.8	5	27	5.2	6	39	7.2	6
Lorry (41−100Q)	11	8.5	4	32	6.1	5	52	9.6	5
Long lorry	5	3.9	11	12	2.3	10	12	2.2	12
Turbo	1	0.8	13	10	1.9	12	1	0.2	16
Special vehicle	3	2.3	12	3	0.6	15	4	0.7	13
Horse drawn cart	0	0.0	17	3	0.6	15	16	2.9	10
Others	1	0.8	13	11	2.1	11	0	0.0	17
Unknown	1	0.8	13	0	0.0	17	2	0.4	15
Total	129	100.0		524	100.0		544	100.0	

Source: Compiled from Bahir Dar police commission office, 2014

As can be seen in table 4, in terms of persons killed, of the 129 individuals dead in the last four years, 28 (21.7per cent), 21 (16.3per cent), 13 (10.1per cent) and 11 (8.5per cent) of them were killed by public vehicle 1 (vehicles having 12 seats), dry 1 (pickups that can carry up to 10 quintals), taxi 1 and 2 (Bajaj and taxi) and dry 3 (lorry that can carry up to 100 quintals) respectively. There are about 524 persons that had faced heavy and light injuries; the major contributing vehicles were motor cycles, taxi 1 and 2 (Bajaj and taxi), dry 1 (pickups that can carry up to 10 quintals) and public vehicle 1 (vehicles having 12 seats) with 108 (20.6per cent), 88 (16.8per cent), 73 (13.9per cent) and 73 (13.9per cent) respectively. With regard to the total 544 damaged properties that occurred during the last four years; motor cycles, dry 1 (pickups that can carry up to 10 quintals), taxi 1 and 2 (Bajaj and taxi) and public vehicle 1 (vehicles having 12 seats) damaged 97 (17.8per cent), 85 (15.6per cent), 80 (14.7per cent) and 68 (12.5per cent) of it respectively. So, to sum up, when death is considered, public vehicle 1 (vehicles having 12 seats), dry 1 (pickups that can carry up to 10 quintals), taxi 1 and 2 (Bajaj and taxi) and dry 3 (lorry that can carry up to 100 quintals) covers 73 (56.6per cent) of the total, in terms of injuries, motor cycles, taxi 1 and 2 (Bajaj and taxi), dry 1 (pickups that can carry up to 10 quintals) and public vehicle 1 (vehicles having 12 seats) responsible for 342 (65.3per cent) of the total and 330 (60.7per cent) of properties were damaged by motor cycles, dry 1 (pickups that can carry up to 10 quintals), taxi 1 and 2 (Bajaj and taxi) and public vehicle 1 (vehicles having 12 seats) from the 544 (100per cent).

Generally, in the last four years, motor cycles, pickups particularly those that can carry up to ten quintals, public vehicles especially those having 12 seats and taxi 1 and 2 (Bajaj and normal taxis) were the major and frequent road traffic accident agents.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The inferential statistics test results indicates that drivers are the prime responsible agents to cause road traffic accidents in Bahir Dar city than pedestrians' error, vehicles defect, environmental factor or what have you.

Analysis of the responses of sample drivers and victim pedestrians on the factor that caused road traffic accidents in Bahir Dar revealed that pedestrian manner in giving priorities to vehicles to pass first when necessary, is a key determining factor for the occurrence of road traffic accident with pedestrians who have very good and good manner are 0.062 and 0.080 times less likely to be affected by road traffic accidents than pedestrians who have poor manner.

Drivers' seatbelt usage behavior is the other determining factor for the occurrence of road traffic accident with drivers who always wear seatbelt while driving are 0.885 times less likely to cause road traffic accident occur than drivers who never use seatbelt. However, drivers who are on and off or who uses seatbelt sometimes are 5.759 times more likely to cause accident than drivers who never use seatbelt.

Drivers' manner in giving priorities to pedestrians to pass first as required by the law is the other key contributing factor for the occurrence of road traffic accident in the city. The odds or the chance of drivers who always gave priorities to pedestrians to commit road traffic accident is 0.351 times less likely than drivers who sometimes gave priorities to pedestrians.

The last determining factor for the occurrence of road traffic accident in Bahir Dar city is speedy driving. Drivers whose approximate average driving speed is greater than 50km/hr are 1.712 and 22.137 times greater in causing road traffic accident than drivers whose approximate average driving speed less than 30km/hr and 30−50km/hr respectively.

The analysis of the response of victim pedestrians to the questionnaire and Bahir Dar traffic police commission office data archive revealed that most of the accidents be it fatal, heavy and light injuries or property damage, occurred by common vehicles. In the last four years alone, in terms of death, public vehicles having 12 seats, pickups that can carry up to 10 quintals, Bajaj and taxis and Lorries that carry up to 100 quintals take the ranks of one up to four. Heavy and light injuries were dominated by motor cycles, Bajaj and taxis, pickups that carry up to 10 quintals and public vehicles having 12 seats in order from 1 to 4th.

4.2 Recommendations

According to the inferential statistical test results under the Odds ratio and analysis of traffic police accident data, the majority of the contributing factors for the occurrence of road traffic accidents in the city are drivers' fault followed by pedestrians' error. This is an issue which needs high level attention and political commitment. So, the government with its lower concerned bodies like the Ethiopian Road and Traffic Authority in collaboration with other NGOs should devise a mechanism to reach each individual to address the problem.

One of these strategies could be education: educating all stakeholders especially drivers, pedestrians or the people as a whole about road safety using Medias (TVs, Radios, Newspapers, magazines *etc*) or in formal organizations in schools and other governmental and non-governmental organizations, in religious institutions like churches, mosques using religious fathers and in informal public associations like *edir*[1], *equib*[2], *mahiber*[3], *etc* using local community elite people.

The Bahir Dar special zone traffic police commissioners should prepare panel discussions monthly on the permanent basis to drivers specially of those drivers of vehicles that commit road traffic accident frequently (motor cycles, pickups, public vehicles, Bajaj and taxis) and urging the participants to bring solutions on the ways out of the problem and arranging on work education and training to update their memories and skills.

Second, setting a national road safety policy, laws and regulations with high level of political commitment and dedication to enforce the laws and regulations and also fulfilling infrastructural setups for traffic police that can facilitate their duties like motor cycles, speed radar, a mechanism to punish violent pedestrians and reorganizing the existing organizational arrangement in a new way so that good behaviors could be rewarded and bad behaviors punished. Example giving the officer or traffic police a promotion in rank with salary increment for his excellence at his/her job) and penalizing the other for his/her ill act.

A mix of revised laws that set a uniform standard in the issuance of driving licenses, empower organizations such as the federal transport authorities and impose heftier for traffic violations could also help reduce the occurrence of the accidents (IRIN, 2011).

To improve the safety along the identified black spots, the zonal traffic police commission should open patrol sites on each of those accident prone areas on the permanent basis with full arrangement of infrastructures

[1] *Edir:* traditional association that people gather in times of sorrow
[2] *Equib*: traditional association of saving money & giving it to members by turn weekly or monthly
[3] *Mahiber*: people gather based on their interest, ethnicity, locality, religious belief *etc* & aimed at strengthening their relationship

and equipments such as motor vehicles, speed radar, alcohol testing machines and others as well as putting the necessary traffic control road signs and signals and posting reclaims somewhere before the vehicle reach the specific area that signify the dangerousness of the area.

REFERENCES

Atnafseged Kifle (2000). Road Safety Management Crisis in Ethiopia. Unpublished Report.

Bian H. 2002. Logistic Regression Analysis using SPSS, http://core.ecu.edu/ofe/StatisticsResearch/ found on Aug. 1, 2014.

Cullagh Mc. (2002). *What is statistical model.* The annuals of statistics, Vol.30 No. 5 Chicago, USA, 1310pp.

Bahir Dar special zone planning department, 2009-2013. Various Unpublished Reports and Broachers in different years, Bahir Dar.

Central Statistical Agency (CSA) of Ethiopia (2007). The 2007 Population and Housing Census of Ethiopia: Statistical Report for Amhara Region; Part I: Population Size and Characteristics, 376pp.

Economic Commission for Africa (ECA), 2006. African Road Safety congress, compendium of Papers. Addis Ababa, Ethiopia.

Economic Commission for Europe (ECE) (2006). Road Traffic Accidents in Europe and N. America. Vol. XLII. Printed at UN, Geneva.

Economic and Social Commission for Asia and the Pacific (ESCAP) (2010). Status of Road Safety in Asia, Regional Expert Group Meeting on Implementation of Decade of Action for Road Safety, 2011-2020, Bangkok, Thailand, pp. 1-11.

Ethiopian Mapping Agency (EMA), (2008). National Atlas of Ethiopia, Addis Ababa: EMA.

Gabrenya K. (2003). Inferential Statistics: Basic Concepts, http://www.ask.com/question/what-are-inferential-statistics?ad=dirN&o=2545, found on Aug. 9, 2014.

Girma Berhanu (2000). *Effects of Road and Traffic Factors on Road Safety in Ethiopia. (A Thesis for the Degree of Dr. ING. Norwegian University of Science and Technology), Trondheim.*

Glenn D., (1992). *Determining Sample Size*, IFAS, University of Florida, USA, pp. 5-8.

John D. Sutter, 2013. The new pandemic: road deaths, *http://www.int/mediacentre/factsheets/fs310/en/index1.html, found on 20 October, 2013.*

Integrated Regional Information Networks (IRIN) (2011). Government moves to address road accident toll, *http://reliefweb.int/organization/irin, retrieved on 21 October 2013.*

Integrated Regional Information Networks (IRIN) (2011). Improved access to emergency medical care and compulsory third-party insurance coverage could help to lower Ethiopia's high road-traffic accident death toll, *http://www.irinnews.org/report/94165/ethiopia-government-moves-to-address-road-accident-toll, found on 23 August 2014.*

Mathewos T., Abebaw D., Tesfaye B. (2011). *Factors affecting the roles of voluntary student traffic police*. BSc. Thesis, Bahir Dar University, Ethiopia, 60pp.

Mekete Belachew. (2004). "Some Thoughts on Intra- Urban Transport Problems in Ethiopia. The Case of the Anbessa City Bus Transport", in Ethiopian Journal of Development Research. Vol. 19. No 1. A.A.U., Addis Ababa.

National Meteorological Agency of Ethiopia (NMA) (2014). Average temperature and rainfall of Bahir Dar, *http://www.ethiomet.gov.et/forecasts/show_cf/239/Bahir%20Dar found on 22, May 2014.*

Persson A. (2008). Road traffic accidents in Ethiopia: magnitude, causes and possible interventions, Advances in Transportation Studies, an international Journal Section A 15: 1-16. *http://www.irinnews.org/report/94165/ethiopia-government-moves-to-address-road-accident-toll.*

Philip B. (2009). Bahir Dar, http://en.wikipedia.org/wiki/Bahir_Dar, found on 23, March 2014.

Rallis T. (2009). Intercity Transport Engineering and Planning: Mac Milan Press Ltd.

Sutter D. (2013). The new pandemic: Road deaths, *http://www.int/mediacentre/factsheets/fs310/en/index1.html, found on 20 October, 2013.*

Yayeh Addis. (2003). *The extent, variations and causes of road traffic accidents in Bahir Dar,* M.Sc. Thesis, Addis Ababa University, Ethiopia, 149pp.

United Nation (UN), (2001). World Population Growth. Department of Economic and Social Affairs. Population Division. New York.

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