

TÜRKİYE'DE TRAFİK KAZALARI, NÜFUS YOĞUNLUĞU VE MOTORLU TAŞIT SAYISI ARASINDAKİ İLİŞKİ

The Relationship among Road Traffic Accidents, Population Size, and The Number of Motor Vehicles in Turkey

Mahmut ASİRDİZER¹, Tarık ULUÇAY², Yavuz HEKİMOĞLU³, İlknur YILMAZ², Mehmet Sunay YAVUZ²

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ABSTRACT

Traffic accidents with high morbidity and mortality rates are one of the most important problems of the world. Several factors have been described for the occurrence of traffic accidents. Two of them are traffic congestion and road density which have infrequently been reported in the Turkish literature. In this study, it was aimed to evaluate the relationship between road traffic accidents, population size, and the number of motor vehicles in Turkey.

The crude data were obtained from the web page of the Turkish Statistical Institute. They was standardized for every one million population, every one million motor vehicles, or every one thousand road traffic accidents. The system of Statistical Regions was used in the classification.

In Turkey, the total number of inhabitants was 74,724,269 and the number of motor vehicles was 16,089,528 in 2011. As a result of 131,845 road traffic accidents 3,835 people died and 238,074 people were injured. In the evaluation of the distribution of the number of motor vehicles for every one million population, the distribution of the number of road traffic accidents for every one million population and every one million motor vehicles, the distribution of the number of people died in road traffic accidents for every one million population, every one million motor vehicles and every one thousand road traffic accidents, and the distribution of the number of people injured in road traffic accidents for every one million population, every one million motor vehicles and every one thousand road traffic accidents

were all statistically significant.

In the traffic accidents, urban and rural society based projects for the identification of risk factors and the preventive measures are great importance. This study represents a pioneer step forward in this field in Turkey.

Keywords: Road traffic accidents, Traffic congestion, Road density, Number of motor vehicles, Population.

ÖZET

Yüksek morbidite ve mortalite oranları ile trafik kazaları dünyanın en önemli sorunlarından biridir. Trafik kazalarının oluşumu için çeşitli faktörler tanımlanmıştır. Bunlardan ikisi, Türkçe literatürde seyrek olarak bildirilmiş olan trafik tıkanıklığı ve yol yoğunluğudur. Bu çalışmada, trafik kazaları, nüfus büyüklüğü, Türkiye'de motorlu araç sayısı arasındaki ilişkinin değerlendirilmesi amaçlanmıştır.

Ham veriler Türk İstatistik Enstitüsü web sayfasından elde edilmiştir. Onlar her bir milyon nüfus, her bir milyon motorlu araç veya her bin trafik kazaları için standardize edilmiştir. İstatistiksel Bölgeler sistemi sınıflandırılmasında kullanılmıştır.

Türkiye'de 2011 yılında toplam nüfus 74.724.269 ve motorlu araç sayısı 16.089.528 idi. 131.845 trafik kazası sonucu 3.835 kişi ölmüş ve 238.074 kişi yaralanmıştı. Her bir milyon nüfus için motorlu araç sayısı dağılımının; her bir milyon nüfus ve her bir milyon araç sayısı için trafik kazası sayısı dağılımının; her bir milyon nüfus, her bir milyon araç ve her bin trafik kazası için ölen kişi dağılımının; her bir milyon nüfus, her bir milyon araç ve

¹Yüzüncü Yıl Üniversitesi Tıp Fakültesi, Adli Tıp Anabilim Dalı, Van

²Celal Bayar Üniversitesi Tıp Fakültesi Adli Tıp Anabilim Dalı, Manisa

³Adli Tıp Kurumu Van Adli Tıp Şube Müdürlüğü, Van

her bin trafik kazası için yaralı kişi dağılımının değerlendirmesinde, tümü istatistiksel olarak anlamlı bulundu.

Trafik kazalarında, risk faktörleri ve önleyici tedbirlerin belirlenmesi için kentsel ve kırsal toplum tabanlı projeler büyük önem taşımaktadır. Bu çalışma, Türkiye'de bu alanda ileriye doğru bir öncü adımı temsil etmektedir.

Anahtar Kelimeler: Karayolu trafik kazaları, trafik sıkışıklığı, yol yoğunluğu, motorlu araç sayısı, nüfus.

INTRODUCTION

In 1769, Nicolas-Joseph Cugnot's steam-powered vehicle collided into a wall during a test. This accident, which occurred in France, is accepted as the first automobile accident in history (1). The first gasoline-powered automobile was invented by Karl Benz in 1886. In 1891, James William Lambert was involved in the first gasoline-powered automobile accident. In Ohio City, the driver James William Lambert lost his control of the vehicle and the automobile collided into a tree root. In this accident, Lambert and the passenger James Swoveland were slightly injured (2). In May 30, 1896, one of the first commercial automobiles used by Henry Wells collided into a bicycle. In this accident, which is accepted as the first motor vehicle accident involving personal injury in history, the bicycle driver Evelyne Thomas' leg was broken (3). The first fatal motor vehicle accident in world history took place near the Crystal Palace in London in August 17, 1896. Forty-four-year-old Bridget Driscoll lost her life after being struck by a car. It was stated that the speed of the car (12.8 km/h (8 mph)) was more than two times the legal limit [6.4 km/h (4 mph)]. The witnesses of the accident expressed that the automobile was going at tremendous speed. Nevertheless, at the inquest, the coroner said, "This is a big misfortune and it must never happen again" (4,5).

In the first road traffic accident recorded in Turkey in 1910, an automobile hit a gardener named Mustafa in Beşiktaş (6,7). It was reported that the first fatal motor vehicle accident in Turkey occurred on January 26, 1912. According to rumors, that night at around 10 p.m., a speedy car driven by Frederico Rasi, an officer in Italian Embassy, came from Zincirlikuyu and hit a person named Idris in front of Şişli Mosque in Istanbul. The driver fled after this accident, but he was caught by the "warning shot" fired by police officers. After the incident, Idris died in Eftal Hospital and Rasi was arrested for accidental murder. The following day, Rasi was freed because Idris'

family accepted the compensation given by the Italian Embassy. However, this event was talked about as a scandal for months by Istanbul people (8).

Since then, in parallel with the increasing number of road traffic accidents and human population, traffic accidents with high morbidity and mortality rates are today one of the most important problems worldwide. It is estimated that 1.3 million people around the globe are killed and 20-50 million people are injured in these accidents each year (9). According to the statistics of the Turkish National Police, 43,051 people were killed and 1,718,704 people were injured by traffic accidents in Turkey between 2002 and 2011 (10). In the World Health Organization (WHO) report it has been foreseen that "unless immediate and effective action is taken, road traffic injuries are predicted to become the fifth leading cause of death in the world, resulting in an estimated 2.4 million deaths each year" (9,11).

Several factors are reportedly related with the occurrence of traffic accidents as well as the rate of economic damage, personal injuries and deaths inflicted by these accidents. These factors are as follows:

- (a) human-related factors, such as inexperience and carelessness of drivers and the nonobservance of rules both by drivers and pedestrians;
- (b) the factors related with vehicles and their equipment, such as the defects in vehicle manufacturing and maintenance, and vehicle age;
- (c) the factors related with weather conditions; and finally,
- (d) the factors related with traffic congestion and road density (12-14).

The impact of traffic congestion and road density on road traffic accidents has been scarcely studied in Turkey. In this article, we aimed to evaluate the relationship between road traffic accidents, population density, and the number of motor vehicles in Turkey.

MATERIAL and METHOD

In this study, the data on the "number of inhabitants," "number of road motor vehicles," "number of road traffic accidents," "number of people died in road traffic accidents," and "number of people injured in road traffic accidents" in the calendar year 2011 was accessed from the web page of the Turkish Statistical Institute (TURKSTAT) of the Republic of Turkey (11). The number of motor vehicles, road traffic accidents, and killed or injured people in road traffic accidents were standardized for every one million population. Also, the

numbers of road traffic accidents and killed or injured people in road traffic accidents were standardized for every one million motor vehicles. Finally, the number of killed or injured people in road traffic accidents was standardized for every one thousand road traffic

accidents. In the classification, the system of Statistical Regions (Level-1) which was determined by TURKSTAT was used (Figure 1) (11).

The results were statistically evaluated by the Chi-square test. A $p \leq 0.05$ was considered statistically significant.

CODES	REGIONS	CITIES
TR1	Istanbul	Istanbul
TR2	Western Marmara	Tekirdag, Edirne, Kırklareli, Balıkesir, Çanakkale
TR3	Aegean	Izmir, Aydın Denizli, Muğla, Manisa, Afyonkarahisar, Kütahya, Usak
TR4	Eastern Marmara	Bursa, Eskişehir, Bilecik, Kocaeli Sakarya, Düzce, Yalova
TR5	Western Anatolia	Ankara, Konya, Karaman
TR6	Mediterranean	Antalya, Isparta, Burdur, Adana, Icel, Hatay, Kahramanmaraş, Osmaniye
TR7	Middle Anatolia	Kırıkkale, Aksaray, Niğde, Kırşehir, Nevşehir, Kayseri, Sivas, Yozgat
TR8	Western Black Sea	Zonguldak, Karabük, Bartın, Kastamonu, Çankiri, Sinop, Samsun, Tokat, Çorum, Amasya
TR9	Eastern Black Sea	Trabzon, Ordu, Giresun, Rize, Artvin, Gumushane
TRA	North Eastern Anatolia	Erzurum, Erzincan, Bayburt, Ağrı, Kars, Iğdir, Ardahan
TRB	Middle Eastern Anatolia	Malatya, Elazığ, Bingöl, Tunceli, Van, Mus, Bitlis, Hakkari
TRC	South Eastern Anatolia	Gaziantep, Adıyaman, Kilis, Sanlıurfa, Diyarbakır, Mardin, Batman, Sırtak, Siirt



Figure 1. The classification system for Statistical Regions (Level-1) determined by TURKSTAT.

RESULTS

In 2011, the total number of inhabitants was 74,724,269 and the number of motor vehicles was 16,089,528 in Turkey. A total of 3,835 people were killed and 238,074 people were injured in total of 131,845 road traffic accidents.

When the number of motor vehicles for every one

million population was evaluated, it was observed that the number of motor vehicles was higher in the Aegean (TR3) (289,619 per 1 million population), Western Anatolian (TR5) (273,585 per 1 million population), Western Marmara (TR2) (272,869 per 1 million population), and Mediterranean (TR6) (264,161 per 1 million population) regions ($p < 0.05$) (Figure 2).

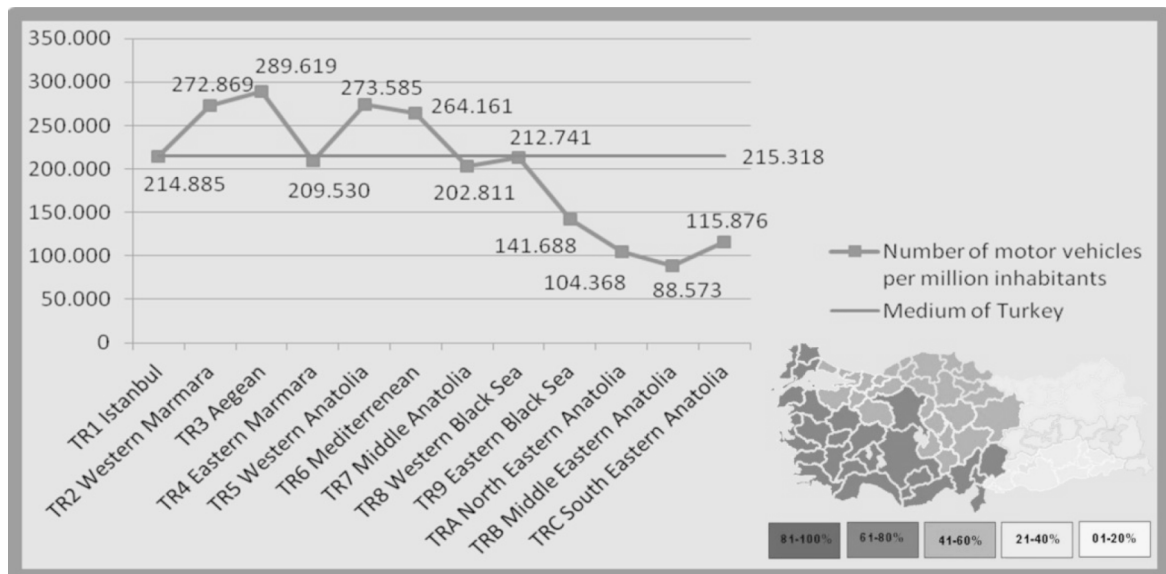


Figure 2. The distribution of the number of motor vehicles to statistical regions for every one million population.

When the number of road traffic accidents for every one million population was evaluated, it was observed that the number of road traffic accidents was higher in Aegean (TR3) (2,249 per 1 million population), Middle Anatolian (TR7) (2,239 per 1 million population),

Mediterranean (TR6) (2,221 per 1 million population), Western Anatolian (TR5) (2,196 per 1 million population) and Western Marmara (TR2) (2,122 per 1 million population) regions ($p < 0.05$) (Figure 3).

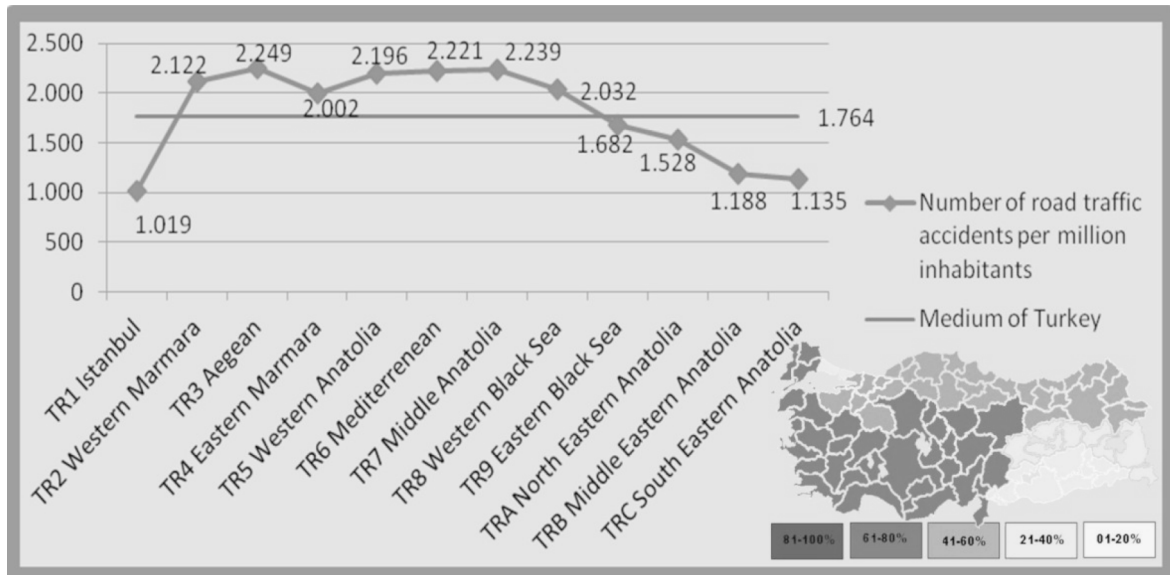


Figure 3. The distribution of the number of road traffic accidents to statistical regions for every one million population.

When calculated for every one million population, the majority of deaths in road traffic accidents occurred in the Western Marmara (TR2) (84 per 1 million population) and Western Black Sea (TR8) (83 per 1 million population) regions. They were followed by the North-

Eastern Anatolian (TRA) (73 per 1 million population), Middle Anatolian (TR7) (67 per 1 million population), Eastern Black Sea (TR9) (66 per 1 million population) and Aegean (TR3) (63 per 1 million population) regions ($p < 0.05$) (Figure 4).

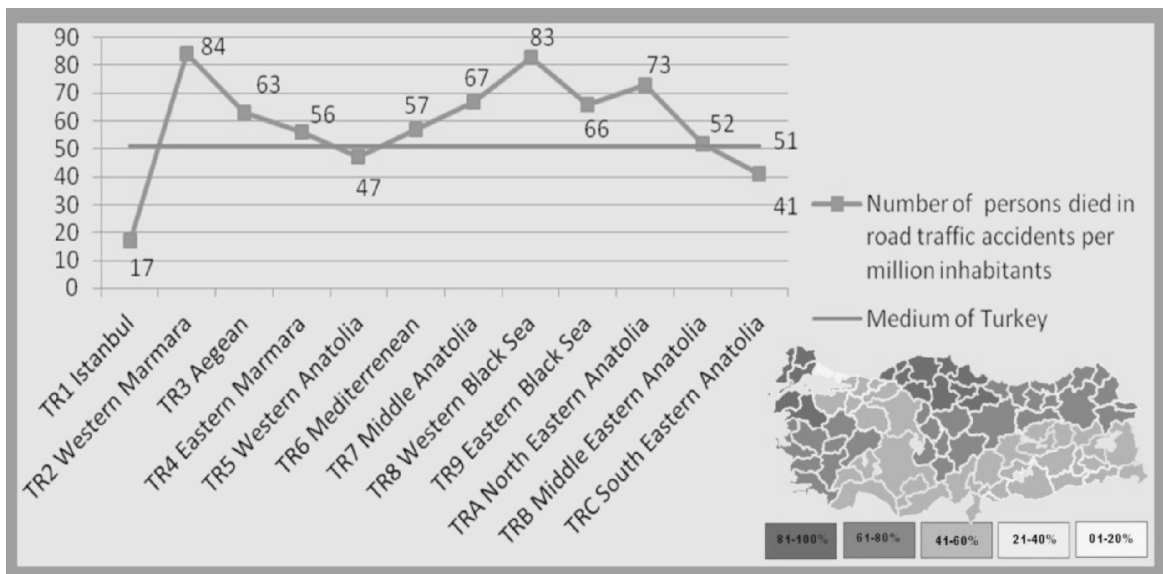


Figure 4. The distribution of the number of people died in road traffic accidents to statistical regions for every one million population.

When calculated for every one million population, the majority of injured people in road traffic accidents were from the Middle Anatolian (TR7) (4,636 per 1 million

population), and Western Black Sea (TR8) (4,158 per 1 million population) regions ($p < 0.05$) (Figure 5).

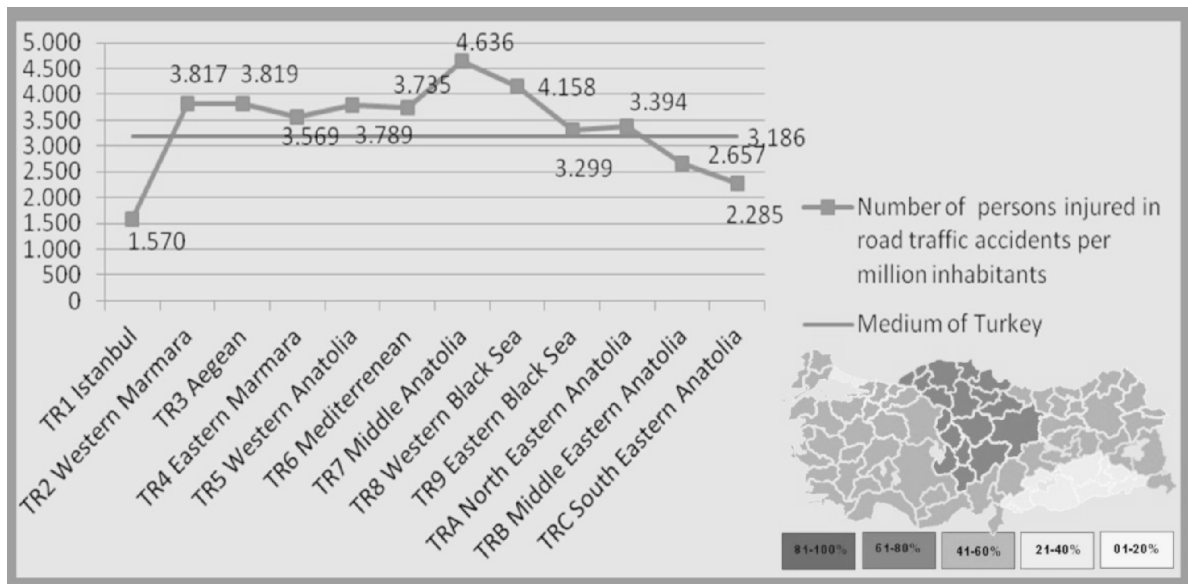


Figure 5. The distribution of the number of people injured in road traffic accidents to statistical regions for every one million populations.

When the number of road traffic accidents for every one million motor vehicles was evaluated, it was observed that the number of road traffic accidents was higher in the North-Eastern Anatolian (TRA) (14,636 per 1 million motor vehicles) and Middle-Eastern Anatolian (TRB) (13,415 per 1 million motor vehicles) regions.

(13,415 per 1 million motor vehicles) regions. They were followed by the Eastern Black Sea (TR9) (11,869 per 1 million motor vehicles) and Middle Anatolian (TR7) (11,042 per 1 million motor vehicles) regions ($p < 0.05$) (Figure 6).

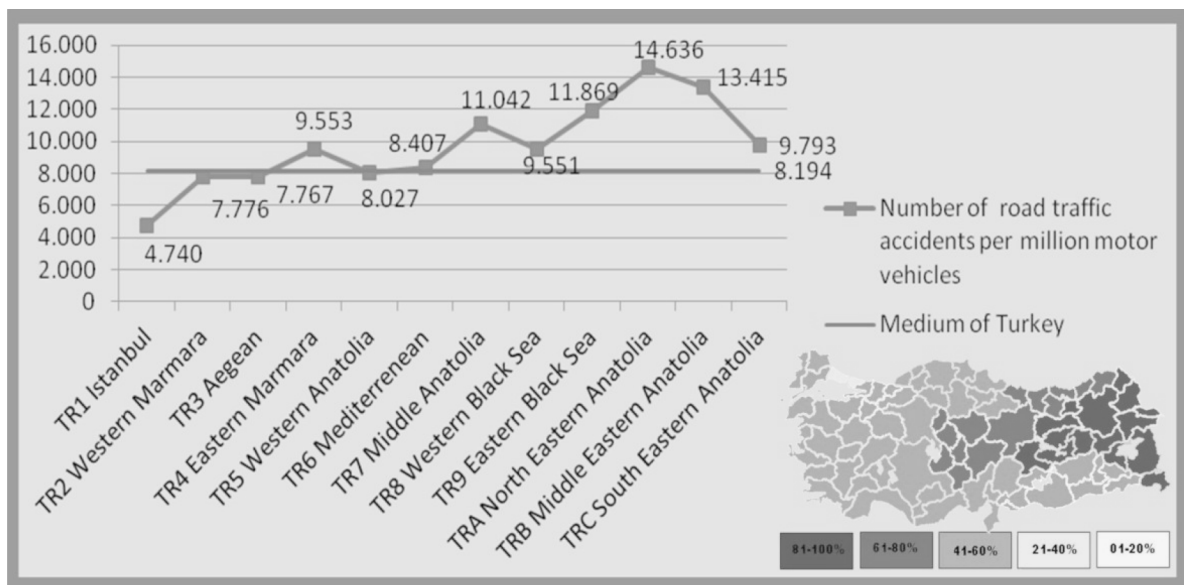


Figure 6. The distribution of the number of road traffic accidents to statistical regions for every one million motor vehicles.

When calculated for every one million motor vehicles, the majority of deaths in road traffic accidents occurred in the North-Eastern Anatolian (TRA) (700 per 1 million motor vehicles), Middle-Eastern Anatolian (TRB) (587 per 1 million motor vehicles), Eastern Black Sea (TR9) (466 per 1 million motor vehicles) and Western Black Sea

(TR8) (391 per 1 million motor vehicles) regions. They were followed by the South-Eastern Anatolian (TRC) (351 per 1 million motor vehicles), Middle Anatolian (TR7) (332 per 1 million motor vehicles) and Western Marmara (TR2) (307 per 1 million motor vehicles) regions ($p < 0.05$) (Figure 7).

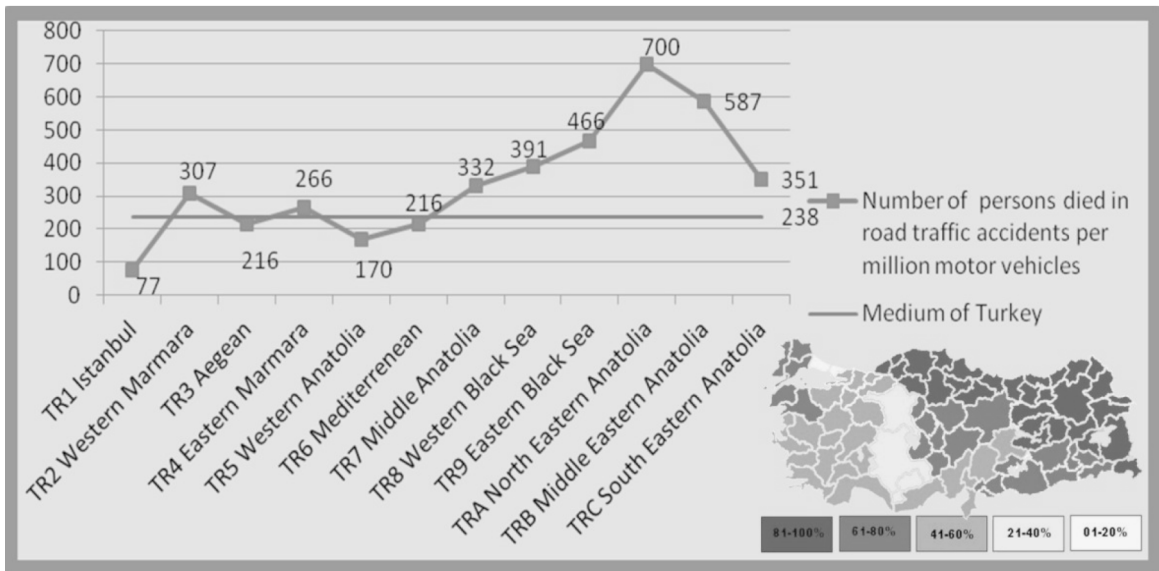


Figure 7. The distribution of the number of people died in road traffic accidents to statistical regions for every one million motor vehicles.

When calculated for every one million motor vehicles, the majority of injured people in road traffic accidents occurred in the North-Eastern Anatolian (TRA) (32,520 per 1 million motor vehicles) and Middle-Eastern Anatolian (TRB) (29,995 per 1 million motor vehicles) regions. They were followed by the Eastern Black Sea

(TR9) (23,285 per 1 million motor vehicles), Middle Anatolian (TR7) (22,858 per 1 million motor vehicles), Western Black Sea (TR8) (19,546 per 1 million motor vehicles) and South-Eastern Anatolian (TRC) (19,717 per 1 million motor vehicles) regions ($p < 0.05$) (Figure 8).

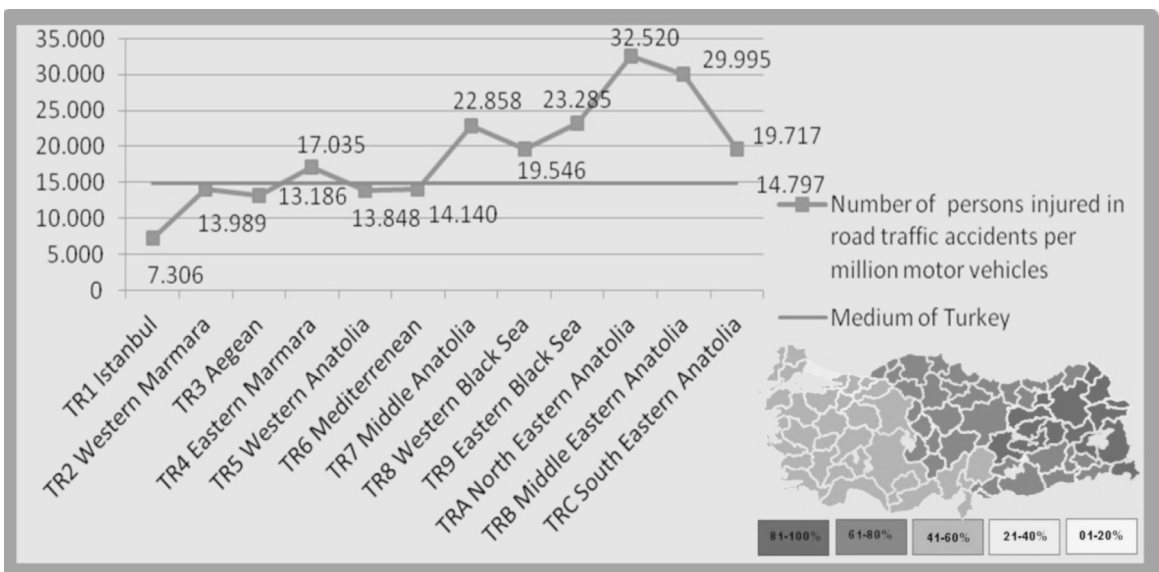


Figure 8. The distribution of the number of people injured road traffic accidents to statistical regions for every one million motor vehicles.

When calculated for every one thousand road traffic accidents, the majority of deaths in road traffic accidents occurred in the North-Eastern Anatolian (TRA) (48 per one thousand road traffic accidents) region. It was followed by the Middle-Eastern Anatolian (TRB) (44 per one thousand road traffic accidents), Western Black Sea

(TR5) (45 per one thousand road traffic accidents), Eastern Black Sea (TR9) (39 per thousand road traffic accidents), Western Marmara (TR2) (39 per one thousand road traffic accidents) and South-Eastern Anatolian (TRC) (36 per one thousand road traffic accidents) regions ($p < 0.05$) (Figure 9).

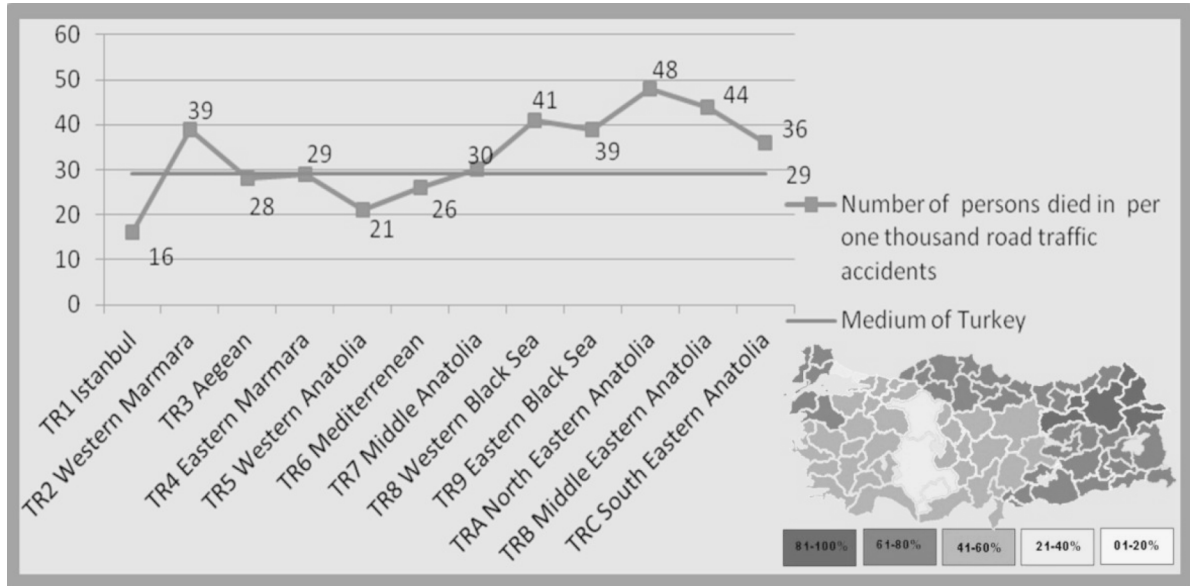


Figure 9. The distribution of the number of people died in road traffic accidents to statistical regions for every one thousand road traffic accidents.

When calculated for every one thousand road traffic accidents, the majority of injured persons in road traffic accidents were from in the Middle-Eastern Anatolian

(TRB) (2,236 per one thousand road traffic accidents) and North-Eastern Anatolian (TRA) (2,222 per one thousand road traffic accidents) regions ($p < 0.05$) (Figure 10).

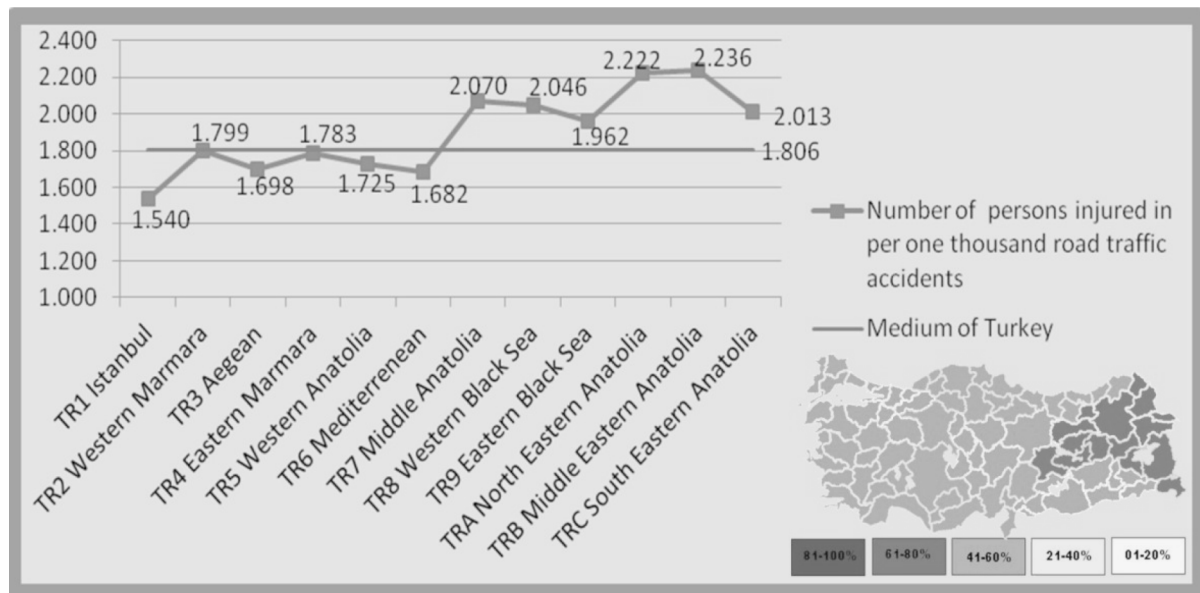


Figure 10. The distribution of the number of person injured road traffic accidents to statistical regions for every one thousand road traffic accidents.

DISCUSSION and CONCLUSION

The distribution of the number of motor vehicles for every one million population in Turkey (Figure 2) is consistent with the data on the “distribution of annual equivalised household disposable incomes by quintiles ordered by equivalised household disposable income (SR, Level 1)” of Turkey (11). Going from the east to the west, the number of motor vehicles increases in parallel with the increasing level of socio-cultural and socio-economic development of the country. The distribution of the number of road traffic accidents for every one million population (Figure 3) is similar to the previous data. These results are suggestive of a relationship between the number of vehicles and the number of accidents.

On the other hand, the rise in the number of traffic accidents per one million motor vehicles, especially in the northern, north-eastern, eastern and central Anatolian regions, (TR-A, TR-B, TR-9, TR-7) (Figure 6) shows that the number of accidents is not only related to the number of motor vehicles, but also possibly to different factors such as geographic and climatic characteristics of the region, road conditions, type of motor vehicles, and the level of education of the drivers of that region.

When it comes to the injuries occurring in road traffic accidents, evaluation of the data in Figure 5, Figure 8, and Figure 10 revealed that the majority of the injuries in road traffic accidents calculated for every one million population occurred in the Middle Anatolian (TR7) and Western Black Sea (TR8) regions regardless of the distribution of the number of road traffic accidents for every one million population and for every one million motor vehicles. On the other hand, when calculated for every one million motor vehicles and every one thousands road traffic accidents, the majority of the injuries in road traffic accidents occurred in the Middle Eastern Anatolian (TRB) and North-Eastern Anatolian (TRA) regions. These results suggest that the road traffic accidents in the Middle Eastern Anatolian (TRB) and North-Eastern Anatolian (TRA) regions are high risk regions for injuries.

Evaluation of total deaths in traffic accidents using the findings in Figure 4, Figure 7, and Figure 9 altogether showed that the majority of deaths in road traffic accidents calculated for every one million population occurred in the Western Marmara (TR2) and Western Black Sea (TR8) regions regardless of the distribution of the number of road traffic accidents for every one million population and for every one million motor vehicles. On the other hand, the majority of the injuries in road traffic accidents

calculated for every one million motor vehicles and every one thousand road traffic accidents occurred in the North-Eastern Anatolian (TRA), Middle Eastern Anatolian (TRB), Eastern Black Sea (TR9), Western Black Sea (TR8), and especially North-Eastern Anatolian (TRA) regions. These results suggest that the road traffic accidents in Western and Eastern Black Sea, North-Eastern and Middle-Eastern Anatolian regions of Turkey are high risk regions for deaths.

Concentration of road traffic accidents to the Northern and Eastern parts of Turkey may be linked to many factors such as the high prevalence of public road transport, use of tractors for public transportation, difficulties in accessing health care facilities, geographical and climatic characteristics, lack of high-quality roads, low level of education, lack of first aid knowledge, and non-compliance with the rules in those areas.

In conclusion, although the present study reports a relationship between the number of traffic accidents, population density, and the number of motor vehicles; these factors alone cannot be accepted as the causative factors for traffic accidents since traffic accidents cannot be attributed to a single cause (12,15-18). In the traffic accidents, urban and rural society based projects for the identification of risk factors and the preventive measures are great importance (17,18). This study represents a pioneer step forward in this field in Turkey.

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Corresponding author:

Prof. Dr. Mahmut Aşirdizer
 Yüzüncü Yıl Üniversitesi Tıp Fakültesi
 Adli Tıp Anabilim Dalı, 65080, Van
 E-mail: masirdizer@yahoo.com
 Tel: +90 432 2251701/6092