

# Magnitude of death and associated factors among road traffic injury victims admitted to emergency outpatient departments of public and private hospitals at Adama Town, East Shewa Zone, Ethiopia

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## Abstract

**Objectives:** Road traffic injuries, disabilities, and deaths have been a major public health problem worldwide and in Ethiopia. Globally, around 1.35 million people die every year on the roads and 20–50 million sustain nonfatal injuries as a result of road traffic crashes. This study aimed to assess the magnitude of deaths and associated factors among road traffic injury victims admitted to emergency outpatient departments of public and private hospitals at Adama town, East Shewa Zone, Ethiopia.

**Methods:** Institution-based cross-sectional study was conducted among 381 road traffic injury victims admitted to hospitals in Adama town, East Shewa, Ethiopia, from 14 December 2019 to 29 February 2020. Data were collected using interviewer-administered structured questionnaires. Data were entered into EpiData version 4.6.0.2 and analyzed using SPSS version 21. Bivariable and multivariable logistic regressions were fitted to identify variables significantly associated with road traffic injury-related deaths and the results were presented with adjusted odds ratios and 95% confidence interval. Statistical significance was declared at  $p$ -value  $< 0.05$ .

**Results:** The magnitude of deaths among road traffic injury victims were 12.9%. Age (25–44 years) (adjusted odds ratio = 4.24, 95% confidence interval = 1.70–10.61), rural resident (adjusted odds ratio = 2.26, 95% confidence interval = 1.11–4.55), pedestrian (adjusted odds ratio = 3.72, 95% confidence interval = 1.67–7.99), night-time injury (adjusted odds ratio = 5.29, 95% confidence interval = 2.52–11.10), injuries on weekends (adjusted odds ratio = 2.32, 95% confidence interval = 1.12–4.80), not getting first aid at injury site (adjusted odds ratio = 2.64, 95% confidence interval = 1.02–6.84), and known comorbidity conditions (adjusted odds ratio = 3.01, 95% confidence interval = 1.23–7.38) were significantly associated with road traffic injuries-related deaths.

**Conclusion:** A significant proportion of road traffic injuries resulted in death. Age, place of residence, pedestrians, night-time injury, and not getting first aid were associated with road traffic injuries-related deaths. Preventive strategies that focus on young adults, rural residents, pedestrians, and people with comorbidities would minimize road traffic injuries-related deaths. Moreover, strict supervision on weekend and night-time drives, and providing accessible lifesaving first aid services would have significant importance.

## Keywords

Magnitude of death, road traffic injury, hospitals, Adama, Ethiopia

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## Introduction

Road traffic injury (RTI) is an injury that happens 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 was involved.<sup>1</sup> According to World Health Organization report of 2015, globally the number of road traffic injuries has continued to rise.<sup>2</sup> Globally, around 1.35 million people die every year on the roads and another 20–50 million sustain nonfatal injuries as a result of road traffic crashes.<sup>3</sup> Regional rates of road traffic deaths in Africa and South-East Asia are highest with 26.6 and 20.7 deaths per 100,000 population respectively.<sup>4</sup>

Ethiopia is a country with a low vehicle/population ratio and is considered one of the countries mostly affected by RTIs. This is mainly due to poor road safety plans and the failure of drivers to abide by the traffic rule.<sup>5,6</sup> A cross-sectional study conducted at Black Lion specialized teaching hospital revealed that from all RTIs, about 7.4% have resulted in deaths.<sup>7</sup> Another study conducted in central Ethiopia showed that among 2335 collisions registered and 16.7% resulted in death.<sup>6</sup> Similarly, in Addis Ababa, capital city of Ethiopia, a total of 16.1% road traffic injuries resulted in death in 2014.<sup>8</sup>

Synthesis of previous studies revealed that days of week, time of day,<sup>9,10</sup> sex,<sup>7</sup> age,<sup>11</sup> and place of residence were associated with RTIs and related deaths.<sup>12,13</sup> Moreover, factors such as sustaining multiple injuries<sup>14</sup>; getting timely first aid<sup>15</sup>; lack of safety gear such as helmets, seat belts, and air bags<sup>16</sup>; and having underlying chronic diseases were identified as determinants of RTI-related deaths.<sup>17</sup>

To this end, sustainable development goals (SDGs) have envisioned to reduce deaths from RTIs by half in 2020.<sup>18</sup> To meet this goal, having evidences on the magnitude of RTI-related deaths and its determinant factors is of paramount importance. Therefore, this study was aimed to assess magnitude of death and associated factors among RTI victims admitted to emergency outpatient departments (EOPDs) of public and private hospitals at Adama town, East Shewa Zone, Ethiopia.

## Methods

### Study design and setting

Institution-based cross-sectional study was conducted among RTI victims admitted to emergency departments of public and private Hospitals in Adama town, East Shewa Zone, Oromia Region, Ethiopia, from 14 December 2019 to 29 February 2020.

Adama town is located about 99 km east of Addis Ababa. In addition, in three directions, main roads cross the town (from Addis Ababa to Djibouti, Dire Dawa, and Harar; from Addis Ababa to Asella and Bale; and from Addis Ababa to Shashamene and Awassa). It is one of the highest traffic movement areas in the country next to the capital city of

Addis Ababa. In the city, one government hospital and five private hospitals render services to all populations of the city and the nation at large.

### Population and sample

The study population was all RTI victims who attended EOPD of public and private hospitals at Adama town from 14 December 2019 to 29 February 2020. Any person who involved in an RTI and who presented for treatment to EOPD of public and private hospitals at Adama town were included. However, patients who needed immediate transfer to other hospitals out of Adama town and critically ill/unconscious patients who did not have attendants were excluded from the study.

The minimum required sample size was estimated using the following assumptions: 80% power of the study, 95% confidence level, 47.6% proportion of RTI-related deaths among unexposed, 62.4% proportion of RTI-related deaths among exposed,<sup>12</sup> and 1:1 ratio of unexposed to exposed. Hence, a minimum of 381 participants were required to conduct the study.

### Variables of the study

The outcome variable in this study is death among RTI victims, a dichotomous variable (yes/no).

The independent variables are sociodemographic characteristics, pre-health facility characteristics, and clinical characteristics:

*Socio-demographic characteristics:* sex, age, residence, marital status, educational status, and occupational status.

*Pre-health facility characteristics:* vehicle type, role of road users, day of a week, mode of arrival to hospital, time of day road traffic accident occurred, time between the injury event and arrival to health facilities, and getting first aid.

*Clinical characteristics:* site of body region injured, severity level of injury, existing co-morbid conditions, and condition of RTI victims at arrival, and time gap after arrival of health facility and get first aid.

*RTI:* the collision between two or more vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and fixed obstacles.<sup>19</sup>

*RTI death:* death due to RTI immediately or within 30 days after the accident.<sup>20</sup>

*First aid:* the immediate treatment or care given to a person suffering from an injury until more advanced care is provided.

*Passenger:* any user of a vehicle (both two- and four-wheeled vehicles) other than the driver.

*Pedestrian*: a person involved in a road crash who was not at the time of the road crash riding in a vehicle.

### Data collection procedures and quality controls

Data collection tool was adapted from injury surveillance guideline document of World Health Organization (WHO) and we also reviewed different literatures.<sup>21</sup> Structured, interviewer-administered questionnaires through face-to-face interview were used for data collection. The data were collected by 18 BSc holder nurses and supervised by two public health professionals. Two days training was given for data collectors and supervisors on the data collection tools and how to approach the study participants.

Before the actual data collection, the pre-test was done on 5% of the sample at Wolenchit Hospital. Then, adequacy of the checklist was evaluated and ambiguous questions were modified before the actual data collection. The principal investigator with the supervisors supervised the data collection closely. Besides, daily monitoring of data for completeness and consistency was made.

### Data processing and analysis

The collected data were entered using Epi-data version 4.6.0.2 and then exported to SPSS version 21.0 for further analysis. Descriptive analysis was done by computing proportions and summary statistics. Binary logistic regression was used to assess associations between RTI-related death and the independent variables. All variables with p-value of  $\leq 0.25$  in bi-variable analysis were retained for multivariable model and, finally, variables with p-value of  $< 0.05$  were identified as statistically significant predictors of deaths related to RTIs. Besides, the goodness of fit of model was checked using Hosmer–Lemeshow test.

## Results

### Socio-demographic characteristics

A total of 381 RTI victims were included in the study. Of total RTI victims admitted to the emergency department, 273 (71.7%) were males. The median age of the victims was 28 years. A majority (59.6%) of the victims were from urban residence (Table 1).

### Pre-health facility characteristics

A majority of 205 (53.8%) RTI victims admitted to EOPD of hospitals were passengers, followed by pedestrians (123 (32.3%)). Of a total of 49 deaths, 28 (57.1%) were pedestrians (Table 2).

The main vehicle types involved in road traffic injuries were automobile, freight truck, public transport, three-wheeled vehicles, and motorcycle. Public transport contributed to the major portion (32.3%) of RTIs, followed by

**Table 1.** Socio-demographic characteristics of road traffic injury victims admitted to EOPD of hospitals in Adama town, Ethiopia.

Variables	Category	No. (%)
Sex	Male	273 (71.7)
	Female	108 (28.3)
Age	< 15 years	7 (1.8)
	15–24 years	106 (27.8)
	25–44 years	199 (52.2)
	$\geq 45$ years	69 (18.1)
Address	Urban	227 (59.6)
	Rural	154 (40.4)
Educational status	Not formal education	70 (18.2)
	Formal education	311 (81.80)
Marital status	Single	133 (34.9)
	Married	208 (54.6)
Occupation	Employed	98 (25.7)
	Merchant	79 (20.7)
	Farmer	64 (16.8)
	House wife	56 (14.7)
	Daily laborer	48 (12.6)
	Student	31 (8.1)
	Under age <sup>a</sup>	5 (1.3)

EOPD: emergency outpatient department.

<sup>a</sup>Preschool children whose age is 4 years and below.

three-wheeled vehicles which accounted for 26.5% of RTIs. Similarly, a majority (40.8%) of RTI-related deaths were contributed by public transport (Table 3).

Regarding mode of transportation of RTI victims to hospitals, 163 (42.8%) were transported by ambulance, followed by public transport (123 (32.3%)) and police vehicles (11 (29.6%)). RTI-related death were more accounted for among those transported by public transport (19 (5%)), followed by police vehicles (18 (4.7%)) and by ambulance (12 (3.2%)).

### Clinical factors associated with RTI-related death

From a total of RTIs, head injury accounted the highest (101 (26.5%)), followed by lower extremity injury (100 (26.2%)) and multiple body part injury (69 (18.1%)). More than two-thirds (29 (59.2%)) of the death were accounted by those sustained multiple body part injuries, followed by head injury (11 (22.4%)) (Table 4).

Regarding severity level during the arrival at hospital; soft-tissue injuries were the commonest injury type (80.3%), followed by compound fractures (10.2%) and complex fractures (9.4%). Among the total RTI victims, more deaths occurred among those who suffered complex fractures (5.2%), followed by those with soft-tissue injury (3.9%).

Generally, among a total of 381 RTI victims admitted to EOPD of hospitals, 182 (47.8%) were discharged with medical advice, 86 (22%) were admitted to surgical department, 29 (8%) were admitted to orthopedic department, 16 (4%) were admitted to intensive care unit (ICU), 13 (3%) were

**Table 2.** Frequency of RTIs and related death by road users.

Road users	RTIs (n = 381)	%	RTI-related death (n = 49)	%
Passengers	205	53.8	16	32.7
Pedestrians	123	32.3	28	57.1
Driver and motorcyclist	53	13.9	5	10.2
Total	381	100	49	100

RTI: road traffic injury.

**Table 3.** Frequency of RTIs and related death by type of vehicles.

Type of vehicles	RTIs	%	RTI-related deaths	%
Automobile	13	3.4	3	6.1
Freight truck	72	18.9	16	32.7
Public transport	119	32.3	20	40.8
Three-wheeled vehicles	101	26.5	5	10.2
Motorcycle	76	19.9	5	10.2
Total	381	100	49	100

RTI: road traffic injury.

**Table 4.** Body site or organ involved in the RTIs.

Body site or organ involved in the RTIs	RTIs (n = 381)	%	RTI-related death (n = 49)	%
Head injury	101	26.5	11	22.4
Lower extremity injury	95	26.2	3	6.1
Multiple body part injury	69	18.1	29	59.2
Upper extremity injury	61	17.3	2	4.1
Pelvic injury	4	1.1	4	8.2
Chest injury	27	7.1		
Abdominal injury	14	3.7		
Total	381	100	49	100

referred to other hospitals out of Adama town, 6 (2%) were defaulted, and 49 (12.9%) were dead.

### Factors associated with RTI-related death

In bi-variable analysis, sex, age, residence, role of road user, mode of arrival, distance from where RTIs occur to facility, time of day RTIs occur, time to reach health facility, day of RTIs occurrence, get first aid at injury site, comorbid condition, and time between arrival to hospital and getting care were associated with RTI-related deaths.

After adjusting for potential confounders in multivariable logistic regressions, age, place of residences, being pedestrians, not getting first aid at injury site, night-time accident, and pre-existing comorbidities were identified as independent determinants of RTI-related deaths.

The young adults (25–44 years) were 4.5 more likely to die from RTIs as compared with aged <15 years (adjusted odds ratio (AOR)=4.5; 95 confidence interval (CI)=1.37–14.8). The odds of deaths from RTI among victims from rural residence were 2.26 times higher compared with urban residents (AOR=2.26; 95 CI=1.11–4.55).

The odds of deaths from RTI among pedestrians were 3.72 times higher compared with passengers (AOR=3.72; 95 CI=1.67–7.99). The odds of death from road traffic injuries were 2.64 times higher among those who did not get first aid at injury site compared with those who did get first aid (AOR=2.64; 95 CI=1.02–6.84).

The odds of RTIs deaths were 5.29 times higher among victims who injured at the night time of a day compared with day-time RTI victims (AOR=5.29; 95 CI=2.52–11.10). Compared with injuries on Monday to Friday, the odds of death were 2.32 times higher among injuries on weekend days (Saturday and Sunday) (AOR=2.32; 95 CI=1.12–4.80). Moreover, the odds of death from RTIs were 3.01 times higher among victims with known comorbidity condition compared with those without comorbidities (AOR=3.01; 95 CI=1.23–7.38) (Table 5).

### Discussion

The magnitude of RTI-related death was 12.9% (95% CI=9.8%–16.6%) in emergency department of hospitals at Adama town. The finding is comparable with the study done

**Table 5.** Factors associated with RTI-related deaths in Adama town, Ethiopia.

Variables	Categories	RTIs deaths		COR (95% CI)	p-value	AOR (95% CI)	p-value
		Yes (%)	No (%)				
Sex	Male	28 (10.2)	245 (89.8)	2.11 (1.14–3.91)*	0.017	2.05 (0.96–4.38)	0.431
	Female	21 (5.5)	87 (22.8)				
Age	<15 years	1 (14.3)	6 (85.7%)				
	15–24 years	3 (2.8)	103 (97.2)	0.5 (0.103–2.183)	0.338	3.94 (0.23–68.54)	0.735
	25–44 years	41 (20.6)	158 (79.4)	4.3 (1.45–12.2)***	0.008	4.5 (1.37–14.8)*	0.029
	≥45 years	4 (5.8)	65 (94.2)	2.7 (0.26–28.2)	0.405	0.9 (0.09–2.64)	0.52
Residence	Urban	20 (8.8)	208 (91.2)				
	Rural	29 (18.9)	124 (80.1)	2.40 (1.30–4.42)**	0.005	2.26 (1.11–4.55)*	0.037
Role of road user	Passenger	16 (7.8)	189 (92.2)				
	Pedestrian	28 (22.8)	95 (77.2)	2.83 (1.02–7.91)***	0.000	3.72 (1.67–7.99)***	0.000
	Driver	5 (9.4)	48 (90.6)	1.23 (0.43–3.53)	0.699	0.86 (0.25–2.88)	0.174
Mode of arrival	Ambulance	12 (7.4)	151 (92.6)				
	Police vehicle	18 (18.9)	77 (81.1)	2.94 (1.35–6.42)**	0.007	2.39 (0.96–8.09)	0.612
	Public transport	19 (14.4)	104 (84.6)	2.30 (1.07–4.94)*	0.033	2.27 (0.95–5.44)	0.491
Distance from where RTIs occur to facility	<10 km	11 (7.1)	144 (92.9)				
	10–50 km	31 (16.7)	155 (83.3)	2.62 (1.27–5.40)**	0.009	0.86 (0.25–2.91)	0.378
	>50 km	7 (17.5)	33 (82.5)	2.78 (1.00–7.70)	0.050	1.19 (0.39–3.67)	0.538
Time of day RTIs occur	Day	26 (8.6)	279 (91.4)				
	Night	23 (30.3)	53 (69.7)	4.67 (2.47–8.77)***	0.000	5.29 (2.52–11.10)***	0.000
Time to reach health facility	>60 min	39 (16)	205 (84)	2.42 (1.17–5.01)*	0.018	1.61 (0.69–3.59)	0.154
	≤60 min	10 (7.3)	127 (92.7)				
Day of RTIs occurrence	Weekend	21 (23.9)	67 (76.1)	2.97 (1.59–5.55)***	0.001	2.32 (1.12–4.80)*	0.026
	Working days	28 (9.5)	265 (90.5)				
Get first aid at injury site	Yes	6 (4.9)	116 (95.1)				
	No	43 (16.6)	216 (83.4)	3.85 (1.59–9.31)**	0.003	2.64 (1.02–6.84)*	0.043
Comorbid condition	Yes	12 (27.3)	32 (72.7)	3.04 (1.44–6.41)**	0.003	3.01 (1.23–7.38)*	0.019
	No	37 (11)	300 (89)				
Time between arrival to hospital and getting care	≥30 min	13 (21.3)	48 (78.7)	2.14 (1.06–4.32)*	0.035	1.53 (0.64–3.67)	0.09
	<30 min	36 (11.3)	284 (88.7)				

COR: crude odds ratio; CI: confidence interval; AOR: adjusted odds ratio; RTI: road traffic injury. Significant at \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

in India 13.1%.<sup>16</sup> However, this finding is higher than the study conducted in Dilchora hospital, Dire Dawa 9.4%,<sup>22</sup> Black Lion specialized teaching hospital 7.4%,<sup>19</sup> and Wolayita Zone SNNPR, Ethiopia, 6%.<sup>23</sup> This discrepancy might be attributed to the difference in study areas in terms of topography, road construction, and socio-economic activities.

The age of the RTI victims is found to be significantly associated with deaths related to RTIs. The odds of death were higher among 25–44 years age group compared with <15 years age group. Similarly, World Health Organization report also estimated that adults in the age group of 15–44 years account for nearly half of the global road traffic deaths.<sup>4</sup> Other studies from Tanzania, Iran, also support this finding.<sup>24,25</sup> This might be probably due to the higher involvement in road transportation, greater tendency toward high-risk activities, and thus, they are more exposed to RTIs and related death.<sup>25</sup>

This study depicted that victims from rural were more likely to die from road traffic injuries than the urban

residents. This finding is in line with the study conducted in central Ethiopia.<sup>6</sup> Moreover, evidences from China also indicated that more RTI-related deaths occurred among victims from rural residences.<sup>26</sup> This might be due to distance from health facility and lack of timely life-supporting intervention and these lead the victims to complication and death.<sup>27</sup>

In addition, this study revealed that pedestrians were more likely to die compared with passengers. This is in line with findings from studies conducted in Japan and Malawi.<sup>28,29</sup> This might be attributed to the inappropriate road use by pedestrians and lack of awareness of how to use roads.<sup>30</sup>

Road traffic accidents that occur during night time were significantly associated with death from RTIs. Similarly, study findings from China<sup>31</sup> and Oman<sup>32</sup> revealed the association between night-time injury and death from RTIs. This might be because decrease in visibility<sup>31,33</sup> and less supervision by traffic police<sup>34</sup> during night time may result in occurrence of accident and related deaths. Moreover, the traffic

volume is lower at night time and drivers might tend to drive carelessly in high speed or ignore traffic signs which increases the likelihood of RTI.<sup>9</sup>

The odds of RTI-related deaths were higher among accidents occurring during the weekend compared with other working days. This finding is in line with the study conducted in Swaziland<sup>9</sup> and this might be because more leisure activities such as alcohol or any other illicit drug use at weekend may contribute to more serious injuries and fatalities.<sup>35,36</sup>

The study indicated that individuals who didn't get first aid during injury occurrence were more likely to die from RTIs compared with those who got first aid at the site of injury. Studies from India support this finding.<sup>15,16</sup> This might be due to the fact that first aid at injury site and during transportation focuses on basic life-supporting care and resuscitations that would decrease complications and the occurrence of death. This implies that getting timely life-supporting first aid during accident would help decrease injury-related deaths.

Finally, this study figured out that having known comorbid conditions had associated with death from RTIs. This is supported by study conducted in Italy.<sup>37</sup> The reason might be injury may aggravate the previous chronic condition and increase the probability of death from injuries. This finding implies that the evaluating for comorbid conditions upon arrival at the emergency department would help reduce RTI-related deaths among victims with comorbid condition.

## Strengths and limitations

Given its importance for policymakers and program implementers, this study is not without limitations. Some information of unconscious victims collected from family, friend, or relative might be subjected to recall bias. The exclusion of unconscious victims who were unaccompanied might be subjected to selection bias. The study is conducted among victims who were admitted to emergency department of hospitals and fails to capture on-spot RTI-related deaths of who did not come to hospital. However, these biases do not seem to influence the validity of this study.

## Conclusion

A significant proportion of RTIs resulted in death among RTI victims attended at Adama town public and private hospitals. Age (25–44 years), place of residence, pedestrian deaths, night-time injury, weekend-time injury, and not getting first aid at injury site were significantly associated with RTI-related death. Preventive strategies that focus on young adults, pedestrians, and people with comorbidities, and having accessible first aid services would help to minimize deaths related to RTIs. Strict supervision during the weekend and night time would decrease the high RTIs and related deaths during the weekend and night time.

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## Author contributions

A.D., H.S., and L.O. initiated the research and drafted the manuscript, and B.T.M., G.M.A., T.B.R., B.N., and A.A. contributed to the study design, data extraction, analysis, and manuscript writing. All authors read and approved the final version of the manuscript.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Ethics approval

Ethical approval was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University (Ref. no.: IHRERC/154/2019). A formal letter of permission was written to Adama town health offices and hospitals. All responses were kept confidential and anonymous.

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## Informed consent

All participants were informed well about the purpose and the procedures of the study. Participation was fully voluntary, and written informed consent was obtained from each participant. For respondents aged <18 years (minors) and unconscious patients, consent was obtained from the family or guardian by confirmed signature and assent was obtained from the minors.

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## Data availability and materials

The data set analyzed during the current study available from the corresponding author on reasonable request.

## Supplemental material

Supplemental material for this article is available online.

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