Analysis of Road Traffic Accidents in Turkey between 2013 and 2017

Ali Kemal Erenler 1,* and Burak Gümüş 2

1 Emergency Medicine, Department of Emergency Medicine, School of Medicine, Hitit University, Çorum 19000, Turkey
2 Forensic Sciences, Department of Forensic Sciences, School of Medicine, Hitit University, Çorum 19000, Turkey; eti19030@hotmail.com

* Correspondence: akerenler@hotmail.com; Tel.: +905324475563

Received: 27 August 2019; Accepted: 30 September 2019; Published: 9 October 2019

Abstract: Background and objectives: Road traffic accident (RTAs) is one of the top ten leading causes of death worldwide and its incidence is higher in developing countries. In this study, our aim was to determine the characteristics of RTAs in Turkey and make recommendations to reduce mortality and morbidity related to RTAs. Material and Methods: We obtained our data, which cover the years 2013 to 2017, from the database accessible at the official website of the Turkish Statistical Institute, which permits the use of its data for research purposes. The chi-square test was used for statistical analysis, and the percentage distribution and odds ratios were calculated. Results: In the study period, a total of 697,957 RTAs occurred in Turkey. A total of 1,168,121 individuals have been wounded and 3534 of them have lost their lives. The majority of RTAs occurred on weekends and in summer months. Male individuals are more likely to be exposed to death and injuries related to accidents. When the vehicle type is considered, motorcycle drivers are under more risk for RTAs. RTAs are more likely to occur in rural areas. Conclusion: Male individuals and motorcyclists are under a great risk for RTAs. Strict laws are mandatory in order to reduce morbidity and mortality related to RTAs. Additionally, educational efforts must focus on two-wheelers and tractor drivers, particularly in developing countries.

Keywords: Road traffic injury; trauma; mortality

1. Introduction

An accident is defined as “an unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury” [1]. Accidents occurring on the road, involving pedestrians and/or vehicles, are defined as road traffic accidents (RTAs) [2]. RTA is one of the top ten leading causes of death worldwide and its incidence is higher in developing countries [3]. It is also known that RTA is the leading cause of death for young people aged 15–29 years [4]. Accidents are influenced by a combination of human, road and environmental factors [5]. An increase in the related burden has been observed worldwide and pedestrians, cyclists, and two-wheeled motorcycle riders are the most vulnerable populations that contribute to the observed mortality [6].

To the best of our knowledge, there are no published studies evaluating regional premature mortality due to traffic accidents in Turkey. Our aim in this study is to investigate characteristics of RTAs in Turkey and make recommendations for prevention from morbidity and mortality.

2. Material and Methods

We obtained our data, which cover the years 2013 to 2017, from the database accessible at the official website of the Turkish Statistical Institute, which permits the use of its data for research purposes.
The data were evaluated by using the Statistical Package for the Social Sciences (SPSS) 10.0 program. The chi-square test was used for statistical analysis, and the percentage distribution and odds ratios were calculated.

3. Results

In a 5-year-period, a total of 697,957 RTAs occurred in Turkey. As a result of these accidents, a total of 1,168,121 individuals have been wounded and 3534 of them have lost their lives.

When the monthly distribution of these RTAs was investigated, it was determined that the frequency of RTAs rose in summer months when compared to winter months. Accordingly, injuries and death also occurred more frequently in summer months. On weekends (Saturday and Sunday), the frequency of RTAs tends to rise. The proportion of RTAs resulting in death was found to be higher at night and twilight hours. Table 1 summarizes the distribution of number of accidents, deaths and injuries according to months, days and day hours.

Table 1. Distribution of number of accidents, deaths and injuries according to months, days and day hours.

| Monthly Distribution | Accidents n (%) | Deaths n (%) | Injuries n (%) |
|----------------------|----------------|--------------|---------------|
| Total 697,957        | 100            | 3534         | 1,168,121     |
| January 42,304       | 6.06           | 189          | 71,146        |
| February 40,601      | 5.82           | 172          | 66,903        |
| March 48,902         | 7.01           | 228          | 77,936        |
| April 55,272         | 7.92           | 258          | 87,863        |
| May 62,043           | 8.89           | 326          | 101,627       |
| June 63,946          | 9.16           | 341          | 107,343       |
| July 72,160          | 10.34          | 427          | 128,128       |
| August 75,224        | 10.78          | 413          | 133,619       |
| September 68,153     | 9.76           | 371          | 116,364       |
| October 63,406       | 9.08           | 300          | 105,573       |
| November 56,437      | 8.09           | 279          | 90,489        |
| December 49,509      | 7.09           | 230          | 81,130        |

| Daily Distribution   | Accidents n (%) | Deaths n (%) | Injuries n (%) |
|----------------------|----------------|--------------|---------------|
| Total 697,615        | 100            | 14,236       | 1,164,083     |
| Monday 100,441       | 14.4           | 2514         | 163,873       |
| Tuesday 95,783       | 13.7           | 2460         | 154,332       |
| Wednesday 96,062     | 13.8           | 2366         | 154,435       |
| Thursday 95,211      | 13.6           | 2385         | 154,210       |
| Friday 103,548       | 14.8           | 2471         | 169,302       |
| Saturday 104,471     | 15.0           | 2911         | 179,665       |
| Sunday 102,099       | 14.6           | 2960         | 188,266       |

| Hourly Distribution  | Accidents n (%) | Deaths n (%) | Injuries n (%) |
|----------------------|----------------|--------------|---------------|
| Total 880,626        | 100.00         | 18,067       | 1,468,504     |
| Daylight 589,000     | 66.88          | 10,512       | 965,590       |
| Night 266,915        | 30.31          | 6843         | 460,090       |
| Twilight 24,711      | 2.81           | 712          | 42,824        |

Death due to RTAs occurred more frequently in males when compared to females. When driver deaths are considered, males have lost their lives 60-fold more. When pedestrian deaths are investigated, males have died 2.5-fold more than females. Also, injuries related to RTAs are more commonly seen in males. Males are also exposed to driver injuries 14-fold more frequently than females. When passengers and pedestrians are considered, significant differences could not be obtained between genders. Comparison of RTAs according to gender is summarized in Table 2.
Table 2. Comparison of drivers, passengers and pedestrians according to gender.

|       | Total   | Driver   | Passenger | Pedestrian |
|-------|---------|----------|-----------|------------|
| Death | Total   | 18,067   | 7896      | 7168       |
|       | Male    | 13,937   | 7769      | 4034       |
|       | Female  | 4130     | 127       | 3134       |
| Injury| Total   | 1,468,504| 617,930   | 680,628    |
|       | Male    | 1,022,671| 578,385   | 348,491    |
|       | Female  | 445,833  | 39,545    | 332,137    |

* Statistically significant.

When the vehicle type involved in the accident is investigated, death and injury rates were low in buses. When compared according to numbers of vehicles, the death rate was higher in tractor and injury rate was higher in motorcycle accidents. Vehicle types and outcomes of RTAs are summarized in Table 3.

Table 3. Comparison of outcomes of drivers according to the type of vehicle.

|       | Number Drivers Died (n) | % | Number Drivers Injured (n) | % |
|-------|-------------------------|---|---------------------------|---|
| Total | 1,396,979               | 7896| 617,930                   | 44.2 |
| Automobile | 719,615               | 3396| 269,699                   | 37.5 |
| Van   | 220,705                 | 897 | 72,160                    | 32.7 |
| Motorcycle | 221,404                | 1549| 189,589                   | 85.6 |
| Tractor| 15,440                  | 770 | 6474                      | 41.9 |
| Truck | 42,538                  | 410 | 13,275                    | 31.2 |
| Minibus | 43,827                 | 108 | 8316                      | 19.0 |
| Bus   | 34,197                  | 71  | 3435                      | 10.0 |
| Tow truck | 32,802                 | 357 | 10,636                    | 32.4 |
| Others| 66,451                  | 358 | 44,346                    | 66.7 |

According to the number of drivers, while driver death rate tends to decrease over the years, a significant difference could not be obtained in injury rates. See Table 4 for details.

Table 4. Death and injury rates among drivers.

|       | Total Number of Drivers | Drivers Died (n) | %   | Drivers Injured (n) | %   |
|-------|-------------------------|------------------|-----|---------------------|-----|
| 2013  | 24,778,712              | 1577             | 0.00636| 113,345            | 0.4574|
| 2014  | 25,972,519              | 1506             | 0.00580| 118,196            | 0.4551|
| 2015  | 27,489,150              | 1658             | 0.00603| 128,036            | 0.4658|
| 2016  | 28,223,393              | 1574             | 0.00558| 129,681            | 0.4595|
| 2017  | 28,181,830              | 1581             | 0.00561| 128,672            | 0.4566|

The majority of RTAs and injuries occurred in residential areas. However, death related to RTAs commonly occurred outside of residential areas. Table 5 summarizes the location of RTAs.

Table 5. Number of accidents, death and injuries according to the scene of the accidents.

|       | Total (n) | Residential Areas (n) | %   | Rural Areas (n) | %   |
|-------|-----------|-----------------------|-----|-----------------|-----|
| Accidents | 1,865,563 | 1,341,033             | 71.9| 524,530         | 28.1|
| Death    | 56,829    | 19,983                | 35.2| 36,846          | 64.8|
| Injury   | 3,220,661 | 2,054,219             | 63.8| 1,166,442       | 36.2|
4. Discussion

Accidents occurring on the road, involving pedestrians and/or vehicles, are defined as RTAs [2]. Globally, RTA is the leading cause of injury-related deaths [7]. According to the reports of World Health Organization (WHO), car accidents will be the fifth leading cause of death in the world by 2030 [8]. In our study, we determined that 3534 individuals have lost their lives in RTAs in a 5-year period. In a study by Tekpa et al., 217 of 1283 victims of RTAs have died, revealing a lethality rate of 16.9% in a 12-month period [9]. In another study involving 50 states of the United States (US), it was reported that a total of 1,220,610 deaths attributable to traffic crashes occurred between 1985 and 2014 [10]. It is known that number of deaths in RTAs and mortality rate are closely related to socio-economical status of countries. In a study in Kosovo, a slight decrease in the mortality rate of 0.1% and lethality rate of 0.1% each year was determined, whereas there was an increase of 21.5% for traumatism rate for each year [4]. Improving the healthcare system plays an essential role in reducing mortality rate.

It is well-known in the literature that RTAs tend to increase in summer months [11]. Accordingly in our study, both RTAs and deaths related to RTAs occurred more frequently in summer months. In summer months, individuals travel more with vehicles and participate in outdoor activities more frequently, thus the number of RTAs increase.

More accidents occur at night than during the day [2]. In a study, it was determined that the majority of RTAs happened between midnight to 6 A.M. [12]. Accordingly in our study, the majority of the incidents happened in night hours in weekends. Contrarily, in another study, RTAs were reported to occur mostly during Monday and in the afternoon rush hours between 14.00–18.00 [4].

In our study, male individuals are found to be exposed to RTAs more frequently than females. According to the WHO report, more than 75.0% of the road traffic deaths happened in males [13]. In a report in a 5-year period, of the 579 RTA casualties examined, 72% were males, 28% females [14]. In another study with a total of 5298 patients, 87.3% were men [15]. Moreover, in a report, the mortality rates due to RTA were four times higher in men [16]. The reason for this result may be the fact that men tend to drive faster and more carelessly when compared to females. Also, drinking and driving may be more common among men.

Our results revealed that the lowest injury and death rates were obtained in buses. This result underlines the importance of public transport. Accordingly, in a study by Fernando et al., individuals involved in RTAs were passengers (44%), drivers (32%), and pedestrians (20%). It was also reported that of the 440 vehicle occupants, 37% were on motorcycles, 28% in three wheelers, 13% in dual purpose vehicles and 11% in buses [14]. In a report, it was stated that passengers in cargo trucks and motorcyclists were the most exposed to fatal accidents [9]. Accordingly, in another report, the majority of the patients were injured while riding a motorcycle or scooter [15]. For instance, in Brazil, in a 15-year period, the mortality rate is 7.5 times higher in motorcycle riders and 3.4 times higher in automobile riders [16]. Our study also revealed that the death rate was higher in motorcycle and tractor drivers. Helmet use may decrease risk of head trauma and thus reduce morbidity and mortality in patients with motorcycle accidents [17]. Implementation of strict license laws and continuous education for motorcyclists are highly recommended.

Over 50% of crashes occur on urban roads (4). In a report of a total of 56,966 RTAs, it was stated that the majority of RTAs occurred in urban areas. It was also reported that the risk of a fatal accident was 6.8-fold higher in rural areas than in urban areas [18]. In concordance with the literature, our results revealed that majority of the RTAs resulting with death occur in urban areas. As a common problem of developing countries; inadequate road infrastructure, high speed and disobeying traffic rules in urban areas may increase RTA frequency in such areas [4].

5. Conclusions

RTAs more commonly occur on weekends and in summer months when people are more active and participate in outdoor activities frequently. Males are under more risk when compared to females. In respect to vehicle type, motorcycle and tractor drivers are under a greater risk when compared to
other vehicle drivers. Public transport may be a solution for increasing rates of RTAs. For individual drivers, laws limiting the number of passengers carried, installation of side doors, mandatory use of seatbelts in three wheelers, and protective clothing for motorcyclists are recommended (14). Since roads are common use areas, drivers must be forced to comply with the rules and law-makers must focus on education of drivers and the public.

**Author Contributions:** Methodology, Writing—Original Draft Preparation, B.G.; Writing—Review & Editing, Visualization, Supervision, Project Administration, Funding Acquisition: A.K.E.

**Funding:** The authors declare no funding.

**Conflicts of Interest:** The authors declare no conflict of interest.

**References**

1. OED Online. Accident Oxford University Press. 2014. Available online: http://www.oxforddictionaries.com/definition/english/accident (accessed on 1 August 2019).
2. Chandrasekharan, A.; Nanavati, A.J.; Prabhakar, S.; Prabhakar, S. Factors Impacting Mortality in the Pre-Hospital Period after Road Traffic Accidents in Urban India. *Trauma Mon.* 2016, 21, e22456. [CrossRef] [PubMed]
3. Onyemaechi, N.; Ofoma, U.R. The Public Health Threat of Road Traffic Accidents in Nigeria: A Call to Action. *Ann. Med. Health Sci. Res.* 2016, 6, 199–204. [CrossRef] [PubMed]
4. Ramadani, N.; Zhjeqi, V.; Berisha, M.; Hoxha, R.; Begolli, I.; Salihu, D.; Krasniqi, P. Public Health Profile of Road Traffic Accidents in Kosovo 2010-2015. *Open Access Maced. J. Med. Sci.* 2017, 5, 1036–1041. [CrossRef] [PubMed]
5. Olsen, J.R.; Mitchell, R.; Ogilvie, D.; M74 Study Team. Effect of a new motorway on social-spatial patterning of road traffic accidents: A retrospective longitudinal natural experimental study. *PLoS ONE* 2017, 12, e0184047. [CrossRef] [PubMed]
6. Murillo-Zamora, E.; Mendoza-Can, O.; Trujillo-Hernández, B.; Guzmán-Esquível, J.; Medina-González, A.; Huerta, M.; Sánchez-Piña, R.A.; Lugo-Radillo, A. Expected years of life lost through road traffic injuries in Mexico. *Glob. Health Action* 2017, 10, 1360629. [CrossRef] [PubMed]
7. Krug, E.G.; Sharma, G.K.; Lozano, R. The global burden of injuries. *Am. J. Public Health* 2000, 90, 523–526. [PubMed]
8. Global Status Report on Road Safety. 2013. Available online: http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/ (accessed on 15 March 2016).
9. Tékpa, B.J.D.; Diemer, H.C.; IssaMapouka, P.A.; NdomeNgatchop, V.; Gassima, B.; Nali, M.N. Mortality during road traffic accidents in Bangui, Central African Republic. *Med. Sante Trop.* 2017, 27, 426–430.
10. Santaella-Tenorio, J.; Mauro, C.M.; Wall, M.M.; Kim, J.H.; Cerdá, M.; Keyes, K.M.; Hasin, D.S.; Galea, S.; Martins, S.S. US Traffic Fatalities, 1985-2014, and Their Relationship to Medical Marijuana Laws. *Am. J. Public Health* 2017, 107, 336–342. [CrossRef]
11. Sungur, I.; Akdur, R.; Piyal, B. Türkiye’deki Trafik Kazalarının Analizi. *Ank. Med. J.* 2014, 14, 114–124.
12. Misra, P.; Majumdar, A.; Misra, M.C.; Kant, S.; Gupta, S.K.; Gupta, A.; Kumar, S. Epidemiological Study of Patients of Road Traffic Injuries Attending Emergency Department of a Tertiary Centre in New Delhi. *Indian J. Crit. Care Med.* 2017, 21, 678–683.
13. World Health Organization. Global Status Report on Road Safety. 2015. Available online: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/ (accessed on 15 August 2019).
14. Fernando, D.M.; Tennakoon, S.U.; Samarayake, A.N.; Wickramasinghe, M. Characteristics of road traffic accident casualties admitted to a tertiary care hospital in Sri Lanka. *Forensic Sci. Med. Pathol.* 2017, 13, 44–51. [CrossRef]
15. Howley, I.W.; Gupta, S.; Tetali, S.; Josyula, L.K.; Wadhvaniya, S.; Gururaj, G.; Rao, M.; Hyder, A.A. Epidemiology of road traffic injury patients presenting to a tertiary hospital in Hyderabad, India. *Surgery* 2017, 162, S77–S84. [CrossRef]
16. Ladeira, R.M.; Malta, D.C.; MoraisNeto, O.D.; Montenegro, M.D.; SoaresFilho, A.M.; Vasconcelos, C.H. Road traffic accidents: Global Burden of Disease study, Brazil and federated units, 1990 and 2015. *Rev. Bras. Epidemiol.* **2017**, *20*, 157–170. [CrossRef] [PubMed]

17. Ay, M.O.; Erenler, A.K.; Kocak, C.; Baydin, A. Efficiency of Helmet and Protective Clothing Use on Outcomes of Patients with Motorcycle Accidents. *J. Clin. Anal. Med.* **2017**, *8*, 383–386. [CrossRef]

18. Vroh, J.B.; Tiembre, I.; Ekra, D.K.; Ama, M.N.; Ka, O.M.; Dagnan, S.N.; Tagliante-Saracino, J. Determinants of Fatal Road Traffic Injuries in Côte d’Ivoire from 2002 to 2011. *Sante Publique* **2016**, *28*, 647–653.

© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).