

# Prevalence and determinants of road traffic injuries in Ethiopia: Based on the 2015 STEPS survey findings

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## Abstract

**Introduction:** Among African countries, Ethiopia has a relatively high burden of road traffic injuries. It is challenging to accurately estimate the public health burden and causes of road traffic crash in Ethiopia.

**Objective:** The objective of this study is to describe the prevalence and determinants of road traffic injuries in Ethiopia.

**Methods:** A population-based cross sectional study was conducted in accordance with the World Health Organization step-wise approach to survey of non-communicable diseases risk factors. The survey was carried out between April and June 2015. Men and women adults ages 15-69 years old were the target population. A single population-proportion formula was implemented to determine the sample size. Data were entered using e-STEPS, cleaned and analysed using SPSS and Stata. Descriptive weighted analysis was done along with complex sample analysis and bivariate and multivariate analysis was conducted for RTIs and associated factors.

**Results:** About 3% (2.7%, 95% CI: 1.8-3.5) of respondents were involved in a road traffic crash as a passenger, driver, or pedestrian during the prior 12 months. Our study found that the risk of being involved in road traffic injuries in those who have completed primary education is 1.4 times higher than in those that have no formal education (95% CI: 1.002-1.992). Those whose household income level is above 30,000 Ethiopian birr (ETB) had the highest involvement in road traffic injuries (4.2%). Those whose annual household income is above 30,000 ETB have an about 2 times increased risk of being involved in road traffic injuries than those whose annual income is below 12,000 ETB (95% CI between 1.313-3.230). The finding revealed that the risk of being involved in road traffic injuries is about 2 times higher in those who chew the plant *khat* (*Catha endulis*) than in those who do not chew *khat* (95% CI: 1.368-2.774).

**Conclusion:** The fact that the most economically productive age group are affected by road traffic injuries has serious economic implications for their immediate families and for the country, in general. Based on the finding of this study, level of education, household income and *khat* use are determinants of road traffic injuries in Ethiopia. These findings indicate that higher education has a role in reducing the risk of road traffic injuries. Based on this study we conclude that income of the individuals is directly proportional to road traffic crashes. [*Ethiop. J. Health Dev.* 2017;31(Special Issue):340-347

**Key words:** Road traffic injuries, prevalence, determinants, population-based, Ethiopia

## Introduction

Globally road traffic incidents cause 1.25 million fatalities and up to 50 million disabilities every year. About 90% of the deaths occur in low and middle-income countries even though these countries have less than half share of the world's registered vehicles. Pedestrians and two or three-wheel drivers account for almost half of all these deaths globally and 43% of deaths occurs in the African region (1).

In Africa, the number of road traffic injuries (RTI) and deaths has increased over the last three decades. In 2013, WHO African Region had the highest rate of

fatalities from road traffic injuries worldwide at 26.6 deaths per 100000 population. The increased burden of road traffic injuries and deaths is partly attributed to urbanization and economic development with a progressive increase of vehicle density and unsafe exposure to road traffic in the African region (2).

Among African countries, Ethiopia has a relatively high burden of RTIs. According to the National Road Traffic Office data, 18,309 road traffic injuries occurred in Ethiopia in 2015-2016 amongst which 4,352 were fatal (3). It is challenging to accurately estimate the public health burden and causes of road

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traffic crash in Ethiopia and other sub-Saharan African countries (5, 6). Most reported statistics in other countries are based only on the traffic police office data which is believed to underreport true rates of death from road traffic Injuries (7, 8).

Road traffic crashes incriminate three groups of factors that increase the risk of injury: host factors, factors associated with the roadway environment and agent factors. Factors related to the road way environment include design factors, road side hazards and driving conditions. Vehicle factors are design issues that contribute to a road traffic crash and the risk of injury in a crash. Host factors play a pivotal role in causing RTIs. At the individual level some of the risks include male gender, young age and behaviours such as substance abuse. Physiological conditions such as advanced age may also impair the individual's ability to function safely in a traffic environment (13).

RTIs are unevenly distributed between the sexes. Death rates due to RTIs are higher for men than women. It is the leading cause of death in the 15-29 age group and contribute to 325,736 deaths globally in the year 2012 (9). Low socioeconomic status is associated with higher risk of road traffic injury and mortality. There is a bidirectional relationship between poverty and road traffic injuries (11). The fact that road traffic injuries are more prevalent among the less advantaged is related to a number of factors such as travelling in less safe conditions, less focus on prevention efforts in poorer areas and poorer access to emergency trauma care and rehabilitation services (9).

According to Ethiopia's National Road Safety Council, 81% of crashes in Ethiopia are attributed to driver error. Driver impairment is rarely recorded as a contributory factor and the traffic police have virtually no equipment to measure drug use. The public generally assumes driver's *khat* use as a risk factor of RTIs. Most people avoid travelling at night, primarily because this is when truck drivers are likely to be tired and/or driving under the influence of *khat*. According to a study that attempted to understand the relationship between chewing *khat* and driver impairment, levels of habituation and withdrawal symptoms are important factors that may influence driver impairment (13). Similarly, studies have shown that there is a strong relationship between frequency of heavy episodic drinking and risk of alcohol related injuries (12). Moreover, other studies reveal that drunk driving increases the likelihood of road traffic crash and, as a result of that, fatality and serious injury. One quarter of all road accident deaths are associated with alcohol. One tenth of all road traffic injuries are associated with driving under the influence of alcohol (1, 15). Introduction and scaling up of random breathalyzer test programs result in significant reduction in road traffic fatalities (13).

In this study, we attempt to show the magnitude of RTIs from a population-based survey, associated socioeconomic factors and substance use specifically

related to alcohol and *khat* use based on NCD STEPs survey conducted in 2015.

### Objective

The objective of this study is to describe the prevalence and determinants of road traffic injuries in Ethiopia.

### Methods and Materials

A population-based cross-sectional study was conducted in accordance with the WHO step-wise approach to the surveillance of NCD risk factors. The survey was carried out between April and June 2015. Men and women adults ages 15-69 years living in Ethiopia were the target population.

A single population-proportion formula was implemented to determine the sample size. To adjust for the design effect, a complex sampling design effect coefficient of 1.5 was used to compute the sample size. In order to have an adequate level of precision for each age-sex estimate and place of residence, the sample was multiplied by the number of age-sex and place of residence groups for which the estimates were reported. Thus,  $Z\text{-score}=1.96$ ; proportion = 35.2% (11); marginal error  $r=0.04$ ; design effect = 1.5; age-sex estimate and place of residence - sex estimate = 10 groups, and non-response rate = 20%. Thus, 10,260 study participants were considered included for the study. A mix of sampling approach, namely, stratified, three-stage cluster sampling, simple random sampling and Kish method were employed to select the study settings and the study participants. The sampling frame was based on the population and housing census conducted for Ethiopia in 2007 (CSA, 2008). The study was conducted in all 11 regions including the two city administrations (Addis Ababa and Dire Dawa).

Data were entered using e-STEPS, cleaned and analysed using SPSS and Stata. Descriptive weighted analysis was done along with complex sample analysis, and bivariate and multivariate analysis were conducted for RTIs and associated factors such as socio-economic determinants (sex, age, household income, occupation and educational status), alcohol and *khat* use.

**Ethical clearance:** Principles of ethics were followed in this survey. Data were collected anonymously without any personal identifiers. For the purpose of data collection, informed consent was obtained from the study participants before administering the questions/collecting blood sample and objectives of the study was explained to the participants by the data collectors. For under eighteen children (age <18 years) survey participants, assent and consent was obtained from their parents or guardians. Ethical clearance was obtained first from the Ethiopian Public Health Institute (EPHI). Institutional review board (IRB) and then from National Research and Ethics Review Committee. Furthermore, official letter was produced and delivered to the respective regional health bureaus by EPHI during fieldwork. Physical measurement was done by performing measurements at a separate room and an area that has been screened off from other people within the household. Individuals with

abnormal physical and biochemical results were referred to the near-by health facilities for further investigation, diagnosis and follow up. Blood sample was drawn by trained health professionals under standard clinical procedure. Study participants were indirectly benefited from this study through early identification of risk factors for NCDs for which they were advised and referred for further diagnosis and follow-up.

## Result

**Characteristics of Respondents:** A total of 9,701 study participants were included in the survey with a response rate of about 97%. More than 40% of the study participants (3,922 people) were between the age of 15 and 30 years and more than 35% were between 30 and 45 years old (3,463 people). Those 60-69 years of age accounted for 6.7% of study participants (646 people). Female study (5,760) participants accounted for about 60%. About 70% of study participants (7,045) were included from rural areas.

Of all survey respondents, nearly one in ten (9.9%) were employed (13.1 % men and 7.8 % women). All individual over 18 years of age in the household were asked about their earnings. Of those who were able to estimate their earning, the mean reported per capita annual income of respondents was 1,500.79 ETB (Is the decimal point in the correct place?). For individuals

who were not able to estimate the exact annual income, quintiles of estimated household earnings were set and respondents were asked which quintile best fits their income category. Accordingly, majority (71.1%) of survey respondents fall under first quintile with annual earning of less than 12,000 ETB. About 17.4% of survey respondents were in the second quintile with annual earnings of more than 12,000 and less than or equal to 18,000 ETB. About 5.3% of respondents fall within the third quintile with annual earnings of more than 18,000 ETB and less than or equal to 23,300 ETB. About 2.7% of respondents fall within the 4<sup>th</sup> quintile with annual earnings of more than 23,300 and less than or equal to 30,000 ETB. About 3.4% of respondents fall within the 5<sup>th</sup> quintile with annual earnings of more than 30,000 ETB.

**Prevalence of RTIs:** About 3% (2.7%, 95% CI: 1.8-3.5) of respondents were involved in a road traffic crash as a passenger, driver, or pedestrian during the past 12 months. There were more men (3.3%) involved in road traffic crash than women (1.9%) did. More RTIs occurred in the 45-59 age group (3.1%) followed by the 15-29 age group (2.7%). The least involvement in RTIs occurred in the 60-69 age group (2.2%). There was also a slight difference in proportion of rural (2.6 %) and urban (2.8%) respondents in road traffic crash involvement (Table 1).

Table 1: Proportion of respondents who were involved in a road traffic injury during the past 12 months by sex, age group and place of residence, Ethiopia NCD STEPS, 2015

Variable	Men		Women		Both Sexes	
	n	%	n	%	n	%
<b>Age (years)</b>						
15-29	1429	3.2	2493	2.0	3922	2.7
30-44	1425	3.3	2038	1.6	3463	2.5
45-50	772	3.8	898	2.0	1670	3.1
60-69	315	2.8	331	1.2	646	2.2
<b>Residence</b>						
Rural	3169	3.1	3876	1.9	7045	2.6
Urban	772	4.4	1884	1.5	2656	2.8
15-69	3941	3.3	5760	1.9	9701	2.7

Road traffic injuries in terms of road users (passengers, driver, pedestrians and cyclist) showed that the majority of RTIs occurred as passengers (66.7%). On the other hand, the least percentage of RTIs occurred as cyclists (8.6%) and pedestrians (8.9%) (Table 2).

Table 2: Road traffic injury prevalence by road user type in Ethiopia

Road user Type	Number	Percent
Driver	33	15.9%
Passenger	138	66.7%
Pedestrians	50	8.9%
Cyclist	14	8.6%
Total RTI	235	100.0%

All the respondents who experienced road traffic crash in the past 12 months, about 18% (CI: 11.4-24.9) of them were seriously injured. Urban residents (35.6%) were more seriously injured than rural residents (13.7 %). The proportion of men who had been seriously injured in road traffic crash progressively increased from age groups 15-29 years to 45-59 years. Greater proportion of women who had been seriously injured in road traffic crash constituted in the age group of 60-69 years (Table 3).

Table 3. Proportion of respondents seriously injured as a result of road traffic injury among those involved in a road traffic injury by age, sex, and place of residence, Ethiopia NCD STEPS, 2015

Variable	Men		Women		Both Sexes	
	n	%	n	%	n	%
<b>Age (years)</b>						
15-29	44	16.5	53	97	97	14.0
30-44	45	27.0	28	15.1	73	23.6
45-50	26	34.5	18	0.6	44	25.4
60-69	10	4.0	8	55.1	18	14.6
<b>Residence</b>						
Rural	86	15.7	67	9.1	153	13.7
Urban	39	44.6	40	14.9	79	35.6
15-69	125	21.7	107	10.3	232	18.1

**Determinants of RTIs:** More males (3.3%) were involved in road traffic injuries than females (1.9%). However, it was found that no association exists between sex and involvement in RTIs with multi-variable analysis. More RTIs occurred in the 45-59 age group (3.1%) followed by 15-29 age group (2.7%). The least percentage of RTIs occurred in the 60-69 age group (2.2%). However, no association was found in this study between age group and involvement in RTIs with multi-variable analysis.

This study showed that RTIs was highest among employed people (4.2%) to be followed by skilled workers (3.2%). The lowest prevalence was noticed amongst housewives and the unemployed (1.6%). However, multi-variable analysis revealed that there is no association between occupational status and RTIs. The prevalence of RTIs in urban population (2.8%) is slightly higher than in rural population (2.6%). No association was found between place of residence and being involved in RTIs based on multi-variable analysis. The finding of this study revealed that 2.1% of the population that are single are involved in RTIs; while, the prevalence of RTIs in married/cohabitating people is 3.0%. However, no association was found between RTIs and marital status with multi-variable analysis. (Tables 4 and 5).

Based on multi-variable analysis, it was found that the risk of being involved in RTIs in those that have completed primary education is 1.4 times higher than in those that have no formal education (95% CI: 1.002-1.992). However, there is no association between RTIs and those that have completed secondary education and higher education.

Those whose household income level is above 30,000 ETB had the highest involvement in RTIs (4.2%) to be followed by those whose income is between 12,000-18,000 ETB (4.1%). The least involvement in RTIs was found in those whose household income is below 12,000 ETB. We found that those whose annual household income is above 30,000 ETB have an about 2 times increased risk of being involved in RTIs than those whose annual income is below 12,000 ETB (95% CI between 1.31-3.23). There is a marginally significant association between RTIs and having an annual household income level between 12,000 to 18,000 ETB (95% CI between 0.967-2.283; p-value 0.071) and between 23,300 to 30,000 ETB (95% CI between 0.925 and 2.622; p-value 0.096). However, there is no association between RTIs and household income level between 18,000 and 23,300 ETB. (See Tables 4 and 5).

Table 4: RTI Prevalence by Socio-demographic characteristics, khat and alcohol consumption status; NCD STEPS, 2015.

Variables	RTI			
	No		Yes	
	Count	%	Count	%
<b>Sex</b>				
Male	3815	96.7%	126	3.3%
Female	5651	98.1%	109	1.9%
Total	9466	97.3%	235	2.7%
<b>Age Group (years)</b>				
15-29	3825	97.3%	97	2.7%
30-44	3387	97.5%	76	2.5%
45-50	1626	96.9%	44	3.1%
60-69	628	97.8%	18	2.2%
Total	9466	97.3%	235	2.7%
<b>Marital status</b>				
Single	3050	97.9%	76	2.1%
Married or cohabiting	6414	97.0%	159	3.0%
Total	9464	97.3%	235	2.7%
<b>Occupational Status</b>				
Employed	906	95.8%	41	4.2%
Skilled Worker	4907	96.8%	129	3.2%
Housewife	2342	98.4%	37	1.6%
Unemployed	1183	98.4%	25	1.6%
Total	9338	97.3%	232	2.7%
<b>Annual Household Income level</b>				
≤12,000 ETB	5385	98.1%	107	1.9%
More than 12, 000 ≤ 18,000 ETB	897	95.9%	28	4.1%
More than 18,000 ≤ 23,300 ETB	403	97.6%	12	2.4%
More than 23,300 ≤ 30,000 ETB	537	96.0%	20	4.0%
More than 30,000 ETB	613	95.8%	31	4.2%
Total	7835	97.5%	198	2.5%
<b>Level of Education</b>				
No Formal Education	4709	97.9%	86	2.1%
Primary Education	3655	97.0%	103	3.0%
Secondary Education	619	96.6%	22	3.4%
College and above	483	96.5%	24	3.5%
Total	9466	97.3%	235	2.7%
<b>Alcohol consumption in the last 12 months</b>				
No	5768	98.1%	123	1.9%
Yes	3698	96.4%	112	3.6%
Total	9466	97.3%	235	2.7%
<b>Khat consumption in the last 12 months</b>				
No	7985	97.3%	179	2.7%
Yes	1481	97.8%	56	2.2%
<b>Total</b>	<b>9466</b>	<b>97.3%</b>	<b>235</b>	<b>2.7%</b>

Table 5: Logistics Regression analysis to determinants which could contribute for occurrence of RTIs, Ethiopia, NCD STEPs Survey, 2015

Variables	RTIs		COR (95% CI)	AOR (95% CI)
	Yes	No		
<b>Sex</b>				
Male	126	3815	1.712 (1.321-2.220)	1.307 (0.918-1.860)
Female	109	5651	1.00	1.00
<b>Occupational Status</b>				
Employed	41	906	2.141 (1.293-3.548)	1.254 (0.684-2.299)
Unemployed	25	1183	1.00	1.00
<b>Annual Household Income level</b>				
≤12,000 birr	107	5385	1.00	1.00
More than 12,000 ≤ 18,000 ETB	28	897	1.571 (1.030-2.396)	1.486 (0.967-2.283)
More than 18,000 ≤ 23,300 ETB	12	403	1.499 (0.818-2.745)	1.361 (0.732-2.532)
More than 23,300 ≤ 30,000 ETB	20	537	1.874 (1.153-3.046)	1.557 (0.925-2.622)
More than 30,000 ETB	31	613	2.545 (1.692-3.892)	2.059 (1.313-3.230)
<b>Level of Education</b>				
No Formal Education	86	4709	1.543 (1.155-2.061)	1.00
Primary Education	103	3655	1.946 (1.209-3.132)	1.413 (1.002-1.992)
Secondary Education	22	619	2.721 (1.714-4.319)	1.612 (0.908-2.863)
College and above	24	483	1.00	1.422 (0.736-2.744)
<b>Alcohol consumption in the last 12 months</b>				
Not consumed alcohol	56	1481	1.00	1.00
Consumed alcohol	179	7985	1.420 (1.096-1.841)	1.192 (0.876-1.622)
<b>Khat consumption in the last 12 months</b>				
Not chewed khat	112	3698	1.00	1.00
Chewed khat	123	5768	1.687 (1.243-2.289)	1.948 (1.368-2.774)

The prevalence of RTIs in those peoples who consumed alcohol in the past 12 months was higher (3.6%) than in those who did not consume alcohol (1.9%). However, in our analysis, we found no association between alcohol consumption and RTIs.

We found out that those who chewed *khat* have RTI prevalence of 2.2% while those who did not chew *khat* have RTI prevalence of 2.7%. However, on multi-variable analysis we found that the risk of being involved in RTIs is about 2 times higher in those who chewed *khat* than in those who did not chew *khat* (95% CI: 1.368-2.774). See Tables 4 and 5.

### Discussion

Our study focused on the prevalence of RTI prevention in Ethiopia and the importance of reducing RTIs in order to achieve one of the key Sustainable Development Goals (SDGs) of halving the number of RTI-related deaths and injuries by 2030 (25). The larger proportion of male victims may be a reflection of their increased exposure to the traffic environment as compared to females. The current study is consistent with other similar studies with the exception that that, in our study, the most affected age group is 45-59 years (4, 16-17). The fact that the most economically productive age group are affected by RTIs has serious economic implications for the country, in general, and, of course, to themselves and their immediate families. Pedestrian injury is reported as the most frequently reported road fatality type in all the countries except for Botswana and Malawi where passenger deaths dominated (9). The predominance of RTIs in passengers may be related with greater use of public transport by the general population, risky driving behaviour and poor driving skill of their operators.

In this particular study, age, sex, marital status, place of residence, occupation and alcohol consumption are not associated with RTIs based on multi-variate analysis. These findings are not in agreement with studies from Thailand and Iran although the Thai study used secondary data analysis of hospital and police records (10, 19). According to the Thai study, most road traffic injuries occurred in the young and productive age group (10-39 years). In the same study, males were 4-5 times at risk of RTI than females were. Overall, RTIs were 45% more common among males than females in the Iranian study. According to Iranian study, there is strong association between age and RTI, with the younger age group (18-25 years) being 2.5 times more likely to have RTI than the older group (>45 years). Moreover, high incidence of RTIs was observed in pensioners and employed people in Iranian study. The STEPS finding is similar to the Iranian study in that marital status did not significantly change the risk of RTI in multivariate model (10, 19).

Based on the Ethiopian STEPS survey findings, level of education, household income and *khat* use are associated with road traffic injuries. Our study found that the risk of being involved in RTIs in those who have completed primary education is about 1.4 times higher than in those that have no formal education. On the other hand, the risk of road traffic injuries is lowest in those that have college and above education. This finding is in agreement with the Iranian study in that the risk of RTIs is lowest in people with a higher education (college) (19). It is also similar to the study done in Welaita, Ethiopia, with the exception that there was an increasing trend of RTIs as level of education decreased (17). The difference between the two studies may be explained by the variation in research methodology as the STEPS finding is in contradiction

to the Welaita study (18). The low prevalence of road traffic injuries in those that have no formal education in the STEPS study may be attributed to the fact that they are less exposed to the traffic environment.

In this study, those whose annual household income is above 30,000 ETB have an about 2 times increased risk of being involved in RTIs than those whose annual income below 12,000 ETB. There is a marginally significant association between RTIs and having an annual household income level between 12,000 to 18,000 ETB and between 23,300 and 30,000 ETB. This could be explained by the fact that as income increases individuals are more likely to own cars and as a result of that they will be exposed to road traffic crashes. Moreover, as income increases individuals are more likely to be exposed to the traffic environment and their likelihood of being involved in road traffic crashes increases. This is in contradiction to the Iranian study (19) perhaps due to variation in the research methodology. This finding is similar to the Addis Ababa study (20) even though it is a hospital-based study.

We found that there is no association between alcohol consumption and RTIs. This finding is inconsistent with studies done in Nigeria (20), Japan (21), Norway (22) and Addis Ababa (23, 24) even though the latter two are hospital-based studies. Our study did not include questionnaires on drinking status before or while driving and/or while riding in a vehicle where the driver had alcoholic drinks.

We also found that the risk of being involved in RTIs is about 1.6 times higher in those who chewed *khat* than in those who did not chew *khat* (95% CI: 1.060-2.288). This finding is consistent with another study (14) and also with the study previously cited above which was done in Addis Ababa (23).

### Strength

Our study is the first population-based study in Ethiopia with a representative sample.

### Limitations

This study did not include questionnaires on other important risk factors of road traffic injuries such as seat belt use, helmet use and alcohol consumption while driving and/or while riding in a vehicle where the driver has had alcoholic drinks.

### Conclusion:

Based on the STEPS survey findings, slightly more urban residents are affected by RTIs than rural residents of Ethiopia. More males are involved in road traffic crashes than females. Level of education, household income and *khat* use are determinants of road traffic injuries in Ethiopia. This findings indicate that higher education has a role in reducing the risk of road traffic injuries. Income of the individuals is directly proportional to road traffic crashes.

### Recommendation

We recommend that road traffic injury prevention programs be designed and implemented by all concerned stakeholders of road safety. There is also a need to reinforce traffic laws and develop legislation on the use of substances such as *khat* chewing while driving. We recommend that road safety education be introduced in school health programs with particular attention on primary education. We also suggest that further studies should be completed on risk factors associated with road traffic injuries such as children age group, seat belt and helmet use, child restraints and alcohol consumption and *khat* use while driving and/or while riding a vehicle where the driver has had alcoholic drinks. Data should also be collected on risky driving behaviours and underlying factors for those behaviours. Finally, we recommend that injury surveillance system should be strengthened in all health facilities of the country.

### Acknowledgments

The successful completion of the Non-Communicable Diseases (NCDs) steps survey demonstrates the combined efforts of Federal Ministry of Health/the Ethiopian Public Health Institute, development partners, professional associations, and individuals without which this manuscript could not have been possible.

We would like to thank the following organizations for their financial and technical support:

- Federal Ministry of Health for providing the lion's share of financial support for conducting this survey
- The overall coordination and guidance provided by Health System Research Directorate of EPHI is also highly appreciated. We would also like to extend our sincere gratitude to the survey participants who cooperated and participated in the realization of the survey.

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