

Article Type 1: Peer-reviewed papers

Factors in Road Traffic Crashes Among Drivers in Buno Bedelle Zone, Southwest Ethiopia: A Case Control Study

Sabit Zenu^{1a}, Ameyyu Tesfaye¹, Gebiso Roba¹, Ebissa Negera¹

¹ College of Health Sciences, Department of Public Health, Mattu University

Keywords: road traffic crashes, Southwest Ethiopia, drivers, road safety

<https://doi.org/10.33492/JACRS-D-22-00012>

Journal of Road Safety

Vol. 34, Issue 4, 2023

Abstract

Road traffic crashes (RTC) are one of the leading causes of global mortality, resulting in over 1.35 million deaths every year. It is a leading cause of death among children and young adults. Ethiopia faces an increasing burden of the problem, and several factors are implicated in the rising trend. Issues concerning drivers and their immediate environments play a crucial role in road traffic crashes. This study was conducted to identify the driver determinants in road traffic crashes in Southwest Ethiopia. A community-based case-control study was conducted on a total of 336 drivers (cases, n=111; controls, n=225). Cases were drivers who had caused an RTC in the past year, controls were drivers who had not. Simple random sampling was employed to select participants. Independent determinants of road traffic crashes were identified using the 95 percent confidence interval of the odds ratio at $p < 0.05$ in the multivariable logistic regression. Driver and vehicle characteristics that were significant determinants of RTC in the study area were: limited driving experience (AOR: 2.6; 95% CI (1.04, 6.5), alcohol consumption (AOR: 5.17; 95% CI (2.23, 11.7), inconsistent use of seat belts (AOR: 3.19; 95% CI (1.6, 6.3), vehicle years of service (AOR: 2.6; 95% CI (1.3, 5.3) and speeding (AOR: 4.595% CI (2.3-8.9). Mentored driving is recommended to boost the experience of novice drivers. Enforcement of existing laws and behavioural interventions should be strengthened against risky driving practices. Drivers of older vehicles with long intervals between service should be kept under close supervision.

Key Findings

- The first study in Ethiopia to apply a case-control design to road traffic crash research.
- Driver inexperience and vehicle years of service were found to be determinants of road traffic crashes.
- Findings upheld the impact of drink driving, inconsistent use of seatbelt and speeding in contributing to road traffic crashes.

Introduction

Road traffic crashes (RTC) are crashes that occur on a way or a street open to public traffic, resulting in one or more persons being injured or killed, and at least one moving vehicle being involved. RTC includes crashes between vehicles, vehicles and pedestrians, vehicles and animals, or fixed obstacles (OECD, 2020). It is a major but neglected

public health problem that requires concerted efforts for effective and sustainable prevention (Sleet et al., 2011).

RTC have become a global public health problem, killing over 1.35 million people in a year and disabling 50 million others. According to the World Health Organization's (WHO) global status report(2018), RTC was the eighth leading cause of death for all age groups, killing more people than HIV/AIDS, tuberculosis, and diarrheal diseases. More importantly, it is a leading cause of death among children

and young adults aged 5-29 years, posing a new threat to the health of adolescents and working-age populations. RTC also result in a huge economic burden, with an estimated loss of nearly two trillion USD to the world economy in 2015-30. In addition, perceived poor road safety also impacts other public health issues as it contributes to physical inactivity and stress. People are less likely to walk or cycle when road conditions are unsafe (WHO, 2018; Chen et al., 2019).

Even though RTC are global challenges, they are more severe in low and middle-income countries (LMIC), where 90 percent of the world's crash deaths occur. The annual RTC death rate in LMIC is three times higher than the death rate in high-income countries. The African region has the highest rate of fatalities from RTC worldwide. What is more, there has been no reduction in the number of road traffic fatalities in any low-income country since 2013 (WHO, 2018).

In Ethiopia, RTC constitute a major burden on the social, economic, and health sectors. According to the WHO report, Ethiopia is considered one of the worst-affected countries in the world, where RTC causes an estimated annual death of over 27,326 people (WHO, 2018; UNEC, 2020; WHO, 2014). According to the official government reports, annual RTC deaths have doubled in the 12-year period between 2007 and 2018 (UNEC, 2019) RTC are the ninth leading cause of death in Ethiopia; the country is ranked 12th in the world, and 9th in Africa in terms of deaths and injuries caused by this public health problem (WHO, 2013). In addition to the direct morbidity and mortality, RTC also adversely affect the livelihoods of individuals and families often forcing them into poverty (Kussia, 2017; Persson, 2008). It has a huge impact on the national economy by consuming already scarce health resources, damaging properties, and killing or disabling the working-age group (Mekonnen & Teshager, 2014).

Several factors predict the occurrence of RTC. Driver factors are the most common ones. Most global and local initiatives are also directed towards the five most common risky driving behaviours: speeding, drink driving, inconsistent use of seatbelts, helmet use, and poor utilisation of child restraint systems (Hareru et al., 2022; Nabi et al., 2005; Neelakantan et al., 2017). Despite this, few studies have been conducted on drivers in Ethiopia.

In addition, in Ethiopia, there is a shortage of reliable data and research-based recommendations, especially those conducted using robust epidemiologic designs (UNEC, 2020). A few studies attempted to capture the problem, but they used study designs and techniques that were not robust enough to address it. Most studies used descriptive techniques, and some failed to collect first-hand information from the drivers (Abegaz et al., 2014; Honelgn & Wuletaw, 2020; Mekonnen & Teshager, 2014). A study conducted in Western Ethiopia used a cross-sectional design, which is not as reliable as case-control studies in identifying determinants (Erena & Heyi, 2020). Two national studies collected the information out of the primary stakeholders in the RTC. Even though these studies involved relatively large sample sizes, they significantly diverted from

primary stakeholders, which may underestimate the problem (Abegaz & Gebremedhin, 2019; Gebremichael et al., 2017). The current study was conducted to identify the determinants of RTC using firsthand information from the drivers and a relatively robust epidemiologic study design.

Methods

Study area, design and period

This study was conducted in the Buno Bedelle zone, Southwest Ethiopia. Buno Bedelle is one of the administrative zones of the Oromia region, the widest and most populous region in Ethiopia. As of 2021, the zone had a total population of 829,663. Bedelle town is the capital of the Buno Bedelle zone, 480 km away from Addis Ababa, the national capital. The transport system in the zone is managed by the zonal transport authority. In 2021, in the Buno Bedelle zone, there was 2,441 registered drivers and 1,921 different types of vehicles, 145 km of paved asphalt roads and 903 km of gravel roads. The study was conducted from May to July 2021, employing a community-based unmatched case-control study design.

Study populations

The study populations for cases were drivers registered in the zonal traffic police office as causing crashes over one year prior to the data collection period and fulfilled the inclusion criteria. The study populations for controls were drivers who had not caused a RTC as identified by the zonal transport authority in the year preceding the study and sampled after fulfilling the inclusion criteria.

Inclusion and exclusion criteria

Inclusion criteria

Cases: registered drivers who had RTC in the year preceding the study, survived the incident, and registered as having caused the RTC in the zonal transport authority; with address information available from the zonal registry.

Controls: registered drivers who had been driving for a minimum duration of 30 days in the year preceding the data collection period, who did not inflict or cause a RTC, with address information is available from the zonal registry.

Exclusion criteria

Cases: registered drivers who are critically ill or died due to any disease after the incident; those who have changed their residence since the last RTC; missing address information.

Controls: registered drivers who were critically ill, died, changed residence, or inflicted RTC after the initiation of the study.

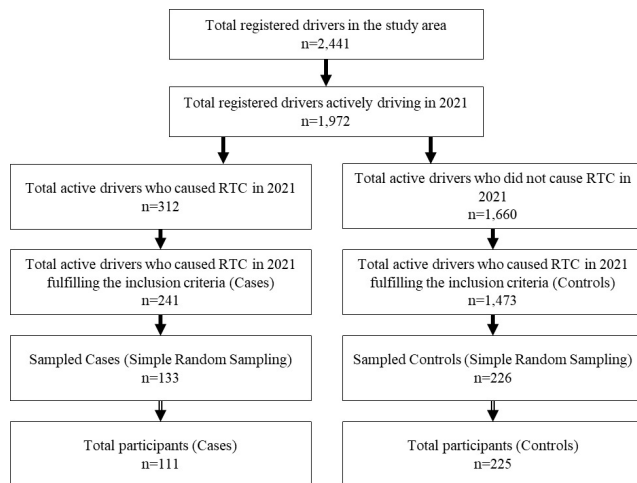


Figure 1. Diagrammatic presentation of the sampling technique for the study; Buno Bedele zone, 2021

Sample size determination and sampling procedures

The sample size was calculated using STATCALC of epi-info-7, considering a case-to-control ratio of 1:2, a power of 80 percent, and a two-sided confidence interval of 95 percent. The sample size was calculated for key behavioural risk factors for RTC. Finally, mobile phone use while driving was chosen as it resulted in the largest sample size using an adjusted odds ratio (AOR) of 2.25, the proportion of exposed controls as 17.3 percent, and the proportion of exposed cases as 32.3 percent (Woldu et al., 2020). This resulted in a sample size of 103 for cases and 205 for controls. After adding 10 percent for the non-response rate, the required sample size was 113 cases and 226 controls, giving a total sample size of 339.

A complete list of drivers who inflicted or caused RTC (cases) and did not inflict RTC over the year prior to the study period (controls) was taken from the register book of the zonal transport authority. Essential address and contact information were collected from the register. The list was refined by applying inclusion and exclusion criteria. Cases and controls were selected separately by simple random sampling from the list. Selected drivers, both cases and controls, were reached according to the contact and address information from the register (Figure 1).

Operational definitions

Road Traffic Crash: a crash that involves personal or property injury occurs on roads (including footways), involving at least one vehicle or a vehicle in crash with a pedestrian, another vehicle, or other object and which becomes known to the police within 30 days and is registered to have happened on the authority register book (Honeln & Wuletaw, 2020; Odero et al., 1997; Tiruneh et al., 2014).

Distracted driving: anything that takes the attention of the driver away from driving, like texting, talking on a cell phone, using social media, and eating while driving (NHTSA, 2018; CDC, 2017).

Data collection tools and procedures

The data were collected using a pretested interviewer-administered questionnaire. The English version of the questionnaire was translated into the local language (Afaan Oromo). Eight trained clinical nurses collected the data under the supervision of two senior health officers. The data were collected according to the suitability of time for the drivers on weekends, at meeting sites, and at bus stations. Transport authority workers facilitated communication between the data collectors and selected drivers.

Data processing and analysis

Data were entered into Epidata version 3.1 and exported to the statistical package for social science (SPSS) version 23 for analysis. Relevant descriptive statistics were used to describe variables according to their distribution. Multivariable logistic regression was used to identify independent determinants of RTC by using the OR and its 95 percent confidence interval (CI) at $p < 0.05$.

Ethical Consideration

This research was conducted according to the principles of the Helsinki Declaration. Ethical approval for the conduct of the study was obtained from the ethics review committee of the college of health science at Mattu University with reference number RPG/18/2013, issued on 11 May 2021. Permission was obtained from the Buno Bedele Zone Health Department, the Transport Authority, and the Police Department. Written informed consent was obtained from all study participants after a detailed explanation of the purpose, objectives, risks, and benefits of the study.

Patient and public involvement

The public was involved from the initial design of data collection tools through pretesting. This helped in aligning the questions in the data collection tool to make them appropriate and acceptable to the study participants. The potential participants were consulted on the appropriate times and locations for data collection. Finally, plans were put in place with study participants to disseminate the results of this study.

Results

Socio-demographic characteristics of participants

From the total sample size, 336 study participants responded to the questionnaires (99.1% response rate). The respondents included cases ($n=111$, 33%) and controls ($n=225$, 67%). All of the cases and 224 (99.6%) of the controls were male. The majority of respondents were in the age group of 25 to 34 years (cases, $n=65.8\%$ controls, $n=69.8\%$). Regarding marital status, more cases were single (60.6%) compared to controls (49.8%). Concerning the ethnicity of respondents, most of the cases (69.4%) and controls (85.3%) were ethnic Oromo. Most of the participants

Table 1. Socio-demographic characteristics of participating drivers in Buno Bedelle Zone, Southwest Ethiopia, 2021

Variable	Category	Cases (n=111) n, %		Controls (n=225) n, %		Total (n=336) n, %	
Age	<25	17	15.3	24	10.7	41	12.2
	25 to 34	73	65.8	157	69.8	230	68.5
	35 to 44	18	16.2	38	16.9	56	16.7
	>44	3	2.7	6	2.7	9	2.7
Gender	Male	111	100	224	99.6	335	99.7
	Female	0	0	1	0.4	1	0.3
Marital status	Single	67	60.64	112	49.8	179	53.3
	Married	43	39.7	112	49.8	155	46.1
	Divorced	1	0.9	1	0.4	2	0.6
Ethnicity	Oromo	77	69.4	192	85.3	269	80.1
	Amhara	29	26.1	26	11.6	55	16.4
	Gurage	2	1.8	4	1.8	6	1.8
	Tigre	3	2.7	3	1.3	6	1.5
Educational status	Primary	2	1.8	2	0.9	4	1.2
	Secondary	87	78.4	169	75.1	256	76.2
	Diploma and above	22	19.8	54	24	76	22.6
Religion	Muslim	52	46.8	92	40.9	144	42.9
	Orthodox	37	33.3	78	34.7	115	34.2
	Protestant	21	18.9	53	23.6	74	22
	Catholic	1	0.9	2	0.9	3	0.9
Monthly income	<4000 birr	99	89.2	163	72.4	262	78
	≥4000 birr	12	10.8	62	27.6	74	22
Children	No children	78	70.3	117	52	195	58
	Have children	33	29.7	108	48	141	42

had completed secondary school (cases, 78.4%; controls, 75.1%) ([Table 1](#)).

Characteristics of respondents and their immediate environment

In this study, 81 (73%) cases and 116 (51.6%) controls had fewer than five years of driving experience. However, seatbelt use was inconsistent as most cases (74.8%) and some controls (40%), did not use seatbelts consistently. More than half of cases and two thirds of controls (65.8%) of controls reported chewing khat (stimulant) while driving. Meanwhile, 54.1 percent of cases and 78.2 percent of controls overloaded, driving with more than the permitted number of people in the vehicle. Regarding the ownership of vehicles, the majority of cases (86.5%) and controls (80.4%) were employed drivers. Moreover, approximately half of cases (55%) and controls (46.7%) drove on gravel roads routinely. Furthermore, 57.7 percent of cases and 40 percent of controls reported driving for more than eight hours per day ([Table 2](#)).

Determinants of road traffic crashes among drivers in Buno Bedele zone

Predictor variables were entered into the binary logistic regression model to identify important variables for the multivariable model. Monthly income of drivers, inconsistent use of seatbelts while driving, having children, years of driving experience, driving under the influence of alcohol, driving under the influence of khat, overloading passengers, vehicle ownership, average driving hours, music listening while driving, road pavement, vehicle inspection interval, speeding and vehicle length of service were found to have *p*-values of <0.25 and were included in the multivariate analysis ([Table 3](#)).

In the multivariable model, years of driving experience, inconsistent use of seatbelts, driving under the influence of alcohol, vehicle length of service and speeding were significantly associated with road traffic crashes among drivers in the study area. Drivers with fewer than five years driving experience were almost three times more likely to inflict RTC than experienced drivers (OR = 2.6, 95% CI (1.04, 6.3)). In relation to seat belt utilisation, inconsistent users of seatbelts were three times more likely to inflict RTC than

Table 2. Distribution of drivers and road related characteristics in Buno Bedelle zone, 2021

Variable	Category	Cases (n=111) n, %		Controls (n=225) n, %		Total (n=336) n, %	
Years of driving	< 5years	81	73	116	51.6	197	58.6
	≥ 5years	30	27	109	48.4	139	41.4
Consistent seatbelt use	Yes	28	25.2	135	60	163	48.5
	No	83	74.8	90	40	173	51.5
Driving under influence of alcohol	Yes	42	37.8	23	10.2	65	19.3
	No	69	62.2	202	89.8	271	80.7
Driving while using khat	Yes	118	52.4	73	65.8	191	56.8
	No	107	47.6	38	34.2	145	43.2
Overloading of passengers	Yes	51	45.9	49	21.8	100	29.8
	No	60	54.1	176	78.2	236	70.2
Ownership of vehicle	Owner	15	13.5	44	19.6	59	17.6
	Employee	96	86.5	181	80.4	277	82.4
Average driving hours	< 8hrs	47	42.3	135	60	182	54.2
	≥ 8hrs	64	57.7	90	40	154	45.8
Listening to music while driving	Yes	89	80.2	161	71.6	250	74.4
	No	22	19.8	64	28.4	86	25.6
Road pavement	Good asphalt	29	26.1	53	23.6	82	24.4
	Defected asphalt	21	18.9	67	29.8	88	26.2
	Gravel	61	55	105	46.7	166	49.4
Road surface	Wet	3	2.7	3	1.3	6	1.8
	Dry	108	97.3	222	98.7	330	98.2
Road location	Mountainous	34	30.6	71	31.6	105	31.3
	Flat area	77	69.4	154	68.4	231	68.8

drivers who used seatbelts consistently (OR = 3.2, 95% CI (1.6, 6.3)). This study also found drivers who were under the influence of alcohol to be five times more likely to inflict crashes than drivers free of alcohol influence (OR = 5.2, 95% CI (2.3, 11.7)). In addition, drivers who drive vehicles older than five years were nearly three times more likely to inflict RTC than drivers of newer vehicles (OR = 2.6, 95% CI (1.3, 5.3)). Finally, speeding was found to be significantly associated with RTC. Drivers who drive over the speed limit were nearly five times more likely to cause RTC when compared with drivers who observed speed limits while driving (Table 4).

Discussion

This community-based case-control study has identified the determinants of RTC among drivers in the Buno Bedelle zone, Southwest Ethiopia. Accordingly, the current study found short years of driving experience, inconsistent use of seatbelts, driving under the influence of alcohol, long vehicle length of service and speeding to be significantly associated with RTC among drivers in the study area.

Short driving experience was found to be independently associated with RTC in the study area. Drivers with fewer years of driving experience were two times more likely to

cause or inflict RTC than drivers with more years of driving experience. This finding has strengthened the claims of descriptive studies conducted in Northern Ethiopia (Tadege, 2020; Woldu et al., 2020), which associated experienced drivers with a lower probability of risky driving behaviours. This is also in line with a finding from Benin City, Nigeria, which found less experienced drivers inflicting more RTC than experienced drivers (Okafor et al., 2017). Findings from research conducted in countries of all development levels indicated a relationship between a lack of sufficient driving experience and risky driving behaviours (Mekonnen et al., 2016; Liu et al., 2021; Madhumali et al., 2021). The occurrence of risky driving behaviours is associated with a greater likelihood of the occurrence of RTC (WHO, 2018).

Likewise, this study revealed inconsistent use of seatbelts as being significantly associated with RTC. Inconsistent users of seatbelts inflicted RTC three times more than drivers who used seatbelts consistently. This corroborated the findings of other studies conducted in Northern Ethiopia and Thailand (Fenta & Muluneh, 2017; Klinjun et al., 2021). One of the most important behaviours that is a proxy indicator of the prevention of RTC is the use of seatbelts (WHO, 2018). It helps in the prevention of injuries and reduces their severity (Fouda Mbarga et al., 2018). This study indicated the continuing importance of seatbelt utilisation in the prevention of RTC.

Table 3. Bivariable logistic regression analysis of the determinants of road traffic crashes among drivers in Buno Bedelle zone, 2021

Variable	Category	Cases (n=111) n, %		Controls (n=225) n, %		COR (95%CI)	p-value
Educational status	Primary	2	1.8	2	0.9	2.4 (0.3-18.5)	0.384
	Secondary	87	78.4	169	75.1	1.3(0.7-2.2)	0.412
	Diploma and above	22	19.8	54	24	1	
Children	No children	78	70.3	117	52	2.182(1.3-3.5)	0.002
	Have children	33	29.7	108	48	1	
Years of driving	< 5years	81	73	116	51.6	2.537(1.5-4.2)	0.000
	≥5years	30	27	109	48.4	1	
Consistent seatbelt use	Yes	28	25.2	135	60	1	
	No	83	74.8	90	40	4.4 (2.7-7.4)	0.000
Driving under influence of alcohol	Yes	42	37.8	23	10.2	5.3 (3.0-9.5)	0.000
	No	69	62.2	202	89.8	1	
Driving while using khat	Yes	118	52.4	73	65.8	0.6(0.4-0.9)	0.021
	No	107	47.6	38	34.2	1	
Overloading of passengers	Yes	51	45.9	49	21.8	3.0 (1.9-5.0)	0.000
	No	60	54.1	176	78.2	1	
Ownership of vehicle	Owner	15	13.5	44	19.6	1	
	Employee	96	86.5	181	80.4	1.5 (0.8-2.9)	0.173
Average driving hours	< 8hrs	47	42.3	135	60	1	
	≥ 8hrs	64	57.7	90	40	2.0 (1.2-3.2)	0.002
Road pavement	Good asphalt	29	26.2	53	23.5	1	
	Defected asphalt	21	18.9	67	29.8	0.5 (0.3-1.1)	0.102
	Gravel	61	54.9	105	46.7	1.0 (0.6-1.8)	0.831
Vehicle year of service	<5years	45	40.5	129	57.3	1	
	≥5years	66	59.5	96	42.7	1.9 (1.2-3.1)	0.004
Vehicle inspection interval	3 months	15	13.5	68	30.2	1	
	6 months	56	50.5	119	52.9	2.1 (1.1-4.0)	0.021
	1 years	33	29.7	35	15.6	4.2 (2.0-8.9)	0.000
	Never	7	6.3	3	1.3	10.5 (2.4-45.7)	0.002
Speeding	Yes	82	73.9	61	27.1	7.6(4.5-12.7)	<0.001
	No	29	26.1	164	72.9	1	

COR: Crude Odds Ratio; CI: Confidence Interval

Driving under the influence of alcohol is found to be a strongly associated with RTC. Drivers who drove after consuming alcohol were five times more likely to inflict RTC compared with drivers who did not consume alcohol. The current finding supports available knowledge concerning the impact of alcohol on road and traffic safety. In addition, it supports prior findings from studies in Ethiopia and elsewhere (Hijar et al., 2000; Tiruneh et al., 2014; Woldeu et al., 2020). This study has shown the continued risk and threat posed by drink drivers to Ethiopian road users.

In this study, drivers who drive older motor vehicles are twice as likely to inflict RTC than drivers of newer vehi-

cles. This is consistent with a study conducted in Addis Ababa (Mengistu & Enquselassie, 2021). This might be due to older vehicles developing defects of different origins that may make it difficult to manage them when threats to road safety arise. This finding is inconsistent with a report from a study conducted in North Ethiopia, which stated that, as vehicle service years increase by a year, the probability of the occurrence of RTC decreases by 0.90 times (Tadege, 2020). This may be due to the relationship between vehicles and drivers in that, when the vehicle is new, the driver may not know the characteristics of the vehicle.

Table 4. Multivariable logistic regression output of the determinants of road traffic crashes among drivers in Buno Bedele zone, Southwest Ethiopia, 2021

Variable	Category	Cases (n=111) n, %		Controls (n=225) n, %		OR (95%CI)	p-value
Children	No children	78	70.3	117	52	1.4 (0.6-3.2)	0.44
	Have children	33	29.7	108	48	1	
Years of driving	< 5years	81	73	116	51.6	2.6 (1.04-6.5) *	0.04
	≥ 5years	30	27	109	48.4	1	
Consistent seatbelt use	Yes	28	25.2	135	60	1	
	No	83	74.8	90	40	3.2 (1.6-6.3) *	0.001
Driving under influence of alcohol	Yes	42	37.8	23	10.2	5.2 (2.3-11.7)*	<0.01
	No	69	62.2	202	89.8	1	
Driving while using khat	Yes	118	52.4	73	65.8	1.4 (0.7-2.7)	0.31
	No	107	47.6	38	34.2	1	
Ownership of vehicle	Owner	15	13.5	44	19.6	1	
	Employed	96	86.5	181	80.4	0.5 (0.18-1.2)	0.10
Average driving hours	< 8hrs	47	42.3	135	60	1	
	≥8hrs	64	57.7	90	40	1.1 (0.6-2.1)	0.70
Listening to music while driving	Yes	89	80.2	161	71.6	1.2 (0.6-2.5)	0.60
	No	22	19.8	64	28.4	1	
Road pavement	Good asphalt	29	26.2	53	23.5	1	
	Defected asphalt	21	18.9	67	29.8	0.5 (0.2-1.3)	0.17
	Gravel	61	54.9	105	46.7	0.9 (0.04-2.0)	0.88
Vehicle length of service	<5years	45	40.5	129	57.3	1	
	≥5years	66	59.5	96	42.7	2.6 (1.3-5.3) *	0.007
Vehicle inspection interval	3 months	15	13.5	68	30.2	1	
	6 months	56	50.5	119	52.9	1.02 (0.4-2.3)	0.95
	1 years	33	29.7	35	15.6	1.6 (0.6-4.1)	0.40
	Never inspected	7	6.3	3	1.3	5.2 (0.8-32.0)	0.07
Speeding	Yes	82	73.9	61	27.1	4.538 (2.307-8.927)*	<0.001
	No	29	26.1	164	72.9	1	

OR: Odds Ratio; CI: Confidence Interval; * Statistically significant at p-value ≤0.05; Hosmer and Lemeshow test p=0.60

Finally, drivers who drive over the speed limit were found to be associated with nearly five times more RTC when compared with drivers who consistently observe the speed limits. Speeding is one of the five risky driving practices (WHO, 2018). Several studies also indicated the importance of speeding in causing RTC and worsening its consequences (Yasmeen, 2019; Yismaw & Ahmed, 2015).

Generally, the finding of this study implies the importance of improving the driving experience of future drivers by implementation of a mentored driving schedule before licensure. In addition, Ethiopia has to strengthen the implementation of the available legislations on risky driving practices by reforming, empowering and funding the road safety agencies. Finally, Ethiopia has to impose a limitation on the import of older motor vehicles. These recommen-

dations all support the road safety performance review on Ethiopia, conducted by the United Nations Economic Commission for Africa and United Nations Economic Commission for Europe (UNECE, 2020).

Strengths and limitations of the study

This study is the first of its kind to employ a case-control study in the study of road traffic crashes in Ethiopia. Despite this, the study has some limitations. Road traffic crashes that may have happened but did not come to the attention of the transport authorities and were not registered were not included in this study (underreporting). In addition, the data were collected on past events, and recall bias may have occurred. Further, the study focused on dri-

vers and their immediate environment but did not consider other perspectives like infrastructure, other road users, or administrative issues.

Conclusions

In conclusion, factors associated with inflicting RTC among drivers in the study area are found to be a lack of sufficient driving experience, inconsistent seat belt utilisation, driving under the influence of alcohol, and long vehicle years of service. It is recommended that drivers develop their driving experience by driving under supervision before starting to drive independently. In addition, drivers are advised to avoid risky driving behaviours and abide by existing laws regarding risky driving behaviours. Transport service users are advised to look for experienced drivers and relatively new vehicles, drivers who constantly use seatbelts while driving, and recognised drivers who are known for their healthy driving behaviours. Transport authorities are advised to implement licensing procedures that require a longer period of supervised driving. Enforcement of existing laws concerning risky driving practises should be strengthened. The use of available technology in alcohol detection has to be strengthened. Authorities can also establish a grading system for drivers depending on their achievements regarding risky driving behaviours.

Human Research Ethics Review

This research was conducted according to the principles of the Helsinki Declaration. The proposal for this study was approved by the ethics review committee of the college of health science at Mattu University, with letter reference number RPG/18/2013 issued on 3 May 2013 on the Ethiopian calendar. Individual participants provided written informed consent after receiving comprehensive information about the purpose, objectives, risks, and benefits of the study.

Data availability statement

All data for this research are available and can be accessed from the corresponding author.

Conflict of interests

All authors declare that there is no competing interest.

Submitted: April 16, 2022 AEDT, Accepted: August 08, 2023 AEDT



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-4.0). View this license's legal deed at <http://creativecommons.org/licenses/by/4.0> and legal code at <http://creativecommons.org/licenses/by/4.0/legalcode> for more information.

References

- Abegaz, T., Berhane, Y., Worku, A., Assrat, A., & Assefa, A. (2014). Road traffic deaths and injuries are under-reported in Ethiopia: a capture-recapture method. *PloS One*, 9(7), e103001. <https://doi.org/10.1371/journal.pone.0103001>
- Abegaz, T., & Gebremedhin, S. (2019). Magnitude of road traffic accident related injuries and fatalities in Ethiopia. *PloS One*, 14(1), e0202240. <https://doi.org/10.1371/journal.pone.0202240>
- Center for Disease Control and Prevention. [CDC]. (2017). *Distracted driving*. https://www.cdc.gov/transportationsafety/distracted_driving/index.html
- Chen, S., Kuhn, M., Prettnner, K., & Bloom, D. E. (2019). The global macroeconomic burden of road injuries: estimates and projections for 166 countries. *The Lancet Planetary Health*, 3(9), e390–e398. [https://doi.org/10.1016/s2542-5196\(19\)30170-6](https://doi.org/10.1016/s2542-5196(19)30170-6)
- Erena, M. G., & Heyi, W. D. (2020). Prevalence of road traffic accident and associated risk factors among drivers of three and four-wheeler vehicles, western Ethiopia, 2017. *MOJ Public Health*, 9(5), 138–145. <https://doi.org/10.15406/mojph.2020.09.00337>
- Fenta, H. M., & Muluneh, E. K. (2017). Determinants of Road Traffic Accidents in Amhara Regional State, Ethiopia: Application of Binary Logistic Regression Analysis. *International Journal of Mathematics And Its Applications*, 5(2-B), 257–264.
- Fouda Mbarga, N., Abubakari, A.-R., Aminde, L. N., & Morgan, A. R. (2018). Seatbelt use and risk of major injuries sustained by vehicle occupants during motor-vehicle crashes: a systematic review and meta-analysis of cohort studies. *BMC Public Health*, 18(1), 1–11. <https://doi.org/10.1186/s12889-018-6280-1>
- Gebremichael, M., Guta, M., Gedefaw, M., Bekele, A., Shiferaw, F., Gelibo, T., Getachew, T., Mudie, K., Amenu, K., Defar, A., & Teklie, H. (2017). Prevalence and determinants of road traffic injuries in Ethiopia: Based on the 2015 STEPS survey findings. *Ethiopian Journal of Health Development*, 31(1), 340–347.
- Hareru, H. E., Negassa, B., Kassa Abebe, R., Ashenafi, E., Zenebe, G. A., Debela, B. G., Ashuro, Z., & Eshete Soboksa, N. (2022). The epidemiology of road traffic accidents and associated factors among drivers in Dilla Town, Southern Ethiopia. *Frontiers in Public Health*, 10, 1007308. <https://doi.org/10.3389/fpubh.2022.1007308>
- Hijar, M., Carrillo, C., Flores, M., Anaya, R., & Lopez, V. (2000). Risk factors in highway traffic accidents: a case control study. *Accident Analysis & Prevention*, 32(5), 703–709. [https://doi.org/10.1016/s0001-4575\(99\)00116-5](https://doi.org/10.1016/s0001-4575(99)00116-5)
- Honegn, A., & Wuletaw, T. (2020). Road traffic accident and associated factors among traumatized patients at the emergency department of University of Gondar Comprehensive Teaching and Referral Hospital. *PAMJ Clinical Medicine*, 4(9). <https://doi.org/10.11604/pamj-cm.2020.4.9.24507>
- Klinjun, N., Kelly, M., Praditsathaporn, C., & Petsirasarn, R. (2021). Identification of factors affecting road traffic injuries incidence and severity in Southern Thailand based on accident investigation reports. *Sustainability*, 13(22), 12467. <https://doi.org/10.3390/su132212467>
- Kussia, A. (2017). *Trends, Causes, and Costs of Road Traffic Accidents in Ethiopia*. GRIN Verlag. <https://www.grin.com/document/352231>
- Liu, J., Wang, C., Liu, Z., Feng, Z., & Sze, N. N. (2021). Drivers' risk perception and risky driving behavior under low illumination conditions: Modified driver behavior questionnaire (DBQ) and driver skill inventory (DSI). *Journal of Advanced Transportation*, 2021, 1–13. <https://doi.org/10.1155/2021/5568240>
- Madhumali, N. W. M., Bandaranayaka, H. M. T., Hashari, G. C., Ayesha, H. K. B., Rathnayaka, R. M. K. P., Withana, I. U. M., Mowlana, F. M., Weerawardhana, P. L., & Jayasekara, J. M. K. B. (2021). Identification of risk factors for road traffic accidents using injured drivers: a cross sectional study conducted in Sri-Lanka. *International Journal of Community Medicine and Public Health*, 8(9), 4232. <https://doi.org/10.18203/2394-6040.ijcmph20213524>
- Mekonnen, F. H., & Teshager, S. (2014). Road traffic accident: the neglected health problem in Amhara National Regional State, Ethiopia. *Ethiopian Journal of Health Development*, 28(1), 3–10.
- Mengistu, Z., & Enquelassie, F. (2021). An Estimating Exposure-Controlled Crash Risk at Roundabout among Drivers of Vehicles in Addis Ababa City: An induced exposure study. *Ethiopian Medical Journal*, 59(01). <https://emjema.org/index.php/EMJ/article/view/1443>

- Nabi, H., Consoli, S. M., Chastang, J.-F., Chiron, M., Lafont, S., & Lagarde, E. (2005). Type A behavior pattern, risky driving behaviors, and serious road traffic accidents: a prospective study of the GAZEL cohort. *American Journal of Epidemiology*, 161(9), 864–870. <https://doi.org/10.1093/aje/kwi110>
- National Highway Traffic Safety Administration. [NHTSA]. (2018). *Distracted Driving*. <https://www.nhtsa.gov/risky-driving/distracted-driving>
- Neelakantan, A., Kotwal, B. A., & Ilankumaran, M. (2017). Determinants of injuries and Road Traffic Accidents amongst service personnel in a large Defence station. *Medical Journal Armed Forces India*, 73(3), 216–221. <https://doi.org/10.1016/j.mjafi.2016.08.002>
- Odero, W., Garner, P., & Zwi, A. (1997). Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine & International Health*, 2(5), 445–460. <https://doi.org/10.1111/j.1365-3156.1997.tb00167.x>
- Okafor, K. C., Azuike, E. C., & Okojie, P. W. (2017). The causes and prevalence of road traffic accidents amongst commercial long distance drivers in Benin City, Edo State, Nigeria. *Nigerian Journal of Medicine*, 26(3), 220. <https://doi.org/10.4103/1115-2613.278844>
- Organization of Economic Cooperation and Development. [OECD]. (2020). *Health Statistics 2020 Definitions, Sources and Methods*. OECD.
- Persson, A. (2008). Road traffic accidents in Ethiopia: magnitude, causes and possible interventions. *Advances in Transportation Studies*, 15, 5–16.
- Sleet, D. A., Baldwin, G., Dellinger, A., & Dinh-Zarr, B. (2011). The decade of action for global road safety. *Journal of Safety Research*, 42(2), 147–148. <https://doi.org/10.1016/j.jsr.2011.02.001>
- Tadege, M. (2020). Determinants of fatal car accident risk in Finote Selam town, Northwest Ethiopia. *BMC Public Health*, 20(1), 1–8. <https://doi.org/10.1186/s12889-020-08760-z>
- Tiruneh, B. T., Dachew, B. A., & Biftu, B. B. (2014). Incidence of road traffic injury and associated factors among patients visiting the emergency department of Tikur Anbessa specialized teaching hospital, Addis Ababa, Ethiopia. *Emergency Medicine International*, 2014, 1–6. <https://doi.org/10.1155/2014/439818>
- United Nations Economic Commission For Europe And United Nations Economic Commission For Africa. [UNEC]. (2019). *Road Safety Performance Review- Ethiopia. Road Safety Performance Review - Albania*. United Nations. <https://doi.org/10.18356/fc854c83-en>
- United Nations Economic Commission For Europe And United Nations Economic Commission For Africa. [UNEC]. (2020). *Road Safety Performance Review Ethiopia*. https://unece.org/sites/default/files/2021-01/RSPR%20Ethiopia%20Report_Final%20web_1.pdf
- Woldu, A. B., Desta, A. A., & Woldearegay, T. W. (2020). Magnitude and determinants of road traffic accidents in Northern Ethiopia: a cross-sectional study. *BMJ Open*, 10(2), e034133. <https://doi.org/10.1136/bmjopen-2019-034133>
- World Health Organisation. [WHO]. (2013). World health rankings. In *Live longer live better*. WHO Press Geneva.
- World Health Organisation. [WHO]. (2014). *Country Profiles - Global Status Report*. WHO Press Geneva.
- World Health Organisation. [WHO]. (2018). *Global status report on road safety* (2nd ed.). WHO Press Geneva.
- Yasmeen, S. (2019). Road traffic crashes (RTCs) and its determinants: public health issue. *International Journal of Collaborative Research on Internal Medicine & Public Health*, 11(3), 911–916. <https://www.iomcworld.org/articles/road-traffic-crashes-rtcs-and-its-determinants-public-health-issue-44415.html>
- Yismaw, A., & Ahmed, M. E. (2015). The Causes of Road Traffic Accidents in Bahir Dar City, Ethiopia. *International Journal of African and Asian Studies*, 11, 99–107.