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Magnitude and determinants of road traffic accident in Mekelle city, Tigray, Northern Ethiopia: A cross sectional study

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3 **1 Magnitude and determinants of road traffic accident in Mekelle city, Tigray,**
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6 **2 Northern Ethiopia: A cross sectional study**
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24 **Abstract**

25 **Objective:** Road Traffic Accident is becoming a threat to public health in many developing
26 countries including Ethiopia. Therefore, this study aimed to assess the magnitude and determinants
27 of road traffic accidents.

28 **Method:** A cross-sectional study was done using a simple random sampling technique and data
29 were collected from drivers from Feb to Jun 2015 in Mekelle city, Ethiopia. A binary logistic
30 regression was used to identify factors associated with road traffic accident.

31 **Results:** The magnitude of road traffic accident was found to be 23.17%. According to the drivers'
32 perceived cause of the accident, 22 (38.60%) of the accident was due to violation of traffic rules
33 and regulations. The majority of the victims were pedestrians, 19 (33.33%). Drivers who were
34 driving a governmental vehicle were 4.16 (AOR=4.16; 95% CI: 1.48- 11.70) times more likely to
35 have road traffic accident compared to those who drive private vehicles. Drivers who consumed
36 alcohol were 2.29 (AOR=2.29; 95% CI: 1.08-4.85) times more likely to have road traffic accident
37 compared to those drivers who do not consume alcohol.

38 **Conclusion:** Magnitude of RTA was high. Driving a governmental vehicle and alcohol
39 consumption were the factors associated with Road Traffic Accident. Monitoring blood alcohol
40 level of drivers should be in place. Holistic study should be done to identify the causes of RTA.

41 **Keywords**

42 Road Traffic Accident; Drivers; Mekelle city; Tigray; Ethiopia

43 **Strength and Limitation**

- 44 ➤ Data quality was assured under close supervision of principal investigators.
- 45 ➤ Findings of the study were based only by quantitative study which may loss the quality that
46 can be addressed by qualitative study.
- 47 ➤ The cross-sectional study design limits the factors to establish temporal relationship;
48 hence inference of causation is not applicable

49 **1. Introduction**

50 Road Traffic Accident (RTA) is an accident that happens unexpectedly, unintentionally and
51 unpredictably under unexpected conditions. Accordingly, RTAs are collisions between vehicles,
52 between vehicles and pedestrians, between vehicles and animals, or fixed obstacles [1]. RTA
53 contributes to poverty by causing loss of productivity, material damages, injuries, disabilities, grief
54 and deaths [2]. Road traffic injuries are increasing worldwide with unequal number occurring in
55 developing countries [3]. Road traffic injuries account for 2.1% of all deaths worldwide and ranked
56 10th killer health problem globally. Twenty three percent of all injury related deaths occurred by
57 traffic accident worldwide, of which 90% occurred in low and middle income countries, where
58 81% of the world's population live and own about 20% of the world's vehicles. Predictions
59 indicated that RTA mortality will be 67% by 2020 if appropriate actions are not taken [4].

60 World Health Organization (WHO) in 2011 reported that the RTA in Ethiopia reached 22,786
61 which accounted 2.77% of all the deaths. The report showed that RTA is the 9th killer health
62 problem in the country. Road traffic accident makes Ethiopia 12th and 9th in the world and in the
63 Africa continent respectively [5]. Poor conditions of quality of vehicles and less road safety are
64 determinant factors for RTA in Africa [6] including Ethiopia [7]. Despite infrastructure and quality

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3 65 of vehicles, evidences also noted that human behavior is the most common factor accounting for
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5 66 more than 85% of all traffic accidents [8]. Mekelle is a fast growing regional city, which owes a
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7 67 heavy traffic flow, especially during peak hours [9]. In Mekelle city it was reported that road traffic
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9 68 accidents had increased from year to year and it was shown that 96% of the causes were related to
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11 69 human risk behavior whereas 4% was due to the vehicle problem [10]. Therefore, this study was
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13
14 70 aimed to assess the magnitude and determinants of road traffic accidents Mekelle city.

17 18 71 **2. Methods**

19 20 21 72 **Study setting**

22
23 73 The study was conducted among drivers in Mekelle city, Tigray, northern Ethiopia from Feb to
24
25 74 Jun 2015. Mekelle is the capital city of the Tigray regional state which is found at 783 Km north
26
27 75 of the capital city of Ethiopia, Addis Ababa. Regarding road infrastructure: Mekelle city has 55
28
29 76 km asphalted, 23 km cobble stone and 152 km gravel road [11].

30 31 32 33 77 **Study design**

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36 78 A cross-sectional study design was used.

37 38 39 79 **Participants**

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41 80 All drivers who were based in Mekelle city, had a legal driving license and who were driving taxi,
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43 81 Bajaj (three wheel taxi), private owned car and governmental car in Mekelle city were included in
44
45 82 the study. Heavy truck drivers, drivers who were not working and sick during the study period,
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47 83 those who drive more than two vehicle types and those who came from other areas to Mekelle city
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49 84 were excluded from the study.
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3 85 The sample size was calculated from a previous study, where the prevalence of road traffic accident
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5 86 was reported, p=22% in Mekelle city [10]. Using 5% marginal error and 95% confidence interval
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7
8 87 by the following formula:

9
10 88 $n = (Z_{\alpha/2})^2 P (P-1)/D^2$

11
12 89 Where n = Minimum sample size required

13
14 90 Z = Standard score corresponding to 95% confidence interval

15
16 91 P = Assumed proportion of drivers

17
18 92 D = Margin of error (precision) 5%

19
20 93 $n = 3.84 \times 0.1716/0.0025 = 263$

21
22 94 Since the source population for the study was less than 10,000(i.e. 1500) the sample size correction
23
24
25
26 95 formula was used:

27
28 96 $nf = n/1 + (n/N)$

29
30 97 Where nf= desired sample size

31
32 98 n=calculated sample size

33
34 99 N=total population

35
36
37 100 $nf = n/1 + (n/N) = 263/1 + (263/1500) = 263/1.175 = 223.8 \sim 224$

38
39
40 101 By adding 10% contingency for non-response, the sample size was $224 + 22 = 246$

102 **Sampling procedures**

103 A sampling frame was constructed by a vehicle plate number, which was obtained from Mekelle
104 city transport office. The frame was sub categorized based on the type of the vehicle as a taxi,
105 Bajaj, governmental vehicles, and private/house vehicles. Sub samples were calculated for each
106 category of vehicles proportional to the number of vehicles in the respective categories. Then,
107 study subjects were selected using simple random sampling method (see Figure 1).

108 **Data collection procedures and tools**

109 The study subjects (drivers) were traced and interviewed for data collection. The drivers were
110 traced at their destination for taxi and Bajaj, house cars in their working area and governmental
111 cars at their offices using the car plate number. A structured interviewer administered
112 questionnaire, adapted from different literatures, was used. The questionnaire was initially
113 prepared in English (“See S1 in the Supporting information for the questionnaire”) and was
114 translated into the local language Tigrigna (“See S2 in the Supporting information for the local
115 language (Tigrigna)). The instrument included: socio-demographic characteristics of drivers, risk
116 factors and risky driving factors associated with road traffic accidents for the previous two years.
117 Trained data collectors and supervisors handled the data collection process.

118 **Patient and Public Involvement**

119 Drivers from Mekelle city have involved in the study for interview regarding RTAs.

120 **Data Quality Control**

121 Pre-test was done on 5% of the sample at Adigrat town, Tigray region. Based on the pretest
122 findings, necessary corrections were made to the questionnaire. Adequate supervision was
123 undertaken by the supervisors and principal investigator during the data collection. Daily spot-

1
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3 124 checking of filled questionnaires for errors or any incompleteness was done by the supervisors and
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5 125 the principal investigator.
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8 126 **Data management and analysis**

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11 127 The collected data were entered and cleaned in Microsoft excel 2007. Then, the data were exported
12
13 128 and analyzed using STATA version 12. Values of categorical variables were presented as
14
15 129 frequencies and percentages. All statistical tests were performed at the 5% significance level.
16
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18
19 130 The dependent variable was a Road Traffic Accident (RTA) which was dichotomized into Yes
20
21 131 (labeled “1”) and No (labeled “0”). Each independent variable was cross tabulated with the
22
23 132 outcome variable and variables which showed significant association were further entered into the
24
25 133 bivariable binary logistic regression. Finally, variables significant in the bivariable analysis were
26
27 134 entered into multivariable binary logistic regression analysis to identify independent determinants
28
29 135 of RTA.
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33 136 Multi-collinearity was checked using Variance Inflation Factor (VIF) at a cutoff value of 10.
34
35 137 Variables with greater than 10 VIF value were handled by removing the most inter-correlated
36
37 138 variable(s) from the model and substitute their cross product as an interaction term. The final model
38
39 139 was developed using a step-wise logistic regression. Final model fitness was checked using the
40
41 140 Hosmer-Lemshew method. Receiver Operating Characteristic (ROC) curve was used to show how
42
43 141 much the independent variables in the final model predicted the dependent variable.
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142 3. Results

143 Socio-demographic characteristics of the respondents

144 The response rate in this study was 100%. The median (IQR) age of the respondents was 30 (10)
 145 years. The majority of study participants (98.37%) were males. Regarding the marital status of the
 146 respondents, 102 (41.46%), 101(41.06%), 30 (12.20%) and 13 (5.28%) were divorced, married,
 147 single and widower respectively. The majority of the drivers, 170 (69.11%) were Christian
 148 Orthodox, followed by Muslims, 54 (21.95%). With regard to their educational status, 225
 149 (91.46%) had attained at least grade 5. The median (IQR) monthly income (in Birr) of the study
 150 participants was 1000 (1200) (Table 1).

151 Table 1: Socio-demographic and economic characteristics of drivers in Mekelle city, Northern
 152 Ethiopia, 2015. (n=246)

Variables	Frequency	Percentage
Age in years, median (IQR)*	30 (10)	
Monthly income in Birr, median (IQR)	1000 (1200)	
Sex		
Male	242	98.37
Female	4	1.63
Marital status		
Married	101	41.06
Single	30	12.20
Divorced	102	41.46
Widower	13	5.28
Religion		
Orthodox	170	69.11
Muslim	54	21.95
Protestant	8	3.25
Catholic	14	5.69
Educational status		
Illiterate	17	6.91
Primary (Grade 1-4)	4	1.63
Secondary (Grade 5-10)	121	49.19

	Preparatory & above (Grade 11 & above)	104	42.28
Ethnicity	Tigraway/ti	222	90.24
	Amhara	17	6.91
	Afar	7	2.85

153 * IQR: Inter Quartile Range

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154 **Magnitude of road traffic accidents**

155 Among all the drivers included in this study, 57 (23.17%) had encountered a road traffic accident
 156 in the past two years, from the time of the current study. Most of the accidents happened on
 157 Monday, 22 (38.60%) and Friday, 13 (22.81%) even though accidents were reported in all the
 158 seven days. The causes of the accidents, as reported by the drivers, were mainly due to violation
 159 of traffic law in 22/57 ((38.60%) of the cases. A significant number of the accidents,
 160 25/57 (43.86%) happened at dawn. Pedestrians and Cyclists constituted the major share of the
 161 RTA, 31/57 (54.40%). About two third of the accidents, 43/57 (75.44%) happened at either T-
 162 junction road or cross road (Table 2).

163 Table 2: Characteristics and Setting of RTA in Mekelle City, Northern Ethiopia. 2015. (n=246)

Variables		Frequency	Percentage
Accident occurrence	Yes	57	23.17
	No	189	76.83
Type of accident	Injury	29	50.88
	Injury and Property damage	14	24.56
	Property damage	8	14.0
	Death	6	10.5
Light Condition	At dawn	41	71.93
	Day time	16	28.07
Victim	Pedestrian	19	32.14
	Cyclist	12	21.43
	Passenger	14	25.00
	Driver	12	21.43
Accident site road	T-junction	15	26.32
	Cross Road	28	49.12
	Straight road	14	24.56
Date of accident	Monday	22	38.60

	Tuesday	4	7.02
	Wednesday	6	10.53
	Thursday	3	5.26
	Friday	13	22.81
	Saturday	9	15.79
Number of accidents (life time experience)	1	42	73.68
	2	12	21.05
	3	3	5.26
Reason for the accident	Lack of general safety awareness of pedestrians	10	18.52
	Violation of traffic rules and regulations	22	40.98
	Violation of speed Limit	9	15.73
	Lack of vehicle maintenance	13	24.77

164 Risky driving behaviors

165 Concerning risky driving behaviors, 92 (37.40) of the drivers drunk alcohol before driving. About
 166 43 (17.48%) of the drivers were chat chewers and 30 (12.20%) were smokers. More than one third
 167 of the drivers, 96 (39.02%) reported that they used mobile for communication while driving (Table
 168 3).

169 Table 3: Risky driving behaviors among drivers in Mekelle city, Northern Ethiopia, 2015. (n=246)

Variables		Frequenc y	Percentag e
Mobile use while driving	Yes	96	39.02
	No	150	60.98
Substance use	Alcohol	92	37.40
	Chat	43	17.48
	Cigarette	30	12.20
Seat belt use	Yes	204	82.93
	No	42	17.07

What do you do when another vehicle tries to pass?	I advise him to slow down	32	13.01
	I give him priority	144	58.54
	I speed up	70	28.46
A measure taken when there is heavy traffic	Pass accordingly	3	1.22
	Speed up	16	6.50
	Slow down speed	227	92.28

170 Factors associated with Road Traffic Accidents

171 Multivariable logistic regression analysis

172 Multivariable binary logistic regression showed that drivers who consumed alcohol on driving
 173 were 2.29 times (AOR=2. 29; 95% CI: 1.08-4.85) more likely to have RTA compared to drivers
 174 who did not consume alcohol. Drivers who drove governmental vehicles were 4.16 (AOR=4. 16;
 175 95% CI: 1.48- 11.70) times more likely to have RTA compared to drivers of privately owned
 176 vehicles. As the driver's experience increased by one year, the probability of RTA decreased by
 177 26% (AOR=0. 74; 95% CI: 0.60-0.90) (Table 4).

178 Table 4: Bivariable and multivariable logistic regression of road traffic accident by background
 179 characteristics in Mekelle city, Northern Ethiopia, 2015. (n=246)

Variables		COR(95% CI)	AOR(95% CI)
Age		0.08(0.041, 0.121)*	1.05(0.98, 1.12)
Marital status	Married	0.85(0.348, 2.086)*	1.62(0.60, 4.39)
	Single	0.37 (0.141, 0.972)*	0.94(0.25, 3.45)
	Divorced	1(Ref.)	1(Ref.)
	Widower	2.72(0.711, 10.408)	
Religion	Protestant	1(Ref.)	1(Ref.)
	Orthodox	0.22(0.052, 0.940)*	0.24(0.05, 1.26)
	Muslim	0.45(0.102, 2.059)	
	Catholic	0.55(0.095, 3.245)	
Ethnicity	Afar	1(Ref.)	1(Ref.)
	Amhara	0.12(0.011, 1.195)	

	Tigraway/ti	0.04(0.004, 0.351)*	0.04(0.005, 0.58)*
Vehicle ownership	Private (Driver is employee)	1(Ref.)	1(Ref.)
	Governmental	3.5(1.464, 8.168)*	4.16(1.48, 11.70)*
	Driver (Driver is the owner)	2.38(1.225, 4.660)*	1.64(0.71, 3.339)
License grade	1 st	1(Ref.)	
	3 rd	1.36(0.329, 5.632)	
	4 th	0.55(0.138, 2.241)	
	Special	1.52(0.249, 9.294)	
Alcohol use	No	1(Ref.)	1(Ref.)
	Yes	1.88(1.034, 3.437)*	2.29(1.08, 4.85)*
Substance use other than alcohol	Chat	2.12.(1.010, 4.478)*	2.18(0.78, 6.05)
	Cigarette	2.55(1.105, 5.884)*	1.11(0.39, 3.18)
	I do not use	1(Ref.)	1(Ref.)
Mobile use	No	1(Ref.)	1(Ref.)
	Yes	2.27(1.246, 4.150)*	1.80(0.86, 3.74)
What do you do when another vehicle tries to pass	I advise him to slow down	1(Ref.)	
	I give him priority	2.88(0.952, 8.724)	
	I speed up	1.3(0.38, 4.463)	
Income		1.00(0.999, 1.000)	
Distance travelled		1.00(0.999, 1.005)	
Driver's experience		0.86 (0. 749, 0.999)*	0.74(0.60, 0.90)*
Vehicle service		1.24(1.103, 1.398)*	1.18(0.99, 1.40)

180 *P-value less than 0.05

181 The residuals were checked for influential outlier observations and the result showed that there
 182 were no suspicious influential outlier observations. Hosmer and Lemshow test showed a chi-square
 183 value of 9.41 (p=0. 3085) which is greater than 0.05. The null hypothesis is not to be rejected,
 184 which implies that the model estimates adequately to fit the data at an acceptable level. The area
 185 under ROC curve was 0.7536 (See figure 2). The predicting power of the independent variables
 186 for the dependent variable was 75.36%. Therefore, it can be concluded that the model fits the data
 187 reasonably well.

188 4. Discussion

189 The main aim of the study was to assess the magnitude and determinants of road traffic accidents
190 among drivers in Mekelle city, Tigray, Northern Ethiopia. The study revealed that the magnitude
191 of self-reported RTA in Mekelle city was 23.17%.

192 There was a slight increment of accidents in this study compared to the previous study done in
193 Mekelle city, which showed that the prevalence of road traffic accident was 22% [9]. This variation
194 might be due to the fact that the city is expanding where the population size is increasing. However,
195 it is lower when compared with a similar study conducted among taxi drivers with 4 wheels, of
196 which 26.4% of them reported RTA encounter within the past 3 years [12]. The difference might
197 be due to the differences in the RTAs report period where the current study included reports of
198 RTA in the past 2 years from the time of the study.

199 The study identified that ownership of the vehicles was found to be predictor of road traffic
200 accident. Road traffic accident was 3.78 times more likely among those who drove governmental
201 vehicles. Though literatures did not show supportive or contradicting idea for this finding, this
202 finding might be due to the fact that governmental drivers might violate the traffic rules and use
203 high speed to take their workers to their offices especially at the peak hours.

204 This study revealed that driver behavior on alcohol consumption while driving was found to be an
205 aggravating factor for RTA. Drivers who drive after consuming alcohol was 2.29 more likely to
206 have RTA compared to those who don't drink alcohol. This finding is similar to a similar study
207 which indicated that individuals who drank alcohol were 3.2 times more likely to get road traffic
208 accident [13]. It was also supported by the Great Britain department for Transport provisional
209 estimates for 2013, which showed that between 230 and 290 people, were killed in accidents in

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2
3 210 Great Britain, where at least one driver was over the drink drive limit [14]. This might be due to
4
5 211 the nature of alcohol that has a range of psycho-motor and cognitive effects, including attitude,
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7 212 judgment, vigilance, perception, reaction, and controlling [15]. This can cause an increase in
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9 213 accident risk on reaction times by lowering cognitive processing, coordination, attention, vision
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11 214 and hearing.
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15 215 This study has also revealed that as a driver's experience increases by one year, the probability of
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17 216 getting RTA decreased by 26 percent. This finding was similar to the finding of a study in 2003
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19 217 which showed as the drive miles and experience increases, the probability of self-reported crash
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21 218 was decreased [16]. This might be due to the anticipation of potentially hazardous traffic situations
22
23 219 require years of practice.
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28 220 Mobile usage while driving was significantly associated with RTA. This study is consistent with
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30 221 a previously done study in Mekelle city [12]. This is because of loss of attention to surroundings
31
32 222 while driving. The findings of this study showed that part time and visual impairment were not
33
34 223 found to be a predictor variable for road traffic accident. But a study done in Ibadan town Nigeria
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36 224 showed that drivers who had part time jobs were 2.6 times more likely to have traffic accident [3].
37
38 225 Similarly the study of Ibadan indicated that drivers who had visual impairment were 1.6 times
39
40 226 more likely to have traffic accident [3]. Therefore, this needs further investigation to explain these
41
42 227 relationships.
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48 228 **5. Conclusion**

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51 229 The magnitude of RTA was high. Driving a governmental vehicle and alcohol consumption were
52
53 230 the factors associated with RTA. Monitoring blood alcohol level of drivers should be in place.
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231 Holistic study should be done to identify the causes of RTA. This study may have a role in
232 monitoring the RTAs which is the main public health problem at this time.

233 **6. Disclosure section**

234 **Acknowledgments**

235 We are glad to extend our gratitude to the data collectors and participants of the study. We would like to
236 extend our gratitude to Mekelle University as well for funding the research.

237 **Author contributions**

238 AW and AD conceptualized and designed the study. AW, AD, and TW were involved in data
239 analyses, drafting the manuscript, critically revising the manuscript and final review.

240 **Disclosure statement**

241 No potential conflict of interest was reported by the authors.

242 **Ethics and consent**

243 Ethical clearance and approval was given by Mekelle University, school of public health Ethical
244 Review Committee with the approval number of ERC 0017/2014. Written consent was taken
245 from each participant during the interview. All authors read and approved the final manuscript.

246 **Data availability**

247 The data set of the study findings are available from the corresponding author upon reasonable
248 request.

249 **Funding**

250 This study was funded by Mekelle University for research and community services.

251 **Supplementary Materials**

252 **S1. This is the S1 File questionnaire.** This is the S1 File questionnaire in English version which
253 was used to collect data for this study.

254 **S2. This is the S2 File questionnaire.** This is the S2 File questionnaire in local language
255 (Tigrigna) version which was used to collect data for this study.

256 **Figures**

257 Fig 1. Sampling Procedure. Schematic presentation of the sampling technique

258 Fig 2. ROC curve. Predicting power of the independent variables for the dependent variable

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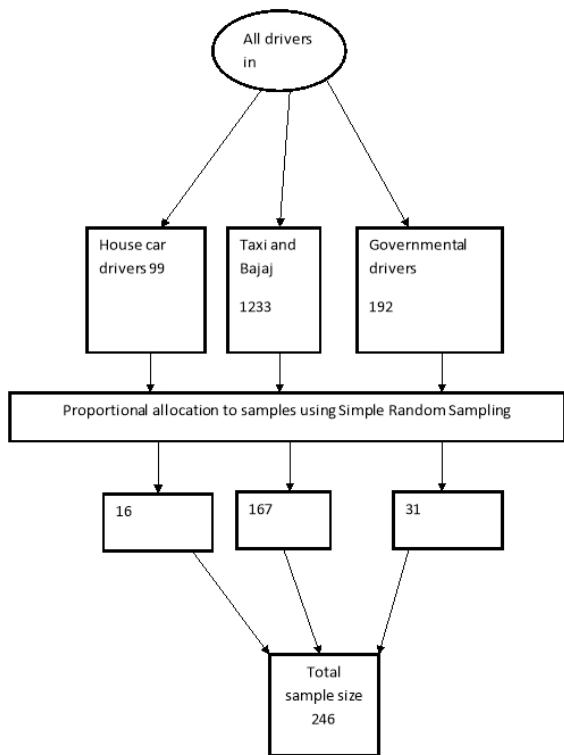


Figure 1: Sampling Procedure. Schematic presentation of the sampling technique.

Schematic presentation of the sampling procedure

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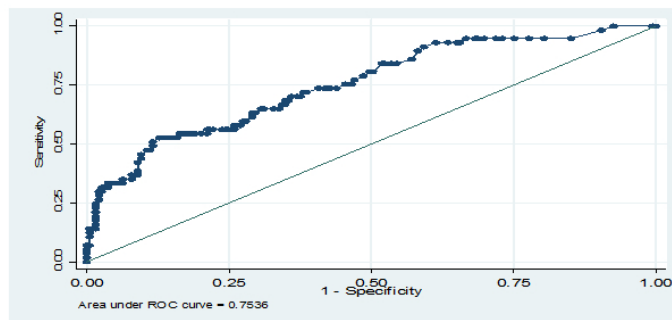


Figure 2: ROC curve. Predicting power of the independent variables for Road Traffic Accident.

ROC curve

69x89mm (300 x 300 DPI)

Supplementary Files

S1 Questionnaire in English Version

I. Questionnaire related to socio-demographic characteristics of drivers

- 1) Age of the driver _____
- 2) Sex of the driver A)Male B)Female
- 3) Marital status A) Married B)Single C)Divorced D)widowed
- 4) Religion of the driver A)Orthodox B)Muslim C)Protestant D)Catholic
- 5) Educational status of the driver A) Illiterate B) 1-4 C) 5-10 D) Greater than grade 10
- 6) Ethnicity A)Tigray B) Amhara C)Oromo D) Others
- 7) Monthly income _____

II. Questionnaire related to determinant factors of road traffic accident

1. What is the type of road mostly you use? A)Gravel B)Asphalt C)Coble stone
2. What kind of vehicle do you drive most often??
A) Automobile B) Minibus C) truck D) Bus E) Liquid Cargo F) Bajaj
3. Vehicle Years of Service/This is the number of years since the date the vehicle is manufactured/ _____
4. What did you tell me about your vehicle insurance A)Insured B)Non-insured/
5. Work experience in years? _____ years
6. To whom does the car belongs to? A)Governmental B) Private employer C)Driver
7. Did you provide service to your car? A.)Yes B) No
8. If yes to the above question how many times per a year? A)1 B)2 C)3 D)4 E)5
9. What is your License grade of driving? A)No License B Special C)1st D)3rd E)4th F)2nd

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2
3 10. Did you use alcohol before or after deriving A.)Yes B) No
4
5
6 11. Which one of the following substance did you use before or after deriving
7
8 A.)Chat B) Cigarette C) Shisha D) Mariwana E) Others
9
10 12. Did you use seat belt while you are driving? A.)Yes B) No
11
12 13. Distance traveled per day_____
- 13
14 14. Have you faced road traffic accident? A.)Yes B) No
15
16 15. If yes what was the day_____
- 17
18 16. What was the Light Condition
19
20 A Day Light B) Dusk C) Dawn D) Night with Light E) Night with Weak Light
21
22 17. What was the reason for the accident
23
24 A. Lack of general safety awareness by pedestrians
25
26 B. Disrespect of traffic rules and regulations
27
28 C. Animal drawn carts and animals frequently using in main highways
29
30 D. Violation of speed Limit
31
32 E. Lack of vehicle maintenance
33
34 F. Others/specify
35
36 18. Who was the victim of your accident A, Pedestrians B, cyclist C, passengers D, Driver
37
38 E)animal
39
40 19. What was the road Junction/ A)T-Shape, B)Cross Road, C)Roundabout/
41
42
43 20. How many accidents did you faced_____
- 44
45 21. Type of accident A)injury B)kill animals C)property damages D)Kill pedestrian
46
47
48 22. What did you do when somebody wants to pass you?
49
50 A) I tend to pass other cars more often than other cars pass me
51
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B) I tend to pass me more often

C) If possible I told him/her to slow down in order to pass

23. What did you do in heavy traffic?

A) Stay with the slower moving traffic

B) Keep up with the faster traffic

C) Both or about equally

24. Have you ever received a ticket, citation, or warning for any traffic violation other than parking a.)yes b) No

25. Did you use mobile while you are driving your vehicle? A.)yes b) No

26. Do you have visual impairment A.)yes b) No

27. While you drive did you limit your speed A.)yes b) No

28. Did you have part time work? A.) yes b) No

29. Did you listen radio? A.) yes b) No

S2 Questionnaire in local language (Tigrigna) Version

I. ውልቃዊ መረዳኢታ ዝምልከቱ ሕቶታት

1. ዕድመ _____

2. ዶታ ሀ) ተባዕታይ ለ) ኣነስታይ

3. ኩነታት ሓዳር ሀ) ዝተመርዓወ/ት ለ) ዘይተመርዓወት ሐ) ዝፈትሐ/ት መ) ሰበይቱ/ሰብኣይ ዝሞቶ/ታ

4. ሃይማኖት ሀ) ክርስትያን ለ) ሙስሊም ሐ) ካቶሊክ መ) ፕሮቴስታንት

5. ደረጃትምህርቲ ሀ) ዘይተምሃረ ለ) ካብ 1ይ-4ይ ሐ) ካብ 5ይ-10ይ መ) ካብ 10ይ ንላዕሊ

6. ዓሌት ሀ) ትግራይ ለ) ኣምሓራ ሐ) ኣሮሞ መ) ዓፋር

7. ወርሐዊ ኢታዊካክንደይ እዩ _____

II. መንቀሊሓደጋት ራፊክዝም ልክቱቶታት

1. መብዛሕትኡ ግዘ እትጓዳዘሉ ዓይነት መንገዲ ሀ) አስፋልቲ ለ) ፀፀር ሐ) ኮብል ስቶን

2. እትዝውራ ዓይነት መኪና ሀ) አውቶሞቢል ለ) ታክሲ ሐ) አውቶቡስ መ) ናይ ረሳሕ ፈሳሲ መጓጓዣ ረ) ባጃጅ

3. ካብ እትስረሐሉ እዋን ጀሚሩ ግልጋሎት እታ መኪና ክንደይ ዓመት እዩ _____

4. ከነታት ኢንፎርጋንስ መኪናኻ እንታይ ይመስል

ሀ) ኢንፎርጋንስ አለዎ ለ) ኢንፎርጋንስ የብላን

5. ስራሕ ልምዶም ክንደይ እዩ _____ ዓመት

6. እዛ መኪና ናይ መን እዩ ሀ) መንግስታዊ ለ) ባዓል ሃፍቲ ሐ) ባዕለይ

7. መኪናኡም ዓመታዊ ፅገና ይገብሩላዮ ሀ) እወ ለ) ኣይገብርን

8. መልሶም እወ እንተኮይኑ ክንደይ ግዘ ሀ) 1 ለ) 2 ሐ) 3 መ) ልዕሊ 4

9. ደረጃ መዘወሪ ፍቓዶም ክንደይ እዩ ሀ) ፍቓድ የብለይን ለ) ፍሉይ ፍቓድ ሐ) 1ይመ) 3ይረ) 4ይ

10. ቅድሚ ምዝዋርም ይኹን ኣብ ዝዝውርሉ እዋን ሰትዮምዶ ይፈልጡ

ሀ) እወ ለ) ኣይፈልጥን

11. ኣብ ክለምግናሕ መኪና ካብዞም ዝስዕቡ ኣይናይ ትጥቀም

ሀ) ጫት ለ) ሽጋራ ሐ) ሸሻ መ) ማሪዋና ረ) ካልእ ይጠቀስ

12. ኣብ ደረቶም ዝግበር ዕጥቂ ይጥቀሙዮ ሀ) እወ ለ) ኣይጥቀምን

13.አብ መዓልቲ ክንደይ ኪሎሜትር ትጓዝ _____

14) ሓደጋ መኪና በዊሑካዶ ይፈልጥ ሀ) እወ ለ) ኣይፈልጥን

15) መልሶም እወ እንተኮይኑ ኣበይናይ መዓልቲ ነይሩ _____

16) ኩነታት መብራህቲ እንታይ ነይሩ ሀ) ድሁር ቀትሪ ለ) ኣጋግዘ

ሐ) ምብራህቲ ኣብ ዘለዎ ምሽት መ) ምሽት ኮይኑ ድኹም መብራህቲ ኣብ ዘለዎ

17.መንቀሊ እቲ ሓደጋ እንታይ እዩ ነይሩ ትብል

ሀ)ሓፈሻዊ ንቕሓት ተጉዳዝቲ ዘይምህላው ለ) ሕጊ ትራፊክ ዋጋ ዘይምህብ ሐ) እቲ ዋና መንገዲ ንእንስሳት መጎዳዳዚ ምውዓል

መ) ፍጥነት መኪና ዘይምሕላው ረ) መኪና ዘይምዕራይ ሰ) ካለእ

18.በቲ ሓደጋ ዝተጠቐሰ ኣካል እንታይ ነይሩ

ሀ) ብእግሩ ዝጓዝ ሰብ ለ) ሳይክል ዘዋሪ ሐ) ተጉዳዚ መ) ዘዋሪ መኪና

19.እቲ እትጓዝሉ ዝነበርካ መንገዲ እንታይ ዓይነት ነይሩ

ሀ) ፕ-ቅርፂ ዘለዎ ለ) መቋረፂ መንገዲ ሐ) ትኽ ዝበለ መንገዲ

20.ክንደይ ሓደጋታት በዊሑም ካይፈልጥ _____

21.ዝበፀሐ ዓይነት ሓደጋ እንታይ ነይሩ

ሀ)መጉዳእቲ ለ)ቅትለት እንስሳ ሐ)ሓደጋ ንብረት መ) ናይ ሰብ ሞት

22.ሓደ በዓል መኪና ከቋርፀካ እንተሎ እንታይ ትገብር

ሀ) ቅድሚ ምሕላፊን ክቕድመን ይመክር ለ) መብዛሕትኡ ግዘ ክሓልፋኒ ይፈቕደለን

ሐ)እንተተካኢሉ ቀስ ኢሉ ንክጓዝ ይመክሮ ::

23. መንገድ አብ ዝተጨናነቐሉ እዋን እንታይ ትገብር

ሀ) ቀስ ኢሉ ክሕልፎ ይፅዕር ለ) ቀልጢፊ ክሓልፍ ይፅዕር ሐ) ዳርጋ ማዕረ

24. ካብ ናይ መዕረፊ መኪና ክፍሊ ትቅብሊት /Parking/ ወፃኢ ብናይ ትራፊክ ሕጊ ዘይምኽባር ተቐባዕነት ትፈልጥ ሀ) እወ

ለ) ኣይፈልጥን

25. ኣብ እተሸከርከረሉ ግዘ ስልኪ/Mobile/ ትጥቀምዶ; ሀ) እወ ለ) ኣይጥቀምን

26. ናይ ምርኣይ ፀገም ዶ ኣለካ ሀ) እወ ኣለኒ ለ) የብለይን

27. ኣብ እትዝውረሉ እዋን ፍጥነት መኪናካ ሓሊካ ዶ ነይርካ

ሀ) እወ ለ) ኣይሓለኩን

28. ትርፌ ሰዓት ትሰርሕ ዶ; ሀ) እወ ይሰርሕ ለ) ኣይሰርሕን

29. ብዛዕባ ትራፊክ ዝምልከቱ ፈነወታት ራዲዮ ትከታተል ዶ

ሀ) እወ ይከታተል ለ) ኣይከታተልን

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

	Reporting Item	Page Number
Title	#1a Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2 Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3 State specific objectives, including any prespecified hypotheses	4
Study design	#4 Present key elements of study design early in the paper	4
Setting	#5 Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Eligibility criteria	#6a Give the eligibility criteria, and the sources and methods of selection of participants.	4
	#7 Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources / measurement	#8 For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6
Bias	#9 Describe any efforts to address potential sources of bias	6
Study size	#10 Explain how the study size was arrived at	6
Quantitative	#11 Explain how quantitative variables were handled in the analyses. If applicable,	7

variables		<i>describe which groupings were chosen, and why</i>	
1			
2	Statistical methods	#12a Describe all statistical methods, including those used to control for confounding	7
3			
4		#12b Describe any methods used to examine subgroups and interactions	7
5			
6		#12c Explain how missing data were addressed	N/A
7			
8		#12d If applicable, describe analytical methods taking account of sampling strategy	N/A
9			
10		#12e Describe any sensitivity analyses	N/A
11			
12	Participants	#13a Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	<i>n/a there were no stages and study was not on patients</i>
13			
14		#13b Give reasons for non-participation at each stage	<i>n/a</i>
15			
16		#13c Consider use of a flow diagram	6
17			
18	Descriptive data	#14a Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
19			
20		#14b Indicate number of participants with missing data for each variable of interest	N/A
21			
22	Outcome data	#15 Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	11
23			
24	Main results	#16a Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
25			
26		#16b Report category boundaries when continuous variables were categorized	N/A
27			
28		#16c If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	<i>n/a estimates were for odds ratio</i>
29			
30	Other analyses	#17 Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	12
31			
32	Key results	#18 Summarise key results with reference to study objectives	7- 12
33			
34	Limitations	#19 Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	3
35			
36	Interpretation	#20 Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	13
37			
38	Generalisability	#21 Discuss the generalisability (external validity) of the study results	15
39			
40	Funding	#22 Give the source of funding and the role of the funders for the present study and, if	15
41		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
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applicable, for the original study on which the present article is based

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Magnitude and determinants of road traffic accidents in Mekelle city, Tigray, Northern Ethiopia: A cross sectional study

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3 **1 Magnitude and determinants of road traffic accidents in Mekelle city, Tigray,**
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6 **2 Northern Ethiopia: A cross sectional study**
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24 **Abstract**

25 **Objective:** This study aimed to assess the magnitude and determinants of Road Traffic Accidents
26 (RTAs) in Mekelle City, Northern Ethiopia.

27 **Methods:** A cross-sectional study was done using a simple random sampling technique.

28 **Setting:** The study was done in Mekelle city from Feb to Jun 2015.

29 **Participants:** The study was done among drivers settled in Mekelle city.

30 **Main outcome measures:** The main outcome measure was occurrence of Road Traffic Accident
31 within two years. A binary logistic regression was used to identify factors associated with RTA.

32 **Results:** The magnitude of RTA was found to be 23.17%. According to the drivers' perceived
33 cause of the accident, 22 (38.60%) of the accident was due to violation of traffic rules and
34 regulations. The majority of the victims were pedestrians, 19 (33.33%). Drivers who were driving
35 a governmental vehicle were 4.16 (AOR=4.16; 95% CI: 1.48- 11.70) times more likely to have
36 RTA compared to those who drive private vehicles. Drivers who used alcohol were 2.29
37 (AOR=2.29; 95% CI: 1.08-4.85) times more likely to have RTA compared to those drivers who
38 did not consume alcohol.

39 **Conclusion:** Magnitude of RTA was high. Driving a governmental vehicle and alcohol use during
40 driving were the factors associated with RTA. Monitoring blood alcohol level of drivers should be
41 in place. Holistic study should be done to identify the causes of RTAs.

42 **Keywords**

43 Road Traffic Accident; Drivers; Mekelle city; Tigray; Ethiopia

44 **Strength and Limitation**

- 45 ➤ Data quality was assured under close supervision of the principal investigators.
- 46 ➤ Appropriate statistical methods were used to present the findings of the study.
- 47 ➤ Cross sectional study design does not allow establishing causality.
- 48 ➤ The analysis of this study misses some important variables like quality of the vehicles
49 and road safety.
- 50 ➤ There may be recall bias on the RTA occurrences.

51 **1. Introduction**

52 Road Traffic Accident (RTA) is an accident which occurs or originates on a way or street open to
53 public traffic; resulting in one or more persons being killed or injured, and at least one moving
54 vehicle is involved. RTA includes collisions between vehicles, vehicles and pedestrians and
55 vehicles and animals or fixed obstacles [1]. RTA contributes to poverty by causing loss of
56 productivity, material damage, injuries, disabilities, grief and deaths [2]. Deaths and injuries
57 resulting from road traffic crashes remain a serious problem globally and current trends suggest
58 that this will continue to be the case in the foreseeable future [3, 4].

59 Approximately 1.3 million people die each year in traffic-related accidents worldwide [5]. Road
60 traffic injury is now the leading cause of death for children and young adults aged 5–29 years,
61 signaling a need for a shift in the current child health agenda. It is the eighth leading cause of death
62 for all age groups exceeding HIV/AIDS, tuberculosis and diarrheal diseases [6] and the deaths due
63 to RTAs are predicted to become the 5th leading cause of death by the year 2020 [5].

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3 64 The burden of road traffic injuries and deaths is disproportionately borne by vulnerable road users
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5 65 and those living in low- and middle-income countries, where the growing number of deaths is
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7 66 fuelled by transport that is increasingly motorized. Between 2013 and 2016, no reductions in the
8
9 67 number of road traffic deaths were observed in any low-income country [2]. Although road
10
11 68 infrastructures have a significant role in the occurrence of RTA, the human factor is the most
12
13 69 prevalent contributing factor of RTAs. This includes both driving behavior (e.g., drinking and
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15 70 driving, speeding, traffic law violations) and impaired skills (e.g. lack of attention, exhaustion,
16
17 71 physical disabilities and so on) [7]. The United Nations (UN) has planned on achieving Sustainable
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19 72 Development Goal (SDG) target 3.6 calls for a reduction in the number of deaths by half by 2020
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21 73 [8].
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27 74 Poor conditions of quality of vehicles and less road safety are determinant factors for RTA in
28
29 75 Africa [9] including Ethiopia [10]. World Health Organization (WHO) in 2011 reported that RTA
30
31 76 in Ethiopia reached 22,786 which accounted for 2.77% of all the deaths. The report showed that
32
33 77 RTA is the 9th killer health problem in the country. Road traffic accident makes Ethiopia 12th and
34
35 78 9th in the world and in Africa respectively [11]. Mekelle is a fast growing regional city, which has
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37 79 a heavy traffic flow, especially during peak hours [12]. In Mekelle city, it was reported that road
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39 80 traffic accidents is increasing from year to year and it was shown that 96% of the causes were
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41 81 related to human risky behavior whereas 4% was due to vehicle related factors [13]. However,
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43 82 despite the growing magnitude of RTAs in the city, there is paucity of data on determinants of
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45 83 RTAs among drivers. Hence, this study was conducted to assess the magnitude and determinants
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47 84 of RTAs among drivers in Mekelle city, Tigray, Ethiopia. This study will have a significant role
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49 85 in supplementing and informing the current status in achieving the SDG 3.6 UN target.
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86 2. Methods

87 Study setting

88 The study was conducted among drivers in Mekelle city, Tigray, northern Ethiopia from Feb to
89 Jun 2015. Mekelle is the capital city of the Tigray regional state which is found at 783 Km north
90 of the capital city of Ethiopia, Addis Ababa. Regarding road infrastructure: Mekelle city has 55
91 km asphalted, 23 km cobble stone and 152 km gravel road [14].

92 Study design

93 A cross-sectional study design was used.

94 Participants

95 All drivers who were based in Mekelle city with a legal driving license and who were driving taxi,
96 Bajaj (three wheel taxi), private owned car and governmental car in Mekelle city were included in
97 the study. Heavy truck drivers, drivers who were not working and sick during the study period,
98 those who drive more than two vehicle types and those who came from other areas to Mekelle city
99 were excluded from the study.

100 The sample size was calculated from a previous study, where the prevalence of road traffic accident
101 was reported, $p=22\%$ in Mekelle city [13]. Using 5% marginal error and 95% confidence interval
102 by the following formula:

$$103 n = (Z_{\alpha/2})^2 P (P-1)/D^2$$

104 Where n = Minimum sample size required

105 Z = Standard score corresponding to 95% confidence interval

106 P = Assumed proportion of drivers

107 D = Margin of error (precision) 5%

$$108 n = 3.84 \times 0.1716/0.0025 = 263$$

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3 109 Since the source population was less than 10,000(i.e. 1500), sample size correction formula was
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5 110 used:

$$n_f = n / (1 + (n/N))$$

Where n_f = desired sample size

n = calculated sample size

N = total population

$$n_f = n / (1 + (n/N)) = 263 / (1 + (263/1500)) = 263 / 1.175 = 223.8 \sim 224$$

By adding 10% contingency for non-response, the sample size was $224 + 22 = 246$

117 **Sampling procedures**

118 A sampling frame was constructed by a vehicle plate number, which was obtained from Mekelle
119 city transport office. The frame was sub categorized based on the type of the vehicle as a taxi,
120 Bajaj, governmental vehicles, and private/house vehicles. Sub samples were calculated for each
121 category of vehicles proportional to the number of vehicles in the respective categories. Then,
122 study subjects were selected using simple random sampling method (see Figure 1).

123 **Data collection procedures and tools**

124 The study subjects (drivers) were traced and interviewed for data collection. The drivers were
125 traced at their destination for taxi and Bajaj, house cars in their working area and governmental
126 cars at their offices using the car plate number. A structured interviewer administered
127 questionnaire, adapted from different literatures, was used. The questionnaire was initially
128 prepared in English and was translated into the local language Tigrigna. The instrument included:
129 socio-demographic characteristics of drivers, risky behaviors factors and other variables which has
130 a bearing on RTA. Trained data collectors and supervisors handled the data collection process.

131 **Patient and Public Involvement**

132 Drivers in Mekelle city were involved in the study.

133 **Data Quality Control**

134 Pre-test was done on 5% of the sample at Adigrat town, Tigray region. Based on the pretest
135 findings, necessary corrections were made to the questionnaire. Adequate supervision was
136 undertaken by the supervisors and principal investigator during the data collection. Daily spot-
137 checking of the filled questionnaires for errors or any incompleteness was done by the supervisors
138 and the principal investigator.

139 **Data management and analysis**

140 The collected data were entered and cleaned in Microsoft excel 2007. Then, the data were exported
141 and analyzed using STATA version 12. Values of categorical variables were presented as
142 frequencies and percentages. All statistical tests were performed at the 5% significance level.

143 The dependent variable was a Road Traffic Accident (RTA) which was dichotomized into Yes
144 (labeled “1”) and No (labeled “0”). Each independent variable was cross tabulated with the
145 outcome variable and variables which showed significant association were further entered into the
146 bivariate binary logistic regression. Finally, variables significant in the bivariate analysis were
147 entered into multivariable binary logistic regression analysis to identify determinants of RTA. The
148 final model was developed using a step-wise logistic regression.

149 The confounding effect of the explanatory variables was checked using forward and backward
150 elimination techniques and any variable above 20% change of coefficient was considered as a
151 confounder. Multi-collinearity was checked using Variance Inflation Factor (VIF) at a cutoff value
152 of 10. Variables with greater than 10 VIF value were handled by removing the most inter-

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3 153 correlated variable(s) from the model and substitute their cross product as an interaction term.
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5 154 Final model fitness was checked using the Hosmer-Lemshew method. Receiver Operating
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8 155 Characteristic (ROC) curve was used to show how much the independent variables in the final
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10 156 model predicted the dependent variable.
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14 157 **3. Results**

158 **Socio-demographic characteristics of the respondents**

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20 159 The response rate was 100%. The median (IQR) age of the respondents was 30 (10) years. The
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22 160 majority of study participants (98.37%) were males. Regarding the marital status of the
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24 161 respondents, 102 (41.46%), 101(41.06%), 30 (12.20%) and 13 (5.28%) were divorced, married,
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26 162 single and widower respectively. The majority of the drivers, 170 (69.11%) were Christian
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29 163 Orthodox, followed by Muslims, 54 (21.95%). With regard to their educational status, 225
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31 164 (91.46%) had attained at least grade 5. The median (IQR) monthly income (in Birr) of the study
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33 165 participants was 1000 (1200) (Table 1).
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175 Table 1: Socio-demographic and economic characteristics of drivers in Mekelle city, Northern
 176 Ethiopia, 2015. (n=246)

Variables	Frequency	Percentage
Age in years, median (IQR)*	30 (10)	
Monthly income in Birr, median (IQR)	1000 (1200)	
Sex		
Male	242	98.37
Female	4	1.63
Marital status		
Married	101	41.06
Single	30	12.20
Divorced	102	41.46
Widowed	13	5.28
Religion		
Orthodox	170	69.11
Muslim	54	21.95
Protestant	8	3.25
Catholic	14	5.69
Educational status		
Illiterate	17	6.91
Primary (Grade 1-4)	4	1.63
Secondary (Grade 5-10)	121	49.19
Preparatory & above (Grade 11 & above)	104	42.28
Ethnicity		
Tigraway/ti	222	90.24
Amhara	17	6.91
Afar	7	2.85

177 * IQR: Inter Quartile Range

178 **Magnitude of RTAs**

179 Among all the drivers, 57 (23.17%) had encountered road traffic accident in the past two years
 180 from the time of the current study. Most of the accidents happened on Monday, 22 (38.60%) and
 181 Friday, 13 (22.81%) even though accidents were reported in all the seven days. The causes of the
 182 accidents, as reported by the drivers, were mainly due to violation of traffic law in 22/57 ((38.60%)
 183 of the cases. A significant number of the accidents, 25/57 (43.86%) happened at dawn. Pedestrians
 184 and Cyclists constituted the major share of the RTA victims, 31/57 (54.40%). About two third of
 185 the accidents, 43/57 (75.44%) happened at either T-junction road or cross road (Table 2).

186 Table 2: Characteristics and Setting of RTA in Mekelle City, Northern Ethiopia. 2015. (n=246)

Variables	Frequency	Percentage
Accident experience in the previous 2 years	Yes	57
	No	189
Type of accident	Injury	29
	Injury and Property damage	14
	Property damage	8
	Death	6
Light Condition	At dawn	41
	Day time	16
Victim	Pedestrian	19
	Cyclist	12
	Passenger	14
	Driver	12
Accident site road	T-junction	15
	Cross Road	28
	Straight road	14
Day of accident	Monday	22
	Tuesday	4

	Wednesday	6	10.53
	Thursday	3	5.26
	Friday	13	22.81
	Saturday	9	15.79
Number of accidents (life time experience)	1	42	73.68
	2	12	21.05
	3	3	5.26
Reason for the accident	Lack of general safety awareness of pedestrians	10	18.52
	Violation of traffic rules and regulations	22	40.98
	Violation of speed Limit	9	15.73
	Lack of vehicle maintenance	13	24.77

187

188 Risky driving behaviors

189 Concerning risky driving behaviors, 92 (37.40) of the drivers drunk alcohol before driving. About
 190 43 (17.48%) of the drivers were chat chewers and 30 (12.20%) were smokers. More than one third
 191 of the drivers, 96 (39.02%) ever reported that they used cell phone for communication while
 192 driving. The prevalence of RTA among drivers was 3.29%, 32.6%, 36.7%, 18.5% and 21.6%
 193 among cell phone users, alcohol consumers, chat chewers, cigarette smokers and seat belt users
 194 while driving respectively. However, the prevalence of RTA among the drivers who do not use
 195 cell phone and seat belt were 17.33% and 30.9% respectively (Table 3).

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199 Table 3: Risky driving behaviors among drivers in Mekelle city, Northern Ethiopia, 2015. (n=246)

Variables		RTA		Frequency	Percentage	P-Value
		Yes n (%)	No n (%)			
Cell phone use while driving	Yes	31(32.29)	65(67.71)	96	39.02	0.007
	No	26(17.33)	124(82.67)	150	60.98	
Substance use	Alcohol	14(32.6)	29(67.4)	92	37.40	0.026
	Chat	11(36.7)	19(63.3)	43	17.48	
	Cigarette	32(18.5)	141(81.5)	30	12.20	
Seat belt use	Yes	44(21.6)	160(78.4)	204	82.93	0.189
	No	13(30.9)	29(69.0)	42	17.07	
What do you do when another vehicle tries to pass?	I advise him to slow down	4(12.5)	28(87.5)	32	13.01	0.028
	I give him priority	42(29.2)	102(70.8)	144	58.54	
	I speed up	11(15.71)	59(84.29)	70	28.46	
A measure taken when there is heavy traffic	Pass accordingly	49(21.59)	178(78.41)	3	1.22	0.069
	Speed up	6(37.50)	10(62.50)	16	6.50	
	Slow down	2(66.67)	1(33.33)	227	92.28	
Road Type	Gravel	5(16.7)	25(83.3)	30	12.2	0.117
	Asphalt	39(28.1)	100(71.9)	77	31.3	
	Cobble stone	13(16.9)	64(83.1)	139	56.5	

200 **Factors associated with Road Traffic Accidents**

201 In the bivariate analysis age, being married, being single, driving governmental vehicle, alcohol
 202 use, other substances other than alcohol use, cell phone use during driving, drivers' years of
 203 experience and vehicle service were significantly associated with RTAs at 95% CI.

204 Multivariable binary logistic regression analysis showed that drivers who drove after consuming
 205 alcohol were 2.29 (AOR=2. 29; 95% CI: 1.08-4.85) times more likely to have RTA compared to
 206 drivers who did not consume alcohol. Drivers who drove governmental vehicles were
 207 4.16 (AOR=4. 16; 95% CI: 1.48- 11.70) times more likely to have RTA compared to drivers of
 208 privately owned vehicles. As the driver's experience increased by one year, the probability of RTA
 209 decreased by 26% (AOR=0. 74; 95% CI: 0.60-0.90) (Table 4).

210 Table 4: Multivariable regression analysis of RTA in Mekelle city, Northern Ethiopia, 2015.
 211 (n=246)

Variables		COR(95% CI)	AOR(95% CI)
Age		0.08(0.041, 0.121)*	1.05(0.98, 1.12)
Marital status	Married	0.85(0.348, 2.086)*	1.62(0.60, 4.39)
	Single	0.37 (0.141, 0.972)*	0.94(0.25, 3.45)
	Divorced	1(Ref.)	1(Ref.)
	Widower	2.72(0.711, 10.408)	
Religion	Protestant	1(Ref.)	1(Ref.)
	Orthodox	0.22(0.052, 0.940)*	0.24(0.05, 1.26)
	Muslim	0.45(0.102, 2.059)	
	Catholic	0.55(0.095, 3.245)	
Ethnicity	Afar	1(Ref.)	1(Ref.)
	Amhara	0.12(0.011, 1.195)	
	Tigray/ti	0.04(0.004, 0.351)*	0.04(0.005, 0.58)*
Vehicle ownership	Private (Driver is employee)	1(Ref.)	1(Ref.)

	Governmental	3.5(1.464, 8.168)*	4.16(1.48, 11.70)*
	Driver (Driver is the owner)	2.38(1.225, 4.660)*	1.64(0.71, 3.339)
License grade	1 st	1(Ref.)	
	3 rd	1.36(0.329, 5.632)	
	4 th	0.55(0.138, 2.241)	
	Special	1.52(0.249, 9.294)	
Alcohol use	No	1(Ref.)	1(Ref.)
	Yes	1.88(1.034, 3.437)*	2.29(1.08, 4.85)*
Substance use other than alcohol	Chat	2.12.(1.010, 4.478)*	2.18(0.78, 6.05)
	Cigarette	2.55(1.105, 5.884)*	1.11(0.39, 3.18)
	I do not use	1(Ref.)	1(Ref.)
Cell phone use while driving	No	1(Ref.)	1(Ref.)
	Yes	2.27(1.246, 4.150)*	1.80(0.86, 3.74)
What do you do when another vehicle tries to pass	I advise him to slow down	1(Ref.)	
	I give him priority	2.88(0.952, 8.724)	
	I speed up	1.3(0.38, 4.463)	
Income		1.00(0.999, 1.000)	
Distance travelled		1.00(0.999, 1.005)	
Driver's experience		0.86 (0. 749, 0.999)*	0.74(0.60, 0.90)*
Vehicle service		1.24(1.103, 1.398)*	1.18(0.99, 1.40)

212 *P-value less than 0.05

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3 213 The residuals were checked for influential outlier observations and the result showed that there
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5 214 were no suspicious influential outlier observations. Hosmer and Lemeshow test showed a chi-
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8 215 square value of 9.41 ($p=0.3085$) which is greater than 0.05. The null hypothesis is not to be
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10 216 rejected, which implies that the model estimates adequately to fit the data at an acceptable
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12 217 level. The area under ROC curve was 0.7536 (See figure 2). The predicting power of the
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14 218 independent variables for the dependent variable was 75.36%. Therefore, it can be concluded that
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16 219 the model fits the data reasonably well. No confounding factor was found.
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20 220 **4. Discussion**

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24 221 The main aim of the study was to assess the magnitude and determinants of road traffic accidents
25
26 222 among drivers in Mekelle city, Tigray, Northern Ethiopia. The study revealed that the magnitude
27
28 223 of self-reported RTA in Mekelle city was 23.17%. There was a slight increment of accidents in
29
30 224 this study compared to the previous study done in Mekelle city, which showed that the prevalence
31
32 225 of RTA was 22% [12]. However, it is lower when compared with a similar study conducted in the
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34 226 same city among taxi drivers with 4 wheels, of which 26.4% of them reported RTA encounter
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36 227 within the past 3 years [15]. This variation might be due to the fact that the city is expanding where
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38 228 the population size is increasing. Or it might be due to the differences in the RTAs report period
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40 229 where the current study included reports of RTA in the past 2 years from the time of the study.
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46 230 The study identified that ownership of the vehicles was found to be predictor of RTA. Road traffic
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48 231 accident was 3.78 times more likely among those who drove governmental vehicles. Though
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50 232 literatures did not show supportive or contradicting idea for this finding, this might be due to the
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52 233 fact that governmental drivers might violate the traffic rules and speed up to arrive timely at
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54 234 workplace especially at the peak hours.
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3 235 This study revealed that driving after taking alcohol was found to be an aggravating factor for
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5 236 RTA. Drivers who drove after consuming alcohol were 2.29 more likely to have RTA compared
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8 237 to those who don't consume alcohol. This finding is similar to a similar study which showed that
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10 238 individuals who drank alcohol were 3.2 times more likely to encounter RTA [16]. It was also
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12 239 supported by the Great Britain department for Transport provisional estimates for 2013 which
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14 240 showed that between 230 and 290 people were killed in accidents in Great Britain where at least
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16 241 one driver was over the drink drive limit [17]. Another study also showed that impairments from
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18 242 alcohol was associated with traffic accident of crashes and deaths [18, 19]. This might be due to
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20 243 the nature of alcohol that has a range of psycho-motor and cognitive effects, including attitude,
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22 244 judgment, vigilance, perception, reaction, and controlling [20]. This can increase accident risk by
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24 245 lowering cognitive processing, coordination, attention, vision and hearing.
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29 246 This study has also revealed that as driver's experience increases by one year, the probability of
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31 247 getting RTA decreased by 26 percent. This finding was similar to the finding of a study in 2003
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33 248 which showed that as the drive miles and experience increases, the probability of self-reported
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35 249 crash decreased [21]. This might be due to the anticipation of potentially hazardous traffic
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37 250 situations which require years of practice.
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41 251 The likelihood of RTA was 1.8 times higher among drivers who used cell phone while driving
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43 252 compared to these who do not use. This study is consistent with a previously done study in Mekelle
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45 253 city [15]. Other studies have also reported that drivers distracted by mobile devices such as
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47 254 smartphones and/ or other in-vehicle devices are at risk for a serious negative outcomes [22- 24].
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49
50 255 A similar study indicated that telephone use while driving increases the likelihood of RTA/ crash
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52 256 by a factor of four, while texting by around 23 times [25]. This is because of loss of attention to
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54 257 surroundings while driving.
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3 258 The findings of this study showed visual impairment was not found to be a predictor variable for
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5 259 RTA. But a study done in Ibadan town Nigeria showed that drivers who had visual impairment
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8 260 were 1.6 times more likely to encounter RTA [26]. Therefore, this needs further investigation.
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11 261 The strength of this study is that data quality was assured under close supervision of the principal
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13 262 investigators during both data entry and data collection time. Appropriate statistical methods were
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15 263 used to present the findings of the study. Despite this strength, the study have certain limitations.
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17 264 Due to cross-sectional study design nature, establishing causality is not possible. In addition to
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19 265 that, there may be recall bias and the analysis of this study misses some important variables like
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21 266 quality of the vehicles and road safety.
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24 25 267 **Conclusion** 26 27

28
29 268 The magnitude of RTA was high. Driving a governmental vehicle and alcohol consumption were
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31 269 the factors associated with RTA. Monitoring blood alcohol level of drivers should be in place.
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33 270 Holistic study should be done to identify the causes of RTA.
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36 37 38 271 **5. Disclosure section** 39 40

41 272 **Acknowledgments** 42

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44 273 We are glad to extend our gratitude to the data collectors and participants of the study. We would like to
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46 274 extend our gratitude to Mekelle University as well for funding the research.
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275 **Author contributions**

276 AW conceptualized and designed the study, involved in data analyses, acquisition of data,
277 tabulating the data, interpretation of data, preparing tables and figures, and critically revising the
278 manuscript. AD and TW have involved in interpretation of data, supervision, administration,
279 drafting the initial manuscript, and critically revising the manuscript. AD have primary
280 responsibility for final content and involved in final review. All authors read and approved the
281 final manuscript.

282 **Disclosure statement**

283 No potential conflict of interest was reported by the authors.

284 **Ethics and consent**

285 Ethical clearance and approval was given by Mekelle University, school of public health Ethical
286 Review Committee with the approval number of ERC 0017/2014. Written consent was taken
287 from each participant during the interview. All authors read and approved the final manuscript.

288 **Data availability**

289 The data set of the study findings are available from the corresponding author upon reasonable
290 request.

291 **Funding**

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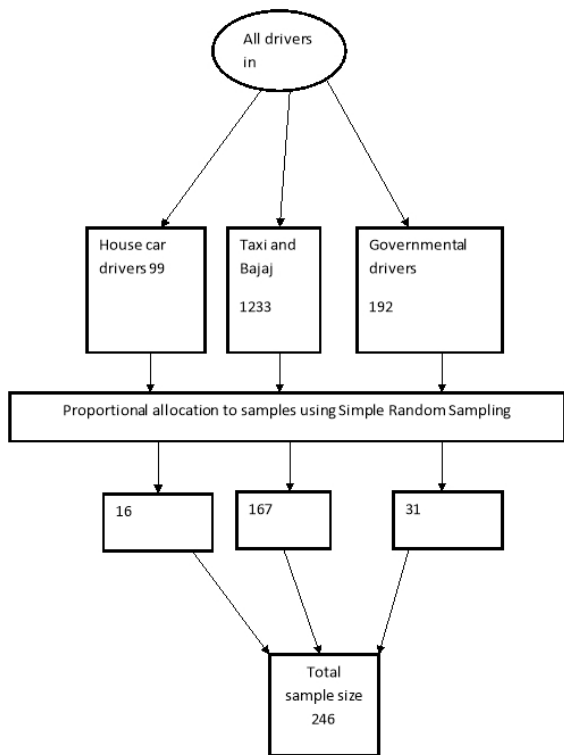


Figure 1: Sampling Procedure. Schematic presentation of the sampling technique.

Fig 1

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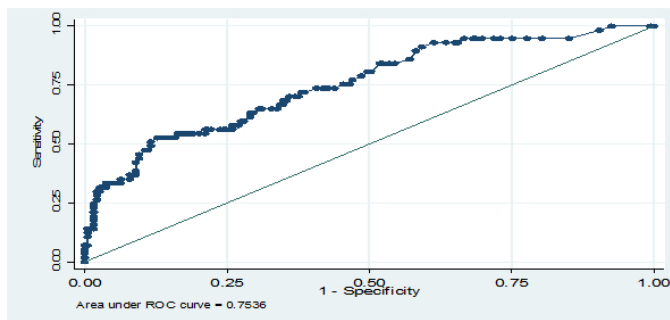


Figure 2: ROC curve. Predicting power of the independent variables for Road Traffic Accident.

Fig 2

69x89mm (300 x 300 DPI)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

	Reporting Item	Page Number
Title	#1a Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2 Explain the scientific background and rationale for the investigation being reported	4
Objectives	#3 State specific objectives, including any prespecified hypotheses	4
Study design	#4 Present key elements of study design early in the paper	5
Setting	#5 Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Eligibility criteria	#6a Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7 Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources / measurement	#8 For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6

1	Bias	#9	Describe any efforts to address potential sources of bias	6
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3	Study size	#10	Explain how the study size was arrived at	6
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5	Quantitative	#11	Explain how quantitative variables were handled in the analyses. If applicable,	7
6	variables		describe which groupings were chosen, and why	
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9	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7
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11		#12b	Describe any methods used to examine subgroups and interactions	7
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13		#12c	Explain how missing data were addressed	N/A
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15		#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
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17		#12e	Describe any sensitivity analyses	N/A
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19	Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for exposed and unexposed groups if applicable.	n/a there were no stages and study was not on patients
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21		#13b	Give reasons for non-participation at each stage	n/a
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23		#13c	Consider use of a flow diagram	6
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25	Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
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27		#14b	Indicate number of participants with missing data for each variable of interest	N/A
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29	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	13
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31	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13
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33		#16b	Report category boundaries when continuous variables were categorized	N/A
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35		#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a estimates were for odds ratio
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1	Key results	#18	Summarise key results with reference to study objectives	8- 15
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7	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity	15-17
8			of analyses, results from similar studies, and other relevant evidence.	
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11	Generalisability	#21	Discuss the generalisability (external validity) of the study results	17
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13	Funding	#22	Give the source of funding and the role of the funders for the present study and, if	18
14			applicable, for the original study on which the present article is based	
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Magnitude and determinants of road traffic accidents in Northern Ethiopia: A cross sectional study

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Keywords:	Road Traffic Accident, Drivers, Mekelle city, Tigray, Ethiopia

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Magnitude and determinants of road traffic accidents in Northern Ethiopia: A cross sectional study

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24 **Abstract**

25 **Objective:** This study aimed to assess the magnitude and determinants of Road Traffic Accidents
26 in Mekelle City, Northern Ethiopia.

27 **Methods:** A cross-sectional study was done using a simple random sampling technique.

28 **Setting:** The study was done in Mekelle city from Feb to Jun 2015.

29 **Participants:** The study was done among drivers settled in Mekelle city.

30 **Main outcome measures:** The main outcome measure was occurrence of Road Traffic Accident
31 within two years. A binary logistic regression was used to identify factors associated with RTA.

32 **Results:** The magnitude of RTA was found to be 23.17%. According to the drivers' perceived
33 cause of the accident, 22 (38.60%) of the accident was due to violation of traffic rules and
34 regulations. The majority of the victims were pedestrians, 19 (33.33%). Drivers who were driving
35 a governmental vehicle were 4.16 (AOR=4.16; 95% CI: 1.48- 11.70) times more likely to have
36 RTA compared to those who drive private vehicles. Drivers who used alcohol were 2.29
37 (AOR=2.29; 95% CI: 1.08-4.85) times more likely to have RTA compared to those drivers who
38 did not consume alcohol.

39 **Conclusion:** Magnitude of reported Road Traffic Accident was high. Violation of traffic laws,
40 lack of vehicle maintenance and lack of general safety awareness on pedestrians were the dominant
41 reported causes of RTAs. Driving a governmental vehicle and alcohol consumption were the
42 factors associated with RTA. Monitoring blood alcohol level of drivers and regular awareness to
43 the drivers should be in place. Holistic study should be done to identify the causes of RTAs.

44 **Keywords:** Road Traffic Accident; Drivers; Mekelle city; Tigray; Ethiopia

Strength and Limitation

- Data quality was assured under close supervision of the principal investigators.
- Appropriate statistical methods were used to present the findings of the study.
- Cross sectional study design does not allow establishing causality.
- The analysis of this study misses some important variables like quality of the vehicles and road safety.
- There may be recall bias on the Road Traffic Accidents (RTAs) occurrences.

1. Introduction

Road Traffic Accident (RTA) is an accident which occurs or originates on a way or street open to public traffic; resulting in one or more persons being killed or injured, and at least one moving vehicle is involved. RTA includes collisions between vehicles, vehicles and pedestrians and vehicles and animals or fixed obstacles [1]. RTA contributes to poverty by causing loss of productivity, material damage, injuries, disabilities, grief and deaths [2]. Deaths and injuries resulting from road traffic crashes remain a serious problem globally and current trends suggest that this will continue to be the case in the foreseeable future [3, 4]. Road Traffic Accidents is the major cause of economic loss globally. The total costs to public services identified as follows: Older drivers, £63 million. (£10,000 per fatality); People driving for work, £702 million (£700,000 per fatality); Motorcyclists, £1.1 billion (£800,000 per fatality) and young drivers, £1.3 billion (£1.1 Million per fatality) [5].

Approximately 1.3 million people die each year in traffic-related accidents worldwide [6]. Road traffic injury is now the leading cause of death for children and young adults aged 5–29 years, signaling a need for a shift in the current child health agenda. It is the eighth leading cause of death

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3 67 for all age groups exceeding HIV/AIDS, tuberculosis and diarrheal diseases [7] and the deaths due
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5 68 to RTAs are predicted to become the 5th leading cause of death by the year 2020 [6].
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9 69 The burden of road traffic injuries and deaths is disproportionately borne by vulnerable road users
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11 70 and those living in low- and middle-income countries, where the growing number of deaths is
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13 71 fuelled by transport that is increasingly motorized. Between 2013 and 2016, no reductions in the
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15 72 number of road traffic deaths were observed in any low-income country [2]. Although road
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17 73 infrastructures have a significant role in the occurrence of RTA, the human factor is the most
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19 74 prevalent contributing factor of RTAs. This includes both driving behavior (e.g., drinking and
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21 75 driving, speeding, traffic law violations) and impaired skills (e.g. lack of attention, exhaustion,
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23 76 physical disabilities and so on) [8].
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28 77 Poor conditions of quality of vehicles and less road safety are determinant factors for RTA in
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30 78 Africa [9] including Ethiopia [10]. World Health Organization (WHO) in 2011 reported that RTA
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32 79 in Ethiopia reached 22,786 which accounted for 2.77% of all the deaths. The report showed that
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34 80 RTA is the 9th killer health problem in the country. Road traffic accident makes Ethiopia 12th and
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36 81 9th in the world and in Africa respectively [11]. Mekelle is a fast growing regional city, which has
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38 82 a heavy traffic flow, especially during peak hours [12]. In Mekelle city, it was reported that road
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40 83 traffic accidents is increasing from year to year and it was shown that 96% of the causes were
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42 84 related to human risky behavior whereas 4% was due to vehicle related factors [12, 13]. However,
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44 85 despite the growing magnitude of RTAs in the city, there is paucity of data on determinants of
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46 86 RTAs among drivers. In addition, to that the study can have significant role to fill the lack of data
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48 87 as there is lack of reliable data although it is a serious problem in most of the developing countries
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50 88 [14]. Hence, this study was conducted to assess the magnitude and determinants of RTAs among
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52 89 drivers in Mekelle city, Tigray, Ethiopia. This study can have a significant role in supplementing
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3 90 and informing the current status in achieving the United Nations (UN) SDG 3.6 for a reduction in
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5 91 the number of deaths by half by 2020 [15].
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10 92 **2. Methods**

13 93 **Study setting**

16 94 The study was conducted among drivers in Mekelle city, Tigray, northern Ethiopia from Feb to
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18 95 Jun 2015. Mekelle is the capital city of the Tigray regional state which is found at 783 Km north
19
20 96 of the capital city of Ethiopia, Addis Ababa. Regarding road infrastructure: Mekelle city has 55
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22 97 km asphalted, 23 km cobble stone and 152 km gravel road [16].
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25 98 **Study design**

28 99 A cross-sectional study design was used.
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30 100 **Participants**

33 101 All drivers who were based in Mekelle city with a legal driving license and who were driving taxi,
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35 102 Bajaj (three wheel taxi), private owned car and governmental car in Mekelle city were included in
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37 103 the study. Heavy truck drivers, drivers who were not working and sick during the study period,
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39 104 those who drive more than two vehicle types and those who came from other areas to Mekelle city
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41 105 were excluded from the study.
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44 106 The sample size was calculated from a previous study, where the prevalence of road traffic accident
45
46 107 was reported, $p=22\%$ in Mekelle city [12]. Using 5% marginal error and 95% confidence interval
47
48 108 by the following formula:
49

$$50$$
$$51 109 n = (Z\alpha/2)^2 P (P-1)/D^2$$
$$52$$

53 110 Where n = Minimum sample size required

56 111 Z = Standard score corresponding to 95% confidence interval

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2
3 112 P = Assumed proportion of drivers

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5 113 D = Margin of error (precision) 5%

6
7
8 114 $n = 3.84 \times 0.1716 / 0.0025 = 263$

9
10 115 Since the source population was less than 10,000(i.e. 1500), sample size correction formula was
11 used:

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13
14 117 $nf = n / 1 + (n/N)$

15
16 118 Where nf= desired sample size

17
18 119 n=calculated sample size

19
20 120 N=total population

21
22 121 $nf = n / 1 + (n/N) = 263 / 1 + (263 / 1500) = 263 / 1.175 = 223.8 \sim 224$

23
24 122 By adding 10% contingency for non-response, the sample size was $224 + 22 = 246$

25 26 27 28 123 **Sampling procedures**

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30
31 124 A sampling frame was constructed by a vehicle plate number, which was obtained from Mekelle
32 city transport office. The frame was sub categorized based on the type of the vehicle as a taxi,
33
34 125 Bajaj, governmental vehicles, and private/house vehicles. Sub samples were calculated for each
35
36 126 category of vehicles proportional to the number of vehicles in the respective categories. Then,
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38 127 study subjects were selected using simple random sampling method (see Figure 1).
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43 44 129 **Data collection procedures and tools**

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46 130 The study subjects (drivers) were traced and interviewed for data collection. The drivers were
47
48 131 traced at their destination for taxi and Bajaj, house cars in their working area and governmental
49
50 132 cars at their offices using the car plate number. A structured interviewer administered
51
52 133 questionnaire, adapted from different literatures, was used. The questionnaire was initially
53
54 134 prepared in English and was translated into the local language Tigrigna. The instrument included:

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3 135 socio-demographic characteristics of drivers, risky behaviors factors and other variables which has
4
5 136 a bearing on RTA. Trained data collectors and supervisors handled the data collection process.
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9 137 **Patient and Public Involvement**

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11 138 Drivers in Mekelle city were involved in the study.
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14 139 **Data Quality Control**

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17 140 Pre-test was done on 5% of the sample at Adigrat town, Tigray region. Based on the pretest
18
19 141 findings, necessary corrections were made to the questionnaire. Adequate supervision was
20
21 142 undertaken by the supervisors and principal investigator during the data collection. Daily spot-
22
23 143 checking of the filled questionnaires for errors or any incompleteness was done by the supervisors
24
25 144 and the principal investigator.
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29 145 **Data management and analysis**

30
31 146 The collected data were entered and cleaned in Microsoft excel 2007. Then, the data were exported
32
33 147 and analyzed using STATA version 12. Values of categorical variables were presented as
34
35 148 frequencies and percentages. All statistical tests were performed at the 5% significance level.
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38

39 149 The dependent variable was a occurrence Road Traffic Accident (RTA) within two years which
40
41 150 was dichotomized into Yes (labeled “1”) and No (labeled “0”). To prevent recall bias respondents
42
43 151 were reinforced to remember the occurrence of RTA in the previous two years. Each independent
44
45 152 variable was cross tabulated and further evaluated for association in the bivariate binary logistic
46
47 153 regression. Finally, variables significant in the bivariate analysis were entered into multivariable
48
49 154 binary logistic regression analysis to identify determinants of RTA. Variables on risky behaviors,
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51 155 traffic safety rules and some other personal characteristics were used to interpret the Adjusted
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3 156 Odds Ratio (AOR) in the multivariate analysis under the adjustment of the socio demographic
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5 157 variables. The final model was developed using a step-wise logistic regression.
6
7
8 158 The confounding effect of the explanatory variables was checked using forward and backward
9
10 159 elimination techniques and any variable above 20% change of coefficient was considered as a
11
12 160 confounder. Multi-collinearity was checked using Variance Inflation Factor (VIF) at a cutoff value
13
14 161 of 10. Variables with greater than 10 VIF value were handled by removing the most inter-
15
16 162 correlated variable(s) from the model and substitute their cross product as an interaction term.
17
18 163 Final model fitness was checked using the Hosmer-Lemshew method. Receiver Operating
19
20 164 Characteristic (ROC) curve was used to show how much the independent variables in the final
21
22 165 model predicted the dependent variable.
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29 166 **3. Results**

30 167 **Socio-demographic characteristics of the respondents**

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32 168 The response rate was 100%. The median (IQR) age of the respondents was 30 (10) years. The
33
34 169 majority of study participants (98.37%) were males. Regarding the marital status of the
35
36 170 respondents, 102 (41.46%), 101(41.06%), 30 (12.20%) and 13 (5.28%) were divorced, married,
37
38 171 single and widower respectively. The majority of the drivers, 170 (69.11%) were Christian
39
40 172 Orthodox, followed by Muslims, 54 (21.95%). With regard to their educational status, 225
41
42 173 (91.46%) had attained at least grade 5. The median (IQR) monthly income (in Birr) of the study
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44 174 participants was 1000 (1200) (Table 1).
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180 Table 1: Socio-demographic and economic characteristics of drivers in Mekelle city, Northern
181 Ethiopia, 2015. (n=246)

Variable	Category	RTA occurrence/s		P-value	Total n (%)/ median (IQR)
		No n (%)/ median (IQR)	Yes n (%)/ median (IQR)		
Age in years	median (IQR)	29 (26, 34)	35 (28, 41)	—	30 (26, 36)
Monthly income in Birr	median (IQR)	1000 (700, 1800)	1500 (1000, 2300)	—	1000 (800, 2000)
Sex	Male	186 (98.41)	56 (98.25)	0.93	242 (98.37)
	Female	3 (1.59)	1 (1.75)		4 (1.63)
Marital status	Married	74 (39.15)	27 (47.37)	0.004	101 (41.06)
	Single	88 (46.56)	14 (24.56)		102 (41.46)
	Divorced	21 (11.11)	9 (15.79)		30 (12.20)
	Widowed	6 (3.17)	7 (12.28)		13 (5.28)
Religion	Orthodox	139 (73.54)	31 (54.39)	0.031	170 (69.11)
	Muslim	37 (19.58)	(17) 29.82		(54) 21.95
	Protestant	4 (2.12)	4 (7.02)		8 (3.25)
	Catholic	9 (4.76)	5 (8.77)		14 (5.69)
Educational status	Illiterate	13 (6.88)	4 (7.02)	0.644	17 (6.91)
	Primary (Grade 1-4)	2 (1.06)	2 (3.51)		4 (1.63)
	Secondary (Grade 5-10)	94 (49.74)	27 (47.37)		121 (49.19)
	Above 10	80 (42.33)	24 (42.11)		104 (42.28)
Ethnicity	Tigray	178 (94.18)	44 (77.19)	0.000	222 (90.24)
	Amhara	10 (5.29)	7 (12.28)		17 (6.91)
	Afar	1 (0.53)	6 (10.53)		7 (2.85)

182 Abbreviations: IQR; Inter Quartile Range, P-value; Precision Value

183 **Magnitude of RTAs**

184 Among all the drivers, 57 (23.17%) had encountered road traffic accident in the past two years
 185 from the time of the current study. Most of the accidents happened on Monday, 22 (38.60%) and
 186 Friday, 13 (22.81%) even though accidents were reported in all the seven days. About 22/57
 187 (38.60%), 13/57 (22.81%), 10/57 (17.54%) and 9/57 (15.79%) of the reported causes of RTAs
 188 were due to violation of traffic laws, lack of vehicle maintenance, lack of general safety awareness
 189 on pedestrians and Violation of speed limit . A significant number of the accidents, 25/57 (43.86%)
 190 happened at dawn. Pedestrians and Cyclists constituted the major share of the RTA victims, 31/57
 191 (54.40%). About three fourth of the accidents, 43/57 (75.44%) happened at either T-junction road
 192 or cross road (Table 2).

193 Table 2: Characteristics and Setting of RTA in Mekelle City, Northern Ethiopia. 2015. (n=246)

Variables	Category	Frequency	Percentage
Accident experience in the previous 2 years	Yes	57	23.17
	No	189	76.83
Type of accident	Injury	29	50.88
	Injury and Property damage	14	24.56
	Property damage	8	14.0
	Death	6	10.5
Light Condition	At dawn	41	71.93
	Day time	16	28.07
Victim	Pedestrian	19	32.14
	Cyclist	12	21.43
	Passenger	14	25.00
	Driver	12	21.43
Accident site road	T-junction	15	26.32
	Cross Road	28	49.12

	Straight road	14	24.56
Day of accident	Monday	22	38.60
	Tuesday	4	7.02
	Wednesday	6	10.53
	Thursday	3	5.26
	Friday	13	22.81
	Saturday	9	15.79
Number of accidents (life time experience)	1	42	73.68
	2	12	21.05
	3	3	5.26
Reason for the accident	Lack of general safety awareness of pedestrians	10	17.54
	Violation of traffic rules and regulations	22	38.60
	Violation of speed limit	9	15.79
	Lack of vehicle maintenance	13	22.81
	Did not remember	3	5.26

194

195 **Risky driving behaviors, infrastructure setup and practices**

196 Concerning risky driving behaviors, 92 (37.40) of the drivers drunk alcohol before driving. About
 197 43 (17.48%) of the drivers were chat chewers and 30 (12.20%) were smokers. More than one third
 198 of the drivers, 96 (39.02%) ever reported that they used cell phone for communication while
 199 driving. The prevalence of RTA among drivers was 3.29%, 32.6%, 36.7%, 18.5% and 21.6%
 200 among cell phone users, alcohol consumers, chat chewers, cigarette smokers and seat belt users
 201 while driving respectively. However, the prevalence of RTA among the drivers who do not use
 202 cell phone and seat belt were 17.33% and 30.9% respectively (Table 3).

203 Table 3: Risky driving behaviors, infrastructure setup and practices among drivers in Mekelle city,
 204 Northern Ethiopia, 2015. (n=246)

Variables	Category	RTA		Total (%)	P-Value
		Yes n (%)	No n (%)		
Cell phone use while driving	Yes	31(32.29)	65(67.71)	96 (39.02)	0.007
	No	26(17.33)	124(82.67)	150 (60.98)	
Substance use	Alcohol	14(32.6)	29(67.4)	92 (37.40)	0.026
	Chat	11(36.7)	19(63.3)	43 (17.48)	
	Cigarette	32(18.5)	141(81.5)	30 (12.20)	
Seat belt use	Yes	44(21.6)	160(78.4)	204 (82.93)	0.189
	No	13(30.9)	29(69.0)	42 (17.07)	
What do you do when another vehicle tries to pass you?	I advise him to slow down	4(12.5)	28(87.5)	32 (13.01)	0.028
	I give him priority	42(29.2)	102(70.8)	144 (58.54)	
	I speed up	11(15.71)	59(84.29)	70 (28.46)	
Road infrastructure	Gravel	5(16.7)	25(83.3)	30 (12.2)	0.117
	Asphalt	39(28.1)	100(71.9)	77 (31.3)	
	Cobble stone	13(16.9)	64(83.1)	139 (56.5)	
Service provision of the vehicle as per the manufacturer recommendation	No	3 (5.26)	6 (3.17)	9 (3.66)	0.462
	Yes	54 (94.74)	183 (96.83)	237 (96.34)	
Visual impairment	No	180 (95.24)	53 (92.980)	233 (94.72)	0.505
	Yes	9 (4.76)	4 (7.02)	13 (5.28)	
No violation rule for the speed limit	No	7 (3.70)	5 (8.770)	12 (4.880)	0.119
	Yes	182 (96.30)	52 (91.23)	234 (95.12)	
Listen radio while driving	No	47 (22.81)	13 (24.87)	60 (24.39)	0.751
	Yes	142 (75.13)	44 (77.19)	186 (75.61)	

What did you do in heavy traffic?	Either pass or stay	1 (0.53)	2 (3.51)	3 (1.22)	0.069
	Pass fast	10 (5.29)	6 (10.53)	16 (6.50)	
	Slow speed	178 (94.18)	49 (85.96)	227 (92.28)	
Ever received a ticket, citation, or warning for any traffic violation	No	113 (59.79)	27 (47.37)	140 (56.91)	0.097
	Yes	76 (40.21)	30 (52.63)	106 (43.09)	

205 **Factors associated with Road Traffic Accidents**

206 In the bivariate analysis age, being married, being single, driving governmental vehicle, alcohol
 207 use, other substances other than alcohol use, cell phone use during driving, drivers' years of
 208 experience and vehicle service were significantly associated with RTAs at 95% CI.
 209 Multivariable binary logistic regression analysis showed that drivers who drove after consuming
 210 alcohol were 2.29 (AOR=2. 29; 95% CI: 1.08-4.85) times more likely to have RTA compared to
 211 drivers who did not consume alcohol. Drivers who drove governmental vehicles were
 212 4.16 (AOR=4. 16; 95% CI: 1.48- 11.70) times more likely to have RTA compared to drivers of
 213 privately owned vehicles. As the driver's experience increased by one year, the probability of RTA
 214 decreased by 26% (AOR=0. 74; 95% CI: 0.60-0.90) (Table 4).

222 Table 4: Bivariate and Multivariable regression analysis of RTA with the predictors in Mekelle
 223 city, Northern Ethiopia, 2015. (n=246)

Variables	Category	COR(95% CI)	AOR(95% CI)
Age		0.08(0.041, 0.121)*	1.05(0.98, 1.12)
Marital status	Married	0.85(0.348, 2.086)*	1.62(0.60, 4.39)
	Single	0.37 (0.141, 0.972)*	0.94(0.25, 3.45)
	Divorced	1(Ref.)	1(Ref.)
	Widower	2.72(0.711, 10.408)	
Religion	Protestant	1(Ref.)	1(Ref.)
	Orthodox	0.22(0.052, 0.940)*	0.24(0.05, 1.26)
	Muslim	0.45(0.102, 2.059)	
	Catholic	0.55(0.095, 3.245)	
Ethnicity	Afar	1(Ref.)	1(Ref.)
	Amhara	0.12(0.011, 1.195)	
	Tigray	0.04(0.004, 0.351)*	0.04(0.005, 0.58)*
Vehicle ownership	Private (Driver is employee)	1(Ref.)	1(Ref.)
	Governmental	3.5(1.464, 8.168)*	4.16(1.48, 11.70)*
	Driver (Driver is the owner)	2.38(1.225, 4.660)*	1.64(0.71, 3.339)
License grade	1 st	1(Ref.)	
	3 rd	1.36(0.329, 5.632)	
	4 th	0.55(0.138, 2.241)	
	Special	1.52(0.249, 9.294)	
Alcohol use	No	1(Ref.)	1(Ref.)
	Yes	1.88(1.034, 3.437)*	2.29(1.08, 4.85)*
Substance use other than alcohol	Chat	2.12.(1.010, 4.478)*	2.18(0.78, 6.05)
	Cigarette	2.55(1.105, 5.884)*	1.11(0.39, 3.18)
	I do not use	1(Ref.)	1(Ref.)
Cell phone use while driving	No	1(Ref.)	1(Ref.)
	Yes	2.27(1.246, 4.150)*	1.80(0.86, 3.74)
Use seat belt while driving	No	1(Ref.)	
	Yes	0.61 (0.29, 1.28)	
Income		1.00(0.999, 1.000)	

Distance travelled		1.00(0.999, 1.005)	
Driver's experience		0.86 (0. 749, 0.999)*	0.74(0.60, 0.90)*
Number of vehicle service since the date of the vehicle manufactured		1.24(1.103, 1.398)*	1.18(0.99, 1.40)
Road infrastructure	Gravel	1 (Ref.)	
	Cobble stone	1.02 (0.33, 3.14)	
	Asphalt	1.95 (0.70, 5.46)	
Service provision of the vehicle as per the manufacturer recommendation	No	1 (Ref.)	
	Yes	0.59 (0.14, 2.44)	
Visual impairment	No	1 (Ref.)	
	Yes	1.51 (0.45, 5.10)	
No violation rule for the speed	No	1 (Ref.)	
	Yes	0.40 (0.12, 1.31)	
Listen radio while driving	No	1 (Ref.)	
	Yes	1.12 (0.56, 2.26)	
What did you do in heavy traffic?	Either pass or stay	1 (Ref.)	
	Pass fast	0.30 (0.02, 4.06)	
	Slow speed	0.14 (0.01, 1.55)	
Ever received a ticket, citation, or warning for any traffic violation	No	1 (Ref.)	
	Yes	1.65 (0.91, 3.00)	

224 Note: * = P-value less than 0.05

225 The residuals were checked for influential outlier observations and the result showed that there
 226 were no suspicious influential outlier observations. Hosmer and Lemeshow test showed a chi-
 227 square value of 9.41 (p=0. 3085) which is greater than 0.05. The null hypothesis is not to be
 228 rejected, which implies that the model estimates adequately to fit the data at an acceptable

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2
3 229 level. The area under ROC curve was 0.7536 (See figure 2). The predicting power of the
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5 230 independent variables for the dependent variable was 75.36%. Therefore, it can be concluded that
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8 231 the model fits the data reasonably well. No confounding factor was found.
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10 11 232 **4. Discussion**

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15 233 The main aim of the study was to assess the magnitude and determinants of road traffic accidents
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17 234 among drivers in Mekelle city, Tigray, Northern Ethiopia. This study showed 23.17% of the
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20 235 drivers have reported having RTA in the previous two years. Ownership of the vehicles, driving
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22 236 after taking alcohol, driver's experience, used cell phone while driving were the determinants for
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25 237 RTAs among the drivers.

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27
28 238 The study revealed that the magnitude of self-reported RTA in Mekelle city was 23.17%. There
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30 239 was a slight increment of accidents in this study compared to the previous study done in Mekelle
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32 240 city, which showed that the prevalence of RTA was 22% [12]. However, it is lower when compared
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34
35 241 with a similar study conducted in the same city among taxi drivers with 4 wheels, of which 26.4%
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37 242 of them reported RTA encounter within the past 3 years [17]. This variation might be due to the
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39 243 fact that the city is expanding where the population size is increasing. Or it might be due to the
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42 244 differences in the RTAs report period where the current study included reports of RTA in the past
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44 245 2 years from the time of the study. About three fourth (75.44%) of the accidents of this study,
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46 246 happened at either T-junction or cross roads. The findings of this study is higher as compared to
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48 247 recent statistics from USA and India which showed, approximately 55% of the total traffic crashes
49
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51 248 and 23% of crashes with fatalities in urban areas in the USA occur at intersections and
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53 249 approximately 32% of urban traffic crashes take place at intersections in India. [18]. This
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55 250 difference might be due to infrastructure differences like traffic lights in the intersections of the
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3 251 roads. Because traffic signals do help to prevent collisions if obeying for traffic rules by the drivers
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5 252 [19]. In this study about 22/57 (38.60%), 13/57 (22.81%), 10/57 (17.54%) and 9/57 (15.79%) of
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7
8 253 the reported causes of RTAs were due to violation of traffic laws, lack of vehicle maintenance,
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10 254 lack of general safety awareness on pedestrians and violation of speed limit. This finding is similar
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12 255 with the study on the comparative analysis of literature concerning road safety, which showed that,
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14 256 the causes include: lack of control and enforcement concerning implementation of traffic
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16 257 regulation (primarily driving at excessive speed, driving under the influence of alcohol, and not
17
18 258 respecting the rights of other road users (mainly pedestrians and cyclists), lack of appropriate
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20 259 infrastructure and unroadworthy vehicles [20]. This is because, obeying traffic laws are designed
21
22 260 to protect the drivers and other people, animals or from destruction of properties around the road
23
24 261 and it self the road. In other words by knowing the rules of the road, practicing good driving skills
25
26 262 and generally taking care as a road user can help a vital role in preventing a crash.
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31 263 This study identified that ownership of the vehicles was found to be predictor of RTA. Road traffic
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33 264 accident was 3.78 times more likely among those who drove governmental vehicles. A study on
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35 265 Arab gulf countries as compared to other countries showed that vehicle ownership levels and safety
36
37 266 parameters in both developed and developing countries is presented to highlight the relative
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39 267 seriousness of the road safety situation in different countries. [21]. The possible justification for
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41 268 this to be happen might be due to the fact that governmental drivers might violate the traffic rules
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43 269 and speed up to arrive timely at workplace especially at the peak hours.
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48 270 This study revealed that driving after taking alcohol was found to be an aggravating factor for
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50 271 RTA. Drivers who drove after consuming alcohol were 2.29 more likely to have RTA compared
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52 272 to those who don't consume alcohol. This finding is similar to a similar study which showed that
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54 273 individuals who drank alcohol were 3.2 times more likely to encounter RTA [22]. It was also
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3 274 supported by the Great Britain department for Transport provisional estimates for 2013 which
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5 275 showed that between 230 and 290 people were killed in accidents in Great Britain where at least
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8 276 one driver was over the drink drive limit [23]. Another study also showed that impairments from
9
10 277 alcohol was associated with traffic accident of crashes and deaths [24, 25]. This might be due to
11
12 278 the nature of alcohol that has a range of psycho-motor and cognitive effects, including attitude,
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14 279 judgment, vigilance, perception, reaction, and controlling [26]. This can increase accident risk by
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16
17 280 lowering cognitive processing, coordination, attention, vision and hearing.
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19

20 281 This study has also revealed that as driver's experience increases by one year, the probability of
21
22 282 getting RTA decreased by 26 percent. This finding was similar to the finding of a study in 2003
23
24 283 which showed that as the drive miles and experience increases, the probability of self-reported
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26
27 284 crash decreased [27]. This might be due to the anticipation of potentially hazardous traffic
28
29 285 situations which require years of practice.
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31

32 286 The likelihood of RTA was 1.8 times higher among drivers who used cell phone while driving
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34 287 compared to these who do not use. This study is consistent with a previously done study in Mekelle
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37 288 city [17]. Other studies have also reported that drivers distracted by mobile devices such as
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39 289 smartphones and/ or other in-vehicle devices are at risk for a serious negative outcomes [28- 30].
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41
42 290 A similar study indicated that telephone use while driving increases the likelihood of RTA/ crash
43
44 291 by a factor of four, while texting by around 23 times [31]. This is because of loss of attention to
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46 292 surroundings while driving.
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49 293 The findings of this study showed visual impairment was not found to be a predictor variable for
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51 294 RTA. But a study done in Ibadan town Nigeria showed that drivers who had visual impairment
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54 295 were 1.6 times more likely to encounter RTA [32]. Therefore, this needs further investigation.
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3 296 The strength of this study is that data quality was assured under close supervision of the principal
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5 297 investigators during both data entry and data collection time. Appropriate statistical methods were
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8 298 used to present the findings of the study. Despite this strength, the study have certain limitations.
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10 299 Due to cross-sectional study design nature, establishing causality is not possible. In addition to
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12 300 that, there may be recall bias and the analysis of this study misses some important variables like
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14
15 301 quality of the vehicles and road safety.

16 17 302 **5. Conclusion**

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21 303 The magnitude of RTA was high. The intersections of the roads were the main cause of RTAs.
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23 304 Violation of traffic laws, lack of vehicle maintenance and lack of general safety awareness on
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26 305 pedestrians were the dominant reported causes of RTAs. Driving a governmental vehicle and
27
28 306 alcohol consumption were the factors associated with RTA. Monitoring blood alcohol level of
29
30 307 drivers should be in place. Education on traffic laws and regulations should be given to drivers on
31
32
33 308 regular basis. In addition to that a holistic study should be done to identify the causes of RTA. Due
34
35 309 to the similarities of the cities in North Ethiopia, this study can represent to other cities in Northern
36
37 310 Ethiopia.

38 39 40 41 42 311 **6. Disclosure section**

43 44 45 312 **Acknowledgments**

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47
48 313 We are glad to extend our gratitude to the data collectors and participants of the study. We would like to
49
50 314 extend our gratitude to Mekelle University as well for funding the research.
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315 **Author contributions**

316 AW conceptualized and designed the study, involved in data analyses, acquisition of data,
317 tabulating the data, interpretation of data, preparing tables and figures, and critically revising the
318 manuscript. AD and TW have involved in interpretation of data, supervision, administration,
319 drafting the initial manuscript, and critically revising the manuscript. AD have primary
320 responsibility for final content and involved in final review. All authors read and approved the
321 final manuscript.

322 **Disclosure statement**

323 No potential conflict of interest was reported by the authors.

324 **Ethics and consent**

325 Ethical clearance and approval was given by Mekelle University, school of public health Ethical
326 Review Committee with the approval number of ERC 0017/2014. Written consent was taken
327 from each participant during the interview. All authors read and approved the final manuscript.

328 **Data availability**

329 The data set of the study findings are available from the corresponding author upon reasonable
330 request.

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333 **Figures**

334 Figure 1: Sampling Procedure. Schematic presentation of the sampling procedure.

335 Figure 2: ROC curve. Predicting power of the independent variables for the dependent variable.

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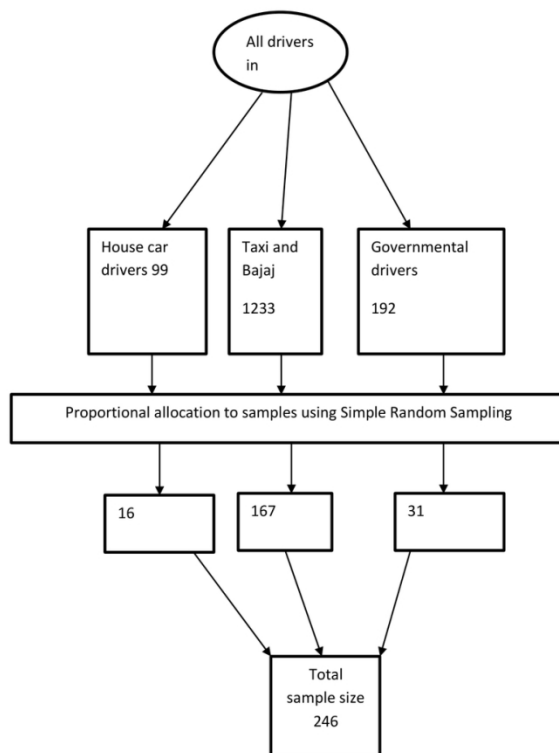


Figure 1: Schematic presentation of the sampling procedure.

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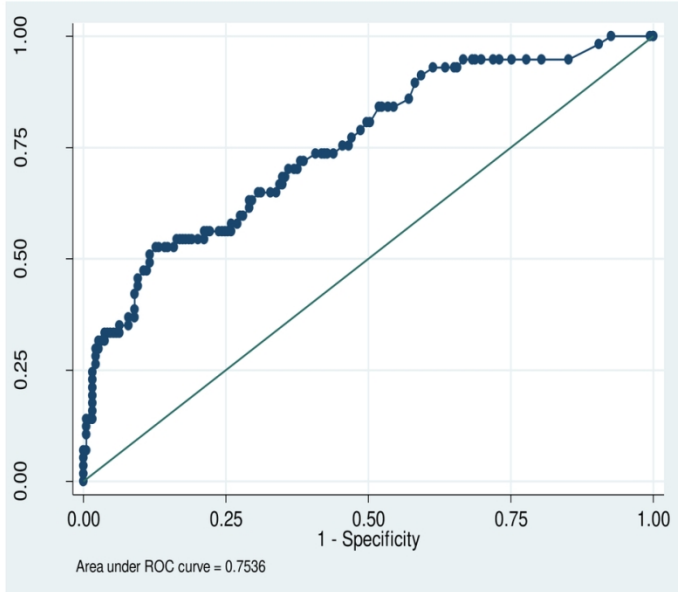


Figure 2: ROC curve, predicting power of the independent variables for the dependent variable.
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Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4- 5
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Study design	#4	Present key elements of study design early in the paper	5
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5- 6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7- 8
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6

1	Bias	#9	Describe any efforts to address potential sources of bias	7
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3	Study size	#10	Explain how the study size was arrived at	6
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5	Quantitative	#11	Explain how quantitative variables were handled in the analyses. If applicable,	7- 8
6	variables		describe which groupings were chosen, and why	
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9	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7- 8
10				
11		#12b	Describe any methods used to examine subgroups and interactions	8
12				
13		#12c	Explain how missing data were addressed	N/A
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15		#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
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17		#12e	Describe any sensitivity analyses	N/A
18				
19	Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	n/a there were no stages and study was not on patients
20				
21		#13b	Give reasons for non-participation at each stage	n/a
22				
23		#13c	Consider use of a flow diagram	6
24				
25	Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
26				
27		#14b	Indicate number of participants with missing data for each variable of interest	N/A
28				
29	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	7
30				
31	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13
32				
33		#16b	Report category boundaries when continuous variables were categorized	N/A
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35		#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a estimates were for odds ratio
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37	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	15- 16
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1	Key results	#18	Summarise key results with reference to study objectives	16
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3	Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or	19
4			imprecision. Discuss both direction and magnitude of any potential bias.	
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7	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity	16-19
8			of analyses, results from similar studies, and other relevant evidence.	
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11	Generalisability	#21	Discuss the generalisability (external validity) of the study results	19
12				
13	Funding	#22	Give the source of funding and the role of the funders for the present study and, if	20
14			applicable, for the original study on which the present article is based	
15				

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