

Determinants of Road Traffic Accidents in Amhara Regional State, Ethiopia: Application of Binary Logistic Regression Analysis

Research Article

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Abstract: The incidence of deaths and injuries as a result of road traffic accidents is now a serious problem in Ethiopia. This study was aimed at determining the significant factors contributing to road traffic accidents in Amhara regional state, Ethiopia. A retrospective record was analyzed on the fourteen year trends of road traffic accidents in Amhara Regional State, Ethiopia, reported from 2003 to 2015 by selecting a simple random sample of 286 accidents files. Logistic regression methods were used to analyze the data and a total of 1003 accidents were registered in the selected files. Of these, 356 (35.5 %) were deaths and 647 (64.5 %) were injuries. It was found that out of 356 deaths, the majority, 286 (80.33%) were caused by drivers who didn't use seat belt when the accident occurred. Most of the accidents, 454 (45.4%) were caused by Cargo vehicles. Specifically in Bahir Dar city, where motorized three-wheeler are the main means of transportation, 42.1 percent of the accidents were directly or indirectly attributed to those vehicles. The regression model showed that use of seat belt, place of accident, types of vehicle and types of causes of the accident were significant contributors of road traffic accidents. Traffic accidents were increasing and use of seat belt, zone, and types of vehicle and cause of accident were significant factors that affect the occurrences of road traffic accidents.

Keywords: Road Traffic Accidents, Trends, Logistic Regression, Ethiopia.

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1. Introduction

Transportation is one of the basic requirements for the proper functioning of societies as its demand is highly related to the movement of people and goods 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 infrastructures and services.

However, 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 [1, 2]. Drivers attitudes and driving under the influence of drugs is also responsible for the occurrence of road traffic accidents [3]. The study done in three main hospitals at Jordan investigated the effects of traffic noise on the performance of hospital workers. It was concluded that road traffic noise had a negative impact on workers and patients outcomes [4]. It is thought that globally 1

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million people are killed in road traffic accidents and about 20 million to 50 million people are injured or disabled from the effect of road traffic accidents. In the year 2020, road traffic accidents are expected to rank third of all causes of morbidity and mortality globally and over 90% of the world's fatalities occur in low and middle income countries [5-7]. Like other countries in Africa, Ethiopia is not immune from road traffic health problems and in Africa over 80 percent of goods and people is transported by roads, where as in Ethiopia road transport accounts for over 90 percent of all the inter-urban freight and passenger movements in the country [8].

High income countries reduced fatalities from road traffic accidents by more than 25 percent during 1968 -1998, and another drop of 30 percent will be recorded by 2020. While in low and middle income countries (including Ethiopia), where 81 percent of the world's population live and own about 20 percent of the world's vehicles, the annual deaths and disabilities from road traffic accidents is expected to rise considerably by 2020 [8, 9]. Road traffic accident problem in Ethiopia, especially in the main cities, is now a major concern of the government, its organizations and other institutions concerned with road safety as well as the public in general [10].

In the year 2013/14, a total of 2775 accidents were registered in Amhara Regional state, Ethiopia. However, in 2014/15 the total number is increased to 3028 (9% increment). Among these accidents in 2014/15, 542 cases were deaths. According to the report among 3028, 1112 (36.7%) were caused by drivers who deny priorities to pedestrians and 584 accidents were because of rollovers. The report of the authority also reported that those accidents have resulted in an estimated loss of US \$5,189,015 during the year.

The infrastructural arrangements in the cities are also increasing both in quantity and quality; new asphalt roads and cobblestone works are being built. But the increase in infrastructural setups, compared with the increase in the number of population and vehicles is not proportionate. Some roads are narrow and one way, others are without pedestrian way, and we can observe that almost all roads are without appropriate traffic signs and signals.

Thus, these situations coupled with the low levels of understanding of the people about road safety makes the road traffic accidents worse than before. So, the findings of this study will enrich the road traffic accident literature, make practitioners be aware of the problems and their causes to take appropriate measures, show readers the severity of the problem so that they will save their lives and livelihoods from loss and destruction, serve as a clue for those researchers interested in conducting further studies in the area and finally enable policy makers to design appropriate strategies so that practitioners and other concerned bodies take preventive as well as counter measures and monitor about the road traffic accident problems.

Generally, the results obtained and recommendations made will benefit all members of the community of the region, and the country at large. Therefore, the main objective of this study was to identify the determinant factors and trends of road traffic accidents at Amhara Regional State (ANRS), North-Western Ethiopia (Figure 1).

2. Materials and Methods

2.1. Description of the Study Area

This study was conducted in Ethiopia, particularly in Amhara Regional State. The region covers 170152k.m2 and has a population of 19 million people (about 25% of the total population in the country). Fourteen percent of the region's

population lives in Urban and the rest 86 percent lives in rural areas of the region [11, 12]. The region is interconnected to other cities of the country through long asphalt roads. Different vehicles such as taxis, privately owned cars, governmental cars, bus, three wheelers, and bicycles (motored or not) are being used to transport people and goods within and outside the region. The most common means of transportation in the some cities of the region are motorized three wheelers and bicycle [8].

2.2. Data Analysis Methods

Sample size determination is the foremost task prior to conducting a research work based on a sample of the parent population which in this case is the accident records [13]. Two hundred eighty six sampled records of traffic accidents were selected using simple random sampling technique. It was found that the average incidence (death and/or injury) per record was about 3.5 which resulted in overall incidence of 1003. In this study descriptive statistics like (percentage and trend plots), chi-square test of association and binary logistic regression were used to identify factors affecting the occurrence of road traffic accidents in Amhara regional state, Ethiopia. Data analysis was done using SPSS version 21 and Minitab version 17.

3. Results and Discussions

3.1. Descriptive Statistics

A total of 1003 road traffic accidents were registered from the selected records of road traffic accidents. Of these, 356 (35.5%) were deaths. The proportion of deaths due to drivers who did not use seat belt was about 286 (28.6%). Majority of the accidents 496 (49.6%) were caused by drivers belonging to the age group 18-30 years. Fifty nine percent of the accidents were caused, among other factors, by drivers who were not using seat belts and 333 (33.3 %) by drivers denying priority for pedestrians and of these 91 (0.91%) were death. Driving experience was also an important factor in that 30.8% of the accidents were caused by drivers having driving experience of 1-2 years during the accident. Nearly half (45.4 %) of the accidents (death or injury) were caused by Cargo vehicles while 740 (74.4%) of the accidents occurred in the week days. When seen from the spatial distribution point of view, the highest proportion of accidents (17%) was recorded in the South Wollo zone of the region (Table 1).

In North Gondar and Oromia zones, the leading causes for the accidents were crashes of Taxis and Minibuses, while in Bahir Dar city, 48 (42.1%) of the accidents were caused by three wheelers rather than other vehicles. However, in the other zones most of the accidents were accounted for by Cargo vehicles (Table 2). A fourteen years trend depicted that the road traffic accident was highest in 2009 followed by 2013 (Figure 2).

Logistic regression was used to identify the significant risk factors for road traffic accidents in the Amhara regional state of Ethiopia. In the modeling process, a univariable analysis was first done with a 0.25 level of significance for selecting the candidate of variables for multivariable analysis. The variables significant at the univariable analysis were then included in the multivariable analysis. The multivariable analysis helps to adjust for the confounding effects [14]. The result of the multivariable logistic regression analysis is displayed in Table 3.

The Adjusted Odds Ratio (AOR) revealed that seat belt usage has a significant impact on the occurrence of road traffic accidents (p -value = 0.000). Furthermore, the odds of the occurrence of road traffic accidents by drivers who did not use seat belt during the accident was 4.52 times those drivers who were using seat belt during the time of the accident. Taxi

and minibus (with up to 12 seats) have no protective effects of road traffic accidents as compared to three wheelers (AOR= 1.6, the 95% CI=1.3, 2.71). Unreliable bending was the most serious causes of accident (Table 3).

4. Discussion

The finding of this study showed that number of deaths and injuries due to road traffic accidents increases from year to year. This result is similar with a study done in Malaysia which reported that road traffic accident has increased from time to time. Previous studies conducted in Nigeria [15-17] emphasize that a higher population density and urbanization results in an increase in pedestrian activity and this study is consistent with our findings. Strangely, this is most marked in Africa, where ownership of motor vehicles is among the lowest in the world [17].

From the results, it was clear that the trends of road traffic accidents are increasing which is similar. Use of seat-belt is very important in decreasing road traffic accidents, and our study shows a significantly increased risk of road traffic accidents of drivers who did not use seat-belts similar results were also reported by [18-20].

In terms of age group of the drivers, our study showed that the majority 496 (49.6%) of the road traffic accidents were caused by drivers of ages between 18-30 years old. Similarly, in India, a hospital based study showed that the majority of the drivers responsible for road traffic accidents were in the age group of 15-50 years [16].

In our study, 333 (33.3%) of the accidents were caused by denying priority to pedestrians. This finding is in line with the study conducted in central Ethiopia that failing to give priority for other vehicles and pedestrians cause the collusion of the accidents [21] and similarly a study conducted in China, that most of the accidents were among road users predominantly pedestrians and inversely in developed countries like USA, the majority of fatalities were due to drivers [22]. In Iran that ignoring the traffic signs and disobeying the rules were the two factors most responsible for traffic accidents [23].

In this study one of the main causes for the occurrence road traffic accident was types of vehicles, which is similar with the study done in Thanjavur city which concluded that vehicles type and road width were responsible for road traffic accidents [18].

On weekends, there were less road traffic accidents 259 (25.9%) than weekdays in which the highest road traffic accidents were registered, 744 (74.4%). This study contradicts with the study conducted in Addis Ababa, Ethiopia where most of the road traffic accidents were made during the weekend time¹¹. This contradiction might be due to the fact that in the regions most of the vehicles are government owned and will be off-duty in the weekends implying the roads will have lesser traffic movements and hence relatively less road traffic accidents. On the other hand, in Addis Ababa the larger proportions of cars are owned privately and people may drive after getting drunk, usually in the weekends.

5. Conclusion and Recommendation

Road traffic accidents are increasing at an alarming rate, causing the loss of valuable workforce and resources. The fundamental findings of this study showed that seat belt use, vehicles type; causes of accident were the leading factors that affect the occurrences of road traffic accidents. Not using seat belt was the main contributor of traffic accidents in

the region. More generally, almost in all zones, cargo vehicles were predominantly involved in road traffic accidents, while in Bahir Dar city, majority of the accidents were attributed to motorized three wheeler taxis. Road traffic accidents related deaths and injuries continue to be an important morbidity and mortality problems in Amhara Regional State, Ethiopia.

The increasing trend of road traffic accidents in the region is a public health problem which needs due attention since both deaths and injuries are easily preventable. Even though, the data is collected only in Amhara region, this study provides an insight for the situation of road traffic accidents and their causes in the country.

Finally, it is our belief that the road traffic accidents can be minimized if the investigated factors are properly and honestly taken care of. Trainings and awareness creation activities for both drivers and pedestrians should be done and must be properly supervised and implemented by qualified personnel and road traffic polices.

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Figure 1. Sample situations of road traffic accidents in Ethiopia

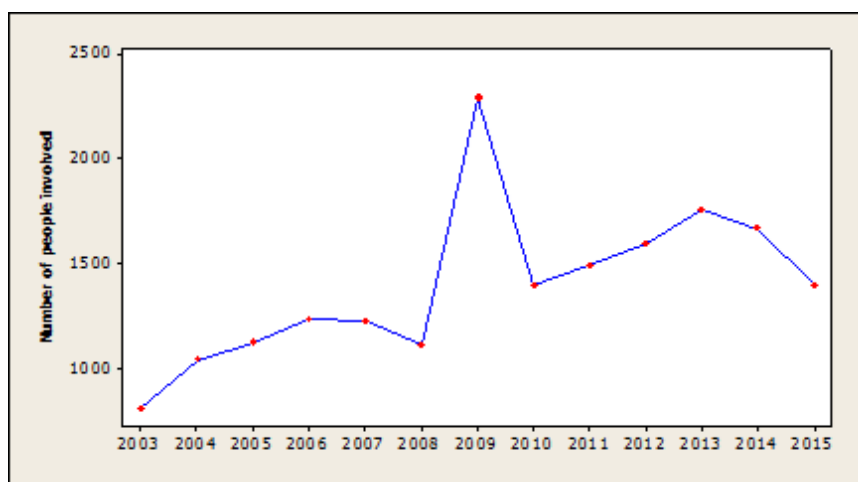


Figure 2. A fourteen years trend depicted that the road traffic accidents in Amhara region, Ethiopia

Table 1: A cross tabulation of types of accident with socio-economic factors

Variables / factors		Types of accident		Total	
		Injured	Death		
Age of drivers	Below 18	29(2.9)	18(1.87)	47(4.7)	
	18-30	325(32.5)	171(17.1)	496(49.6)	
	31-50	205(20.5)	108(10.8)	313(31.3)	
	Above 51	97(9.7)	50(5.0)	147(14.7)	
Use Seat Belt	Not	290(29)	286(28.6)	591(59.2)	
	Yes	338(33.8)	70(7)	408(40.8)	
Types of Zone	South Gondar	41(4.1)	27(2.7)	68(6.8)	
	North Wollo	62(6.2)	61(6.1)	123(12.5)	
	Waghima	8(0.8)	2(0.2)	10(1)	
	North Gondar	86(8.2)	52(5.2)	138(13.7)	
	Bahir Dar	78(7.8)	36(3.6)	114(11.4)	
	Awie	27(2.7)	16(1.6)	43(4.3)	
	West Gojam	51(5.1)	40(4)	91(9.1)	
	East Gojam	40(4)	22(2.2)	62(6.2)	
	North Shea	81(8.1)	37(3.7)	118(11.8)	
	Oromia	47(4.7)	19(1.9)	66(6.6)	
	South Wollo	92(9.2)	78(7.8)	170(17)	
	Types of License	New	397(39.6)	201(20)	598(59.6)
		Old	259(25.8)	146(14.6)	405(40.5)
Experience of drivers	Below 1 year	118(11.8)	71(7.1)	189(18.8)	
	1-2	191(19)	117(11.7)	308(30.7)	
	2-5	172(17.1)	116(11.6)	288(28.7)	
	Above 5	132(13.2)	86(8.6)	218(21.7)	
Types of Vehicle	Automobile	54(5.4)	24(2.4)	78 (7.8)	
	Station wagon	24(2.4)	10(1)	34(3.4)	
	Buses(13-45 Seats, Above 45 Seats)	62(6.2)	14(1.4)	76(7.6)	
	Taxis and Minibuses(Upto 12 Seats)	149(14.9)	99(9.9)	248(24.8)	
	Cargo(Upto 10 quintals,11-40 quintals,41-100 quintals)	300 (30)	154(15.4)	454(45.5)	
	Three wheelers	67(6.7)	46(4.6)	113(11.3)	
Causes for the accident	Priority error to Vehicles/ Crash with other vehicles	178(17.8)	87(8.7)	265(26.5)	
	Unreliable bending /Curving	183(18.3)	145(14.5)	328(32.8)	
	Pedestrian error of priority	242(24.2)	91(9.1)	333(33.3)	
	Others	53(5.3)	24(2.4)	77(7.7)	
Days of Accident	Week-days	486(48.6)	258(25.8)	744(74.4)	
	Weekend	170(17.0)	89(8.9)	259(25.9)	

Table 2: Accidents by Vehicle type in different zones of Amhara Regional State, Ethiopia.

Types of Zones	The type of the vehicle (Count (percent))						Total
	Automobile	Station wagon	Buses(13-45 Seats, Above 45 Seats)	Taxis and Minibuses (Up to 12 Seats)	Cargo(Up to 10 quintals,11-40 quintals,41-100 quintals)	Three wheelers	
South Gondar	11(16.2)	1(1.5)	6(8.8)	9(13.2)	38(55.9)*	3(4.4)	68(100)
North Wollo	0(0.0)	4(3.3)	5(4.1)	19(15.4)	89(72.4)*	6(4.9)	123(100)
Wag	2(20)	2(20)	0(0.0)	0(0.0)	6(60)	0(0.0)	10(100)
North Gondar	13(9.4)	12(8.7)	8(5.8)	72(52.2)*	22(15.9)	11(8)	138(100)
Bahir Dar	23(20.2)	1(0.9)	0(0.0)	16(14)	26(22.8)	48(42.1)*	114(100)
Awie	3(7)	0(0.0)	0(0.0)	11(25.6)	29(67.4)*	0(0.0)	43(100)
West Gojam	4(4.4)	6(6.6)	14(15.4)	8(8.8)	57(6.6)*	2(2.2)	91(100)
East Gojam	3(4.8)	0(0.00)	10(16.1)	12(19.4)	37(59.7)*	0(0.00)	62(100)
North Shea	3 (2.5)	2(1.7)	17(14.4)	31(26.3)	65(55.1)*	0(0.00)	118(100)
Oromia	9(13.6)	0(0.00)	1(1.5)	25(37.9)*	18(27.3)	13(19.7)	66(100)
south Wolo	7(4.1)	6(3.5)	15(8.8)	45(26.5)	67(39.4)*	30(17.6)	170(100)
Count (percent)	78(7.8)	34(3.4)	76(7.6)	248(24.7)	454(45.3)*	113(11.3)	1003(100)

Table 3: Multivariable analysis of determinant factors for the outcome of traffic accident in Amhara National Regional State, Ethiopia

Variables		COR (95% CI)	COR P - Value	AOR (95% CI)	AORP- Value
Types of Zone	Zones		0.027		0.002*
	South Gondar	0.77(0.44,1.38)	0.389	0.78(0.42,1.5)	0.446
	North Wollo	1.16(0.73,1.85)	0.53	1.46(0.87,2.46)	0.154
	Waghimra	0.295(0.6,1.43)	0.129	0.22(0.4,1.1)	0.065
	North Gondar	0.7(0.45,1.13)	0.148	0.62(0.38,1.03)	0.063
	Bahir Dar	0.54(0.33,0.9)	0.016	0.48(0.27,0.84)	0.01
	Awie	0.7(0.35,1.39)	0.308	0.72(0.34,1.5)	0.396
	West Gojam	0.93(0.55,1.54)	0.766	1.2(0.68,2.14)	0.511
	East Gojam	0.65(0.36,1.18)	0.158	0.68(0.36,1.32)	0.26
	North Shea	0.54(0.33,0.88)	0.014	0.58(0.34,1.01)	0.052
	Oromia	0.48(0.29,0.88)	0.18	0.41(0.21,0.79)	0.008*
	South Wollo	1		1	
Use Seat Belt	Not	3.84(2.89,5.12)	0.000	4.516(3.3,6.17)	0.000*
	Yes	1		1	
Types of Vehicle	Types Vehicles		0.015		0.024*
	Automobile	0.62(0.34,0.97)	0.045	1.16(0.6,2.24)	0.035
	Station wagon	0.544(0.24,1.24)	0.149	0.85(0.33,2.16)	0.73
	Buses(13-45 Seats, Above 45 Seats)	0.38(0.2,0.73)	0.376	0.52(0.27,1.10)	0.064
	Taxis and Minibuses(Up to 12 Seats)	0.9(0.633,1.6)	0.003	1.6(1.3,2.71)	0.0035
	Cargo(Upto 10 quintals, 11-40 quintals, 41-100 quintals)	0.87(0.58,1.33)	0.969	1.13(0.68,1.89)	
	Bajaj	1	0.001	1	
Causes for the accident	Crash with other vehicles	0.899(0.54,1.51)	0.69	0.945(0.535,1.671)	0.846
	Unreliable bending /Curving	1.36(0.82,2.26)	0.23	1.39(0.799,2.41)	0.244
	Pedestrian error of priority	0.66(0.39,1.1)	0.105	0.67(0.381,1.17)	0.158
	Others	1			

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