

## Research Article

# Study of the Injured Persons and the Injury Pattern in Road Traffic Accident in Sana'a City, Yemen

**Abdulhameed Ali Al-Thaifani, Nabil Ahmed Al-Rabeei,  
and Abdulsalam Mohammed Dallak**

*Department of Nursing, Faculty of Medicine and Health Sciences, Sana'a University, Sana'a, Yemen*

Correspondence should be addressed to Abdulhameed Ali Al-Thaifani; [abdulhameedl@yahoo.com](mailto:abdulhameedl@yahoo.com)

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**Background.** Fatal road traffic accidents constitute a significant public health problem. **Aim.** The aim of the study was to analyze road traffic accidents in Sana'a city, Yemen, during 2013–2015. **Methods.** The required information and data of accidents were collected, respectively, from police reported road accident statistics, Sana'a city. 11684 cases of road traffic accidents during period 2013–2015 were studied. **Results.** 840 people were killed and 9760 people were injured in RTAs during 2013–2015 in Sana'a city. The accident rates per 100000 of the population were 234.8 in 2013, 180.3 in 2014, and 92.2 in 2015. Mortality rates per 100000 of the population were 15.17 in 2013, 12.2 in 2014, and 8.9 in 2015. High speed was the single most important factor responsible for accidents, deaths, and injuries accounting for 38.1% of RTAs followed by drivers' fault accounting for 18.9% of the total RTAs. The most common age group involved was  $\geq 18$  years. Males accounted for 83.1% of killed and injured persons. Most frequent victims of road traffic accidents were vehicles motor (48.9%) followed by pedestrians (38.1%). More than half of RTAs occurred on the straight road. **Conclusion.** RTAs are a major source of public health concern in Sana'a city, Yemen. Preventive measures to reduce the burden of mortality and morbidity due to road accidents should be introduced.

## 1. Introduction

Road traffic accidents (RTAs) represent a leading and increasing contributor to regional and global disease burden. Each year nearly 1.3 million people die as a result of a road traffic collision in the world, more than 3500 deaths each day. Moreover, twenty to fifty million more people sustain nonfatal injuries from a collision, and these injuries are an important cause of disability worldwide [1]. RTAs are projected to become the 3rd largest contributor to global disease burden by 2020 [2]. According to the WHO [3] road traffic injuries caused an estimated 1.24 million deaths worldwide in the year 2010, down from 1.26 million in 2000. Half of all road traffic deaths are among pedestrians, cyclists, and motorcyclists, and adults aged between 15 and 44 years account for 59% of deaths. Three out of 4 road deaths are among men. The average rate was 18 per 100,000 people (down from 20.8 in 2000). 92% occurred in low- and middle-income countries, with South-East Asia and Africa having the

highest rates in the world due to risk factors such as speed and alcohol, and exacerbated by inadequate enforcement of traffic safety regulations and public health infrastructure [4]. There is marked variation across the world in the way that roads are used and injuries are caused, which have important implications for road safety policy and practice [5]. RTAs are a major source of public health concern in Yemen. RTAs constitute about 12% of the total deaths in the country. It is the fifth major cause of deaths in Yemen [6, 7]. These deaths are largely preventable through the concerted efforts of institutions and civil society and by implementing effective road safety measures. The result of this study shall provide important information on road traffic accidents in Sana'a city, Yemen, which in turn shall contribute to better understanding of the extent of RTA as a critical public health problem.

**Aim.** The aim of the study was to analyze road traffic accidents in Sana'a city, Yemen, during 2013–2015 periods.

## 2. Material and Methods

**2.1. Study Setting.** The study takes place in Sana'a city, capital of Yemen.

**2.2. Study Design.** Retrospective study was administered to analyze road traffic accidents in Sana'a city, Yemen.

**2.3. Study Population.** The study population is all road traffic accidents that occurred in Sana'a city from 2013 to 2015.

**2.4. Data Collection Tools.** The required data of RTAs were collected, respectively, from police reported road accidents statistics, Sana'a secretary traffic police office on a standardized, and closed-ended data collection form. The data collected comprised all of these parameters: characteristics of road accidents (road traffic condition), causes of RTAs, classification of accident (road vehicle accidents type, severity of RTAs: killed and injured persons), injury characteristics, type of road traffic user involved, and age and sex profile of victims.

**2.5. Data Analysis.** Data was entered into SPSS version 18.0 database (SPSS Inc., Chicago, IL). Descriptive statistics (frequency and the percentage) was applied. The accident rate was calculated as follows: number of RTAs per year/total population \* 100000. Mortality rate was calculated as follows: number of deaths due to RTAs per year/total population \* 100000 [8].

The injury rate was calculated as follows: number of injuries due to RTAs per year/total population \* 100000 [8]. Death/accident was calculated as follows: number of deaths due to RTAs/number of RTAs \* 1000 [8]. Injury/accident was calculated as follows: number of injuries due to RTA/number of RTAs \* 1000. Death/injury was calculated as follows: number of deaths due to RTAs/number of injuries due to RTAs \* 1000. Accident/vehicle was calculated as follows: number of RTAs per year/number of registered vehicles per year \* 10000 [8].

Death/vehicle was calculated as follows: number of deaths due to RTAs per year/number of the registered vehicles per year \* 10000. Injuries/vehicle were calculated as follows: number of injuries per year/number of registered vehicles per year \* 10000. Accident/day was calculated as follows: number of RTAs/360 days. Death/day was calculated as follows: number of deaths/360 days and injury/day was calculated as follows: number of injuries/360 days. Case fatality rate (%) was calculated as follows: number of deaths due to RTAs/number of deaths and injuries \* 100 [9]. Accidents severity rate was calculated as follows: number of deaths/number of RTAs per 100 accidents [10].

**2.6. Ethical Consideration.** Prior permission from appropriate authorities was taken for conducting the study that mainly included access to records.

## 3. Results

**3.1. Classification of Road Traffic Accidents.** A total of 11684 RTAs occurred during 2013–2015. The majority of the RTAs

TABLE 1: Road vehicle accidents type and persons killed and injured ( $N = 11684$ ).

Variables	2013	2014	2015	Total
<i>Accidents type</i>				
Overturning accident	182	154	100	436
Collision with other vehicles	2921	2157	970	6048
Collision with pedestrians	1816	1656	985	4457
Collision with fixed objects	299	242	202	743
<i>Severity of RTAs</i>				
No injury	694	390	0	1084
Persons killed	337	285	218	840
Persons injured	4187	3532	2041	9760

TABLE 2: Distribution of the victims of RTAs according to type and site of injured persons ( $N = 1600$ ).

Injury characteristics	Number	%
<i>Type of injury</i>		
Fracture	765	47.81
Dislocation	89	5.56
Crush injury	75	4.68
Cut wound/laceration	154	9.62
Blunt injury	45	2.81
Internal hemorrhage	472	29.5
<i>Site of injury</i>		
Head	287	17.93
Maxillofacial region	76	4.75
Thorax	189	11.81
Abdomen	113	7.06
Upper limb	87	5.43
Lower limb	675	42.18
Spine	30	1.87
Pelvis	143	8.93

11248 (96.3%) were collision accidents with other vehicles or pedestrians or fixed objects and 436 (3.7%) were overturning accidents. Our results showed that, in 2015, 218 people were killed in reported RTAs in Sana'a city, with a lesser number of 67 (30.7%) in 2014 and of 119 (54.5%) in 2013. Furthermore, 2041 people were injured, with a lesser number of 1491 (42.2%) in 2014 and 2146 (51.3%) in 2013 (Table 1).

**3.2. Injury Characteristics.** Fracture (47.81%) was the most common type of injury in the victims of RTI, followed by internal hemorrhage (29.5%) and cut wound/laceration (9.62%). Dislocation injury was seen in 5.56 percent of the victims of RTI. Lower limb (42.18%) was the most common site of injury, followed by head (17.93%) and thorax (11.81%) (Table 2).

**3.3. Location and Causes of RTAs.** With regard to characteristics of street accidents and causes, there were 6488 (55.5%) of the accidents that occurred on the straight road

TABLE 3: Distribution of location and causes of RTAs (N = 11684).

Variables	2013	2014	2015
<i>Location of RTAs</i>			
Straight road	2895	2334	1259
Round road	632	382	185
Cross road	1314	1126	472
Close road	25	0	0
Tunnel	67	124	80
Declivity	252	241	235
Others	13	0	48
<i>Causes of RTAs</i>			
Young children drivers	194	80	6
High speed	2025	1625	806
Pedestrians' fault	939	770	235
Drivers' fault	1013	822	372
Vehicle defect	288	209	94
Inexperience (no driving license)	452	381	240
Others	307	320	251

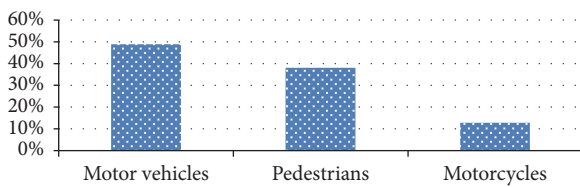


FIGURE 1: Distribution of persons killed and injured by road user type (N = 10600).

followed by 2912 (24.9%) across the road. Round road, tunnel, and declivity accounted for 1199 (10.3%), 728 (6.2%), and 271 (2.3%), respectively. Other accounted for 8 (0.7%). The analysis of road accidents in terms of causal factors reveals that high speed is the single most important factor responsible for accidents; deaths and injuries accounted for 38.1% (4456 accidents) followed by drivers' fault accounting for 18.9% (2207 accidents) of total accidents. The fault of the pedestrians and that of the drivers without driving license (inexperience) accounted for a share of 16.6% and 9.2%, respectively, in road accidents. Defects in the motor vehicles caused 5.1% of RTAs and young children driver represents 2.9% of RTAs. Others factors accounted for 7.5% (Table 3).

**3.4. Types of Road Traffic Users.** Of all road traffic casualties during 2013–2015, 48.9% were motor vehicles (car and bus) users, followed by pedestrians 38.3%, and 12.8% were motorcyclists (Figure 1).

**3.5. Distribution of Killed and Injured Persons by Age and Sex.** Distribution of killed and injured persons due to RTAs by age and sex during the year 2013–2015 reveals that the age group ≥18 years accounted for the largest share of 72 percent of total road accident casualties, followed by the age group <18 years with a share of 28 percent. With regard to sex

TABLE 4: Distribution of persons killed and injured by age and sex (N = 10600).

Years	<18 years		≥18 years		Total
	Female	Male	Female	Male	
2013	301	994	535	2694	4524
2014	259	770	482	2306	3817
2015	156	487	252	1364	2259
Total	716	2251	1269	6364	10600

distribution, there were more males than females as accident victims (81.3% in males, 18.7% in females). M/F ratio was 4.6 : 1 (Table 4).

**3.6. Indicators of Road Traffic Accidents.** The incidence of road accidents per 100000 of population was 234.8 accidents in 2013, 180.3 in 2014, and 92.2 in 2015. Mortality rate due to RTAs per 100000 of population decreased from 15.17 deaths in 2013 to 12.21 in 2014 followed by a sharp decrease to 8.90 in 2015. There has been a onefold decrease in the number of persons injured per 100000 of population from 188.43 in 2013 to 151.33 in 2014 and more than threefold decrease 83.3 in 2015. With regard to the number of persons killed per 1000 accidents, it increased from 64.58 in 2013 to 67.47 in 2014 and to 96.50 in 2015. The number of persons injured per 1000 accidents increased from 802.4 in 2013 to 839.55 in 2014 and to 903.49 in 2015. Regarding accidents per day, 14.3 accidents occurred per day in 2013, 11.5 in 2014, and 6.2 per day in 2015. Similarly there were 0.93 person deaths and 11.47 injured per day in 2013, 0.78 person deaths and 9.68 injured per day in 2014, and 0.60 person deaths and 5.59 injured per day in 2015. The number of accidents per 10000 vehicles has declined from 657.4 accidents in 2013 to about 530 in 2014 and 284.6 in 2015. With regard to the number of persons killed and injured per 10000 vehicles the decline has been dramatic. The number of persons killed per 10000 vehicles has plummeted from 42.5 in 2013 to about 35.9 in 2014 and 27.5 in 2015. Similarly, the number of persons injured per 10000 vehicles has also fallen from about 527.5 in 2013 to 444.99 in 2014 and 257.14 in 2015. The accidents severity rate was 6.45 % in 2013, 6.77 in 2014, and 9.65 in 2015. Case fatality rate was 7.44% in 2013, 7.46% in 2014, and 9.65% in 2015 (Table 5).

#### 4. Discussion

This study has some limitations related to the incompleteness of background information on the deceased, inadequate specification, the cause of death, and time of the accident. More people were killed and injured due to RTAs in Sana'a city in 2013 compared to 2014 and 2015. To some extent, the decline in this parameter has been brought about due to the crisis that happened in Yemen in 2014 and 2015 which led to absence of benzene and fewer vehicles movement and that is due to fewer people walking around. The mortality rate for 2013 was 15.17 deaths per 100,000 of population which was higher than reported in Egypt 13.2 and Qatar 14, but lower

TABLE 5: Severity indicators of road traffic accidents.

Indicators	2013	2014	2015
Accidents rate	234.8	180.3	92.2
Mortality rate	15.2	12.2	8.9
Injury rate	188.4	151.3	83.3
Death/accidents	64.6	67.5	96.5
Injury/accidents	802.4	839.6	903.5
Death/injury	80.5	80.7	106.8
Accident/day	14.3	11.5	6.2
Death/day	0.93	0.78	0.60
Injury/day	11.47	9.68	5.59
Accident/vehicle	657.4	530.03	284.6
Death/vehicle	42.5	35.9	27.5
Injury/vehicle	527.5	444.9	257.1
Accidents severity rate	6.45	6.77	9.65
Case fatality rate	7.44	7.46	9.65

than reported from Iran 34.1, Iraq 31.5, Sudan 25.1, and Saudi Arabia 24.8 [11].

The mortality rate per 100,000 vehicles was 42.5 higher than reported in Bahrain 2.45 [12], in Australia 1.39, and in New Zealand 1.7 [13]. Also it was higher than reported in Canada 1.6, Germany 1.5, USA 1.9, and UK 1.2 [14]. More than half of the RTAs are in the wage earning age group. The loss of the main earning member can be disastrous, leading to falling in income of the household and lower living standards. Our study showed highest incidence of mortality has occurred in the age group of  $\geq 18$  years (72%) compared to the age group  $< 18$  years (28%). Our findings are in general agreement with those of another worker in the field [15]. Kochar et al. [16] have reported that maximal fatal accidents have occurred in the age group of 31–40 years. Singh and Dhatarwal [15] have observed that the commonest age group involved is 21–30 years (27.3%) followed by 31–40 years (20.6%). Similar findings were also reported from India and Nepal [6, 7, 17]. However, studies of 16–30 years' and 15–35 years' age groups were more involved in RTAs [18, 19]. A study from India reported that people of the 3rd decade of age were most commonly involved in RTAs [20].

In the present study, proportion of male involved in RTAs was 81.3%. In societies where women's mobility is traditionally restricted, men may spend substantially more time in moving vehicles than women, and among all groups other than among the small economic elite, men are more likely to own cars than women. Men are also more likely to be employed as drivers and mechanics in cars and trucks, including drivers of long-haul vehicles which may mean spending several days and nights in the vehicle [21]. Yemen's gender proportion (among RTAs persons) shows a great difference as compared to the statistics from other nations such as Australia with 66% being male [22] or Turkey with 68% [23]. The bias observed towards male involvement in car accidents can be explained by the fact that, in the Yemen society, females tend to participate less in outdoor activities. However, the figure from our study comes near the ratio

found in other developing countries such as India with 83% of the victims of RTAs being men [24] and 86% in Pakistan [25].

With regards to road user type, cars and buses have been mostly involved followed by pedestrians and motorcycles. The proportion of cars and buses was 48.9% which falls over the years as more and more vehicle victims are being affected. The findings are in conformity with Singh and Dhatarwal [15]. Our findings are general in agreement with Eke and Frused [26] who have observed that cars and buses are commonly involved in the casualties followed by motorcycles. The proportion of pedestrians were 38.1%. Being the second common victims can be explained by the fact that there is a lack of proper footpath and presence of vendors and other commercial installations by the side of the roads. This percentage is much lower when compared to values found in a study of the Middle East (50% pedestrian) [26] and with those of other studies [6, 7, 17, 27], which noted that pedestrians, cyclists, and motorcyclists are the most vulnerable road user constituting 70–80% of all RTAs deaths.

The fracture was the most common type of injury in the patients of RTI, followed by internal hemorrhage and cut wound/laceration. Lower limb was the most common site of injury, followed by the head. A similar trend has been demonstrated in other studies [28–30]. This shows that the injury pattern is generally the same following road traffic accidents and this knowledge of injury pattern could be helpful while planning Emergency and Trauma Care Services and also in designing and implementation of safety measures.

## 5. Conclusion

This study has shown the data recorded for road traffic accidents in the past three years in Sana'a city, Yemen. As we have seen, the incidence of RTAs was higher in Sana'a city, Yemen, compared to other countries. Mortality rate was more in 2013 than 2014 and 2015.

## Additional Points

*Recommendations.* There is clearly a need for road safety education and it should be directed towards road users, who are frequently involved and injured in RTAs.

## Competing Interests

The authors declare that there is no conflict of interests regarding the publication of this article.

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