



## Evaluation of the Clinical Status and Cost Analysis of Patients Aged 65 and Over who Applied to the Emergency Department due to Traffic Accident

Fatma Gül Akgüner<sup>1</sup>, Ali Karakuş<sup>2</sup>, Mustafa Polat<sup>2</sup>

1 Mamak State Hospital, Emergency Service, Ankara Türkiye

2 Hatay Mustafa Kemal University, Medical Faculty, Department of Emergency Medicine, Hatay, Türkiye

Received: 31.12.2024; Revised: 28.04.2025; Accepted: 29.04.2025

### Abstract

**Aim:** The elderly population is increasing worldwide. Traffic accidents are an important cause of morbidity and mortality in the elderly. Depending on the increasing age and population, the cost required for the admission and treatment of patients aged 65 and over to the emergency department also increases. The aim of our study is to make clinical evaluation and cost analysis of patients aged 65 and over who applied due to traffic accidents.

**Methods:** A total of 110 patients aged 65 years and older who presented to the Emergency Department of Hatay Mustafa Kemal University Hospital due to traffic accidents between January 1, 2016, and December 31, 2018, were included in this study. The clinical evaluations of the patients were made retrospectively by scanning their files. Findings were analyzed using appropriate statistical methods.

**Results:** 70% (n=77) of the patients were male and 30% (n=33) were female. The most cases were in november (16.4%)(n=18) and summer (31.8%) (n=35). Injury was most common (42.7%) in the thoracic region. Multiple trauma was present in 24.5% of the cases. The rate of death in the emergency department was 6.4%, the rate of hospitalization in the intensive care unit was 19.1%, and the rate of hospitalization was 30.9%. The overall mortality rate was 12.7%. A statistically significant difference was found between head-neck, thorax, abdomen and extremity injuries and the clinical outcomes of the cases (death, discharge, hospitalization) (p=0.022, p=0.003, p=0.011, p=0.013, respectively). It was determined that mortality was increased in patients with thorax, abdominal injuries and multiple traumas (p=0.02, p=0.001, p=0.001, respectively). The average length of stay in the hospital was (9.8±9.68) days, and the average cost (3555±5663) was Turkish Lira. It was determined that the cost of treatment increased in cases with extremity injury, multiple trauma, and death (p=0.006, p=0.012, p=0.004, respectively). It was observed that the cost of treatment increased as the length of hospital stay increased (r=0.602; p=0.001).

**Conclusion:** The first approach in the emergency department is often life-saving in traffic accident patients in the elderly patient group. Prevention of traffic accidents in the elderly, adequate and timely intervention are important in terms of reducing hospital treatment costs, morbidity and mortality.

**Key words:** Traffic Accident, Emergency Department, Elderly, Cost

DOI: 10.5798/dicletip.1722874

**Correspondence / Yazışma Adresi:** Ali Karakuş, Hatay Mustafa Kemal University Faculty of Medicine Department of Emergency Medicine Hatay, Türkiye  
e-mail: drkarakus@yahoo.com

## Trafik kazası nedeniyle acil servise başvuran 65 yaş ve üzeri hastaların klinik özellikleri ve maliyetlerinin değerlendirilmesi

### Öz

**Amaç:** Dünya genelinde yaşlı nüfus giderek artmaktadır. Trafik kazaları, yaşlı bireylerde morbidite ve mortalitenin önemli nedenlerinden biridir. Yaş ve nüfus artışına bağlı olarak, 65 yaş ve üzeri hastaların acil servise başvuru ve tedavi maliyetleri de artmaktadır. Bu çalışmanın amacı, trafik kazası nedeniyle başvuran 65 yaş ve üzeri hastaların klinik değerlendirmesini yapmak ve tedavi maliyet analizini gerçekleştirmektir.

**Yöntemler:** Çalışmaya 1 Ocak 2016 - 31 Aralık 2018 arasında Hatay Mustafa Kemal Üniversitesi Hastanesi Acil Servisi'ne trafik kazası nedeniyle başvuran 65 yaş ve üzeri 110 hasta dâhil edilmiştir. Hastaların klinik değerlendirmeleri, dosya taramaları yapılarak retrospektif olarak gerçekleştirilmiştir. Elde edilen bulgular uygun istatistiksel yöntemler kullanılarak analiz edilmiştir.

**Bulgular:** Hastaların 77'si (%70) erkek, 33'ü (%30) kadındı. En çok vaka aylardan Kasım ayında (%16,4; n=18), mevsimlerden yaz mevsiminde (%31,8; n=35) görüldü. Yaralanmalar en sık toraks bölgesinde (%42,7) görüldü. Vakaların %24,5'inde çoklu travma mevcuttu. Acil serviste ölüm oranı %6,4, yoğun bakım ünitesine yatış oranı %19,1, genel yatış oranı ise %30,9 olarak bulundu. Genel mortalite oranı %12,7 idi. Baş-boyun, toraks, batin ve ekstremiteler yaralanmaları ile klinik sonuç (ölüm, taburculuk, yatış) arasında istatistiksel olarak anlamlı fark saptandı (sırasıyla p=0,022; p=0,003; p=0,011; p=0,013). Toraks ve batin yaralanmaları ile çoklu travma varlığında mortalitenin arttığı saptandı (sırasıyla p=0,02; p=0,001; p=0,001). Ortalama hastanede kalış süresi 9,8±9,68 gün, ortalama tedavi maliyeti ise 3555±5663 Türk Lirası olarak hesaplandı. Ekstremiteler yaralanması, çoklu travma ve exitus durumunda tedavi maliyetlerinin arttı (sırasıyla p=0,006; p=0,012; p=0,004). Hastanede kalış süresi arttıkça tedavi maliyetinin arttığı saptandı (r=0,602; p=0,001).

**Sonuç:** Yaşlı hasta grubunda trafik kazası sonrası acil serviste yapılan ilk yaklaşım çoğu zaman hayat kurtarıcıdır. Yaşlı bireylerde trafik kazalarının önlenmesi, yeterli ve zamanında müdahale edilmesi; hastane tedavi maliyetlerini, morbiditeyi ve mortaliteyi azaltma açısından önem arz etmektedir.

**Anahtar kelimeler:** Trafik Kazası, Acil Servis, Yaşlı, Maliyet.

### INTRODUCTION

In patients aged 65 and above who present to the emergency department due to a traffic accident, even minor trauma can result in serious damage. Traffic accidents are one of the most common causes of trauma. Injuries related to traffic accidents are the second most frequently observed traumatic injuries in the elderly population and a leading cause of mortality in geriatric patients<sup>1</sup>.

Trauma in patients aged 65 and above represents a significant cause of morbidity and mortality. Despite having trauma characteristics similar to younger patients, geriatric individuals face a higher risk of morbidity and mortality<sup>2-4</sup>. Consequently, hospitalization is often required for ongoing treatment, and the length of hospital stay for these patients can be extended based on age. This situation contributes to increased treatment costs in geriatric patients<sup>5</sup>. Factors such as age, gender, Glasgow Coma Scale value, and the

location of injuries can influence the emergency department process, the course of treatment in the hospital, and treatment costs<sup>6</sup>. There is a limited number of studies on the elderly population presenting to emergency departments due to traffic accidents, and the literature on treatment costs in this population is scarce. The aim of this study is to evaluate the clinical characteristics and costs of individuals aged 65 and above who are brought to the emergency department due to a traffic accident.

### METHODS

The study was designed as a single-center, retrospective study at the Department of Emergency Medicine, Hatay Mustafa Kemal University Hospital. The study was conducted in accordance with the Helsinki Declaration and received approval from the Non-Interventional Clinical Research Ethics Committee of Hatay Mustafa Kemal University (Decision No: 23, 01/04/2021).

The medical records and hospital information system data of 110 patients aged 65 and older who presented to the emergency department due to traffic accidents between January 1, 2016, and December 31, 2018, were reviewed.

The inclusion criterion of the study was defined as all traffic accident cases involving patients aged 65 and over who presented to the emergency department between January 1, 2016, and December 31, 2018. The exclusion criteria were defined as follows:

1. Trauma cases other than traffic accidents,
2. Patients whose medical records were inaccessible or incomplete in the hospital information system,
3. Patients aged 65 and over who presented after a traffic accident but only for follow-up examination,
4. Patients aged 65 and over who were referred to another healthcare facility after presenting with a traffic accident,
5. Patients aged 65 and over who presented due to a traffic accident but left the emergency department by refusing treatment.

Data including age, gender, the month and season of presentation, Glasgow Coma Scale (GCS) score at the time of presentation, physical examination findings, and radiological investigations were examined. Additionally, trauma body regions, presence of multiple traumas, admission details (ward, intensive care unit), clinical outcomes (discharge, hospitalization, death), and the total treatment costs in Turkish Lira were recorded. Multiple trauma is defined as the simultaneous occurrence of two or more distinct injuries that pose a threat to the patient's life<sup>7</sup>. Patients were categorized into three groups based on age: 65-74, 75-84, and 85 years and older. Glasgow Coma Scale (GCS) was evaluated in two categories: GCS above 8 and GCS 8 or below. The normality of the data distribution was assessed using the Shapiro-

Wilk test. Mann-Whitney U test was used to compare non-normally distributed variables between two independent groups. For the comparison of non-normally distributed variables among more than two independent groups, the Kruskal-Wallis test and Dunn's multiple comparison test were employed. The relationship between categorical variables was analyzed using the Chi-square test. The correlation between numerical variables was tested using the Spearman correlation coefficient. Descriptive statistics were presented as median, minimum-maximum for numerical variables, and as counts and percentages for categorical variables. Statistical analyses were performed using the SPSS Windows version 24.0 software package, and a p-value of <0.05 was considered statistically significant.

## RESULTS

The clinicopathological and demographic data of the patients are presented in Table 1.

**Table 1:** Patients characteristics, injury regions and clinical outcomes

		n	%
Gender	Male	77	70
	Female	33	30
Age	65-74	77	70
	75-84	22	20
	≥85	11	10
GCS	>8	101	91.8
	≤8	9	8.2
Head and neck		38	34.5
Thorax		47	42.7
Abdomen		14	12.7
Thoracic/ Lumbar Vertebrae		10	9.1
Pelvic		12	10.9
Extremity		46	41.8
Multipl Trauma		27	24.5
Clinical Outcome	Discharge from ED	48	43.6
	Death in ED	7	6.4
	Non-ICU Hospitalization	34	30.9
	ICU Hospitalization	21	19.1
Outcome in ICU	Recovery	14	66.7
	Death	7	33.3

GCS: Glasgow Coma Scale, ED:emergency department, ICU:Intensive care unite

It was found that the Glasgow Coma Scale (GCS) score, head-neck, thoracic, abdominal, and extremity injuries, as well as the presence of multiple traumas, significantly affected clinical outcomes (respectively;  $p < 0.001$ ,  $p = 0.022$ ,  $p = 0.003$ ,  $p = 0.011$ ,  $p = 0.013$ ,  $p < 0.001$ ,

respectively) (Table 2). An increase in mortality was observed in patients with thoracic and abdominal injuries, as well as those with multiple traumas ( $p = 0.02$ ,  $p < 0.001$ ,  $p < 0.001$ , respectively) (Table 3).

**Table II:** Differences between case results and clinical endpoints

		Discharging and Hospitalization								p*
		Discharged from		Death in		Hospitalization to non-		Hospitalization to		
		N	%	n	%	n	%	n	%	
Gender	Female	18	37.5	3	42.9	9	26.5	3	14.3	0.212
	Male	30	62.5	4	57.1	25	73.5	18	85.7	
GCS value	≤8	0	0	6	85.7	0	0	3	14.3	<0.001
	>8	48	100	1	14.3	34	100	18	85.7	
Age	65-74	33	68.8	4	57.1	26	76.5	14	66.7	0.625
	75-84	10	2.8	3	42.9	4	11.8	5	23.8	
	≥ 85	5	10.4	0	0	4	11.8	2	9.5	
Head-Neck	Yes	20	41.7	5	71.4	6	17.6	7	33.3	0.022
	No	28	58.3	2	28.6	28	82.4	14	66.7	
Thorax	Yes	14	29.2	6	85.7	13	38.2	14	66.7	0.003
	No	34	70.8	1	14.3	21	61.8	7	33.3	
Abdomen	Yes	5	10.4	3	42.9	1	2.9	5	23.8	0.011
	No	43	89.6	4	57.1	33	97.1	16	76.2	
Thoracic/ Lumbar vertebrae	Yes	5	10.4	1	14.3	1	2.9	3	14.3	0.462
	No	43	89.6	6	85.7	33	97.1	18	85.7	
Pelvic	Yes	2	4.2	1	14.3	6	17.6	3	14.3	0.245
	No	46	95.8	6	85.7	28	82.4	18	85.7	
Extremity	Yes	16	33.3	2	28.6	22	64.7	6	28.6	0.013
	No	32	66.7	5	71.4	12	35.3	15	71.4	
Multipl Trauma	Yes	6	12.5	5	71.4	6	17.6	10	47.6	<0.001
	No	42	87.5	2	28.6	28	82.4	11	52.4	

\*:Calculated by chi-square test. GCS: Glasgow coma scale, ED:Emergency department, ICU:Intensive care unit

**Table III:** Differences in Mortality Rates by Trauma Region, Age, and Gender

		Death		Recovery		p*
		n	%	n	%	
Gender	Female	4	28,6	29	30,2	0.901
	Male	10	71.4	67	69.8	
Age	65-74	9	64,3	68	70,8	0.16
	75-84	5	35,7	17	17,7	
	≥85	0	0	11	11.5	
Head-Neck	Yes	2	42,9	4	28,6	0.513
	No	4	57.1	10	71.4	
Thorax	Yes	10	71,4	37	38,5	<b>0.02</b>
	No	4	28.6	59	61.5	
Abdomen	Yes	6	42,9	8	8,3	<b>&lt;0.001</b>
	No	8	57.1	88	91.7	
Thoracic/ Lumbar Vertebrae	Yes	1	7,1	9	9,4	0.786
	No	13	92.9	87	90.6	
Pelvic	Yes	1	7,1	11	11,5	0.628
	No	13	92,9	85	88.5	
Extremity	Yes	5	35.7	41	42,7	0.62
	No	9	64.3	55	57.3	
Multipl Trauma	Yes	10	71.4	17	17.7	<b>&lt;0.001</b>
	No	4	28.6	79	82.3	

\*: Calculated by chi-square test.

The average length of stay for hospitalized patients was 9.8±9.68 days, and the average treatment cost was 3555±5663 Turkish Lira. An increase in the length of stay was found to correlate with an increase in treatment costs (r=0.602; p=0.001) (Table 4).

**Table IV:** Comparison of costs based on hospitalization durations

	Cost	
Hospitalization days	r*	0,602
	p	0,001
	n	55

r\*:Spearman rank correlation coefficient

In cases where death occurred, the presence of extremity injuries and the development of multiple traumas were associated with higher costs (p=0.004, p=0.006, p=0.012, respectively) (Table 5).

**Table V:** Comparison of costs according to clinical characteristics of cases

		Cost*			p**
		Median	Minimum	Maximum	
Gender	Female	349.52	21.5	23769.41	0.055
	Male	899.45	26.3	27462.19	
GCS value	≤8	900.11	225	23192.2	0.139
	>8	435.81	21.05	27462.19	
Age	65-74	435.81	21.05	23769.41	0.658
	75-84	401.15	29.2	27462.19	
	≥85	1317.8	115.45	10111.29	
Death(ED+ICU)	Recovery	417.69	21.05	23769.41	<b>0.004</b>
	Death	4953.54	225	27462.19	
Season	Spring	910.8	111.94	14234.8	0.454
	Summer	431.81	21.05	23192.2	
	Autumn	399.12	26.3	27462.19	
	Winter	409.16	30.77	13440.12	
Head-Neck	Yes	349.91	67.32	27462.19	0.146
	No	733.75	21.05	23769.41	
Thorax	Yes	615.71	21.05	23769.41	0.384
	No	371.76	29.2	27462.19	
Abdomen	Yes	733.75	177.31	23769.41	0.399
	No	437.43	21.05	27462.19	
Thoracic/ Lumbar Vertebrae	Yes	668.34	173.71	11541.26	0.647
	No	455.64	21.05	27462.19	
Pelvic	Yes	3729.15	90.01	23769.41	0.064
	No	420.49	21.05	27462.19	
Extremity	Yes	3243.19	29.2	27462.19	<b>0.006</b>
	No	375.28	21.05	23769.41	
Multipl Trauma	Yes	1083.08	172.68	23769.41	<b>0.012</b>
	No	390.19	21.05	27462.19	

\*: Turkish Liras, \*\*: P value was obtained from Mann Whitney U or Kruskal Wallis test. ED:Emergency department, ICU:Intensive care unit

## DISCUSSION

This study evaluated the clinical and cost analysis of the elderly population presenting to the emergency department due to traffic accidents.

Studies have shown that among elderly patients who present to the emergency department due to traffic accidents, there is a higher proportion of males<sup>8-10</sup>. In our study, it was found that 70% of cases were male, aligning with similar findings in the literature regarding gender distribution. The fact that men are involved in more traffic accidents is an issue that should be examined from various perspectives.

Studies indicate that hospitalization duration is higher among geriatric age groups compared to younger patients. Factors contributing to

prolonged hospital stays in elderly patients include weaker immune response to trauma compared to younger age, slower wound healing, presence of secondary infections, higher prevalence of comorbidities in advanced age, and development of thrombosis<sup>11,12</sup>. In a study involving elderly patients, it was found that 27.1% of cases required hospitalization for treatment, with an average length of stay of 10.7 days<sup>8</sup>. In our study, 50% of patients resulted in hospitalization with an average stay of 9.8 days. While hospitalization rates were higher compared to the literature, average length of stay aligned with existing findings. We think that factors prolonging hospitalization in the elderly need further exploration through additional studies.

Studies report that the mortality rate among the elderly population due to traffic accidents ranges from 4.4% to 10.1%<sup>10-13</sup>. In our study, the overall mortality rate was found to be 12.7%, which is higher than the rates reported in previous studies. The variation in mortality rates may be attributed to several factors, including differences in patient populations, the presence of comorbid conditions, the site of trauma, and the medical resources available at the admitting centers. Studies have presented varying results regarding mortality rates among the elderly. In the study by Etehad et al., a mortality rate of 10.1% was reported, with higher mortality observed in the group aged 75 years and older compared to those aged 65-74 years<sup>10</sup>. In our study, patients were categorized into three age groups, and no significant differences were found in terms of mortality rates among these groups. Additionally, the same study reported an intensive care unit admission rate of 1.6%<sup>10</sup>. In the retrospective study conducted by Meşin et al., which included 204 patients aged 65 and older who presented due to traffic accidents, the intensive care unit (ICU) admission rate was found to be 6.9%, and the overall mortality rate was 4.4%<sup>15</sup>. In our study, we found an ICU admission rate of 19.1% and a mortality rate of 12.7%. These rates are higher compared to those reported in the literature.

In the literature, various findings have been reported regarding the affected injury regions in elderly patients<sup>10-13,14</sup>. In our study, we observed that thoracic injuries were most common and increased mortality among elderly patients with thoracic trauma both in the emergency department and during hospitalization.

In the study by Yee et al., it was found that thoracic trauma is more common among elderly patients aged 65 and above compared to

younger individuals, with a majority of cases involving motor vehicle passenger<sup>15</sup>. Rib fractures in elderly patients increase the risk of mortality and pneumonia. Additionally, ICU stay duration is longer for elderly patients with rib fractures compared to those with injuries in other trauma regions<sup>16</sup>. Seatbelt use increases the incidence of thoracic injuries but reduces overall mortality and morbidity<sup>17</sup>. In our study, we observed increased mortality among elderly patients with thoracic trauma both in the emergency department and during hospitalization. We believe that initial assessment in the emergency department plays a crucial role in determining mortality in elderly patients with thoracic injuries.

Studies have shown an increased mortality rate among patients with head trauma<sup>18,19</sup>. Studies have demonstrated that severe thoracic and pelvic injuries have a more fatal outcome in the elderly compared to younger individuals<sup>20</sup>. In elderly patients, pelvic fractures can lead to retroperitoneal bleeding, which may progress slowly and be challenging to diagnose during initial evaluation, contributing to mortality<sup>21</sup>. The frequency of abdominopelvic injuries in elderly patients following traffic accidents ranges from 6.9% to 8.1%<sup>13,15</sup>. In our study, the incidence of abdominal injuries was found to be 12.7%. We also observed that abdominal injuries increased overall mortality.

Etehad et al. found that the frequency of multiple traumas in elderly patients was 83.4% in drivers, 77.7% in motorcyclists, and overall 72.6%<sup>10</sup>. Nagata et al. reported that the most common injuries in individuals aged 65 and above occur in car and bicycle accidents, with the highest risk of mortality observed in pedestrians<sup>22</sup>. Another study indicated that motor vehicle drivers and pedestrians are more frequently involved in accidents<sup>15</sup>. Richter et al. demonstrated that in the elderly population,

pedestrian and cyclist accidents are the most common, and compared to younger individuals, those aged 65 and above experience increased injury severity and mortality<sup>23</sup>. In studies specific to Turkey, Güler et al. showed that non-vehicle accidents are the most common type of accidents among individuals aged 65 and above<sup>24</sup>.

Traffic accident-related injuries and deaths cause significant social and economic impacts worldwide. They impose a substantial economic burden on healthcare systems, patients, and their families<sup>25</sup>. Globally, about 3% of the gross domestic product is spent on deaths and injuries resulting from traffic accidents<sup>26</sup>. The increasing elderly population and their greater participation in social life contribute to rising elderly care costs, especially related to hospital and post-hospital morbidities following traffic accidents.

One study has shown that treatment costs increase with age among patients involved in traffic accidents<sup>27</sup>. Emamgholipour et al.'s study examined the relationship between traffic accidents and hospital healthcare costs, revealing that treatment costs increase with age, particularly for individuals aged 60 and above compared to younger age groups. They also found that as length of hospital stay increases, so does the overall treatment cost. The study also indicated that treatment costs are higher for men compared to women. Additionally, cases resulting in death incurred higher costs, especially in injuries involving the hands-wrists and head-neck regions compared to other injuries<sup>27</sup>. In our study, we similarly found that treatment costs are higher for men compared to women, and costs increase in cases with extremity injuries and fatal outcomes.

The literature generally indicates that frailty and comorbid conditions are associated with increased healthcare needs and costs. However, there are studies that suggest the opposite, showing no direct relationship between frailty and treatment costs in elderly patients<sup>28,29</sup>.

Van der Vlegel et al.'s study on elderly patients presenting to the hospital due to trauma demonstrated that as age increases, treatment costs increase both during hospitalization and in the post-hospitalization period<sup>30</sup>.

The limitations of our study include its retrospective design, being conducted at a single center, the lack of data regarding patients' comorbid conditions, and the exclusion of post-discharge cost data. Comprehensive studies involving larger patient populations will contribute to the literature by providing valuable insights into the management and treatment costs of traffic accidents involving the elderly in emergency departments.

## CONCLUSION

In conclusion, this study provides valuable insights into the clinical characteristics and treatment costs of elderly patients presenting to the emergency department due to traffic accidents. The observed mortality and cost rates highlight the importance of tailored approaches for this vulnerable population.

**Ethics Committee Approval:** The study was conducted in accordance with the Helsinki Declaration and received approval from the Non-Interventional Clinical Research Ethics Committee of Hatay Mustafa Kemal University (Decision No: 23, 01/04/2021).

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

## REFERENCES

1. Schwab CW, Kauder DR. Trauma in the geriatric patient. *Arch Surg.* 1992;127(6):701-6.
2. Taylor MD, Tracy JK, Meyer W, et al. Trauma in the elderly: intensive care unit resource use and outcome. *J Trauma.* 2002;53(3):407-414.
3. Llompert-Pou JA, Chico-Fernández M, Sánchez-Casado M, et al. Age-related injury patterns in Spanish trauma ICU patients. Results from the RETRAUCI. *Injury.* 2016;47 Suppl 3:61-5.
4. Keller JM, Sciadini MF, Sinclair E, O'Toole RV. Geriatric trauma: demographics, injuries, and mortality. *J Orthop Trauma.* 2012;26(9):161-5.
5. Bonne S, Schuerer DJ. Trauma in the older adult: epidemiology and evolving geriatric trauma principles. *Clin Geriatr Med.* 2013;29(1):137-50.
6. Kapçı M, Tomruk Ö, Beceren NG, et al. Investigation of factors affecting cost of geriatric patients admitted to the emergency department. *Eurasian J Emerg Med.* 2013;12(3):134.
7. Frink M. Multiple trauma and emergency room management. *Dtsch Arztebl Int.* 2017;114(29-30):497-503.
8. Eser M, Keten A, İçme F, et al. Investigation of traffic accidents in geriatric age group. *Turk J Geriatr.* 2013;16(3):277-80.
9. Kandış H, Karakuş A, Katırcı Y, et al. Geriatrik yaş grubu ve adli travmalar. *Turk J Geriatr.* 2011;14(3):20-4.
10. Etehad H, Yousefzadeh-Chabok S, Davoudi-Kiakalaye A, et al. Impact of road traffic accidents on the elderly. *Arch Gerontol Geriatr.* 2015;61(3):489-93.
11. Safih MS, Norton R, Rogers I, et al. Elderly trauma patients admitted to the intensive care unit are different from the younger population. *N Z Med J.* 1999;112(1098):402-4.
12. Perdue PW, Watts DD, Kaufmann CR, et al. Differences in mortality between elderly and younger adult trauma patients: geriatric status increases risk of delayed death. *J Trauma.* 1998;45(4):805-10.
13. Meşin MZ, Cihan FG, Pekkör S, et al. Evaluation of geriatric patients admitted to the emergency department due to a traffic accident. *Turk J Geriatr.* 2017;20(2):3-8.
14. Abou-Raya S, ElMeguid LA. Road traffic accidents and the elderly. *Geriatr Gerontol Int.* 2009;9(3):290-7.
15. Lee WY, Cameron PA, Bailey MJ. Road traffic injuries in the elderly. *Emerg Med J.* 2006;23(1):42-6.
16. Bulger EM, Arneson MA, Mock CN, et al. Rib fractures in the elderly. *J Trauma.* 2000;48(6):1040-7.
17. Coley A, Partridge R, Kaylor C, et al. The effect of seatbelt use on injury patterns, disposition, and hospital charges for elders. *Acad Emerg Med.* 2002;9(12):1411-6.
18. Güneytepe U, Aydın S, Gökgöz S, et al. The factors influencing the mortality in elderly trauma patients and scoring systems. *Uludag Med J.* 2008;34(1):15-9.
19. Akköse Aydın Ş, Bulut M, Fedakar R, et al. Trauma in the elderly patients in Bursa. *Turk J Trauma Emerg Surg.* 2006;12(3):230-4.
20. Heinrich D, Holzmann C, Wagner A, et al. What are the differences in injury patterns of young and elderly traffic accident fatalities considering death on scene and death in hospital? *Int J Legal Med.* 2017;131(4):1023-37.
21. Matsui Y, Oikawa S, Hitosugi M. Features of fatal injuries in older cyclists in vehicle-bicycle accidents in Japan. *Traffic Inj Prev.* 2018;19(1):60-5.
22. Nagata T, Uno H, Perry MJ. Clinical consequences of road traffic injuries among the elderly in Japan. *BMC Public Health.* 2010;10(2):375.
23. Richter M, Pape HC, Otte D, et al. The current status of road user injuries among the elderly in

Germany: a medical and technical accident analysis. *J Trauma*. 2005;58(3):591-5.

24. Güler H, Kaya KA, Şenol E, et al. 65 yaş ve üzeri olgular için düzenlenen adli raporların retrospektif incelenmesi. *Ege Tıp Derg*. 2020;59(3):196-201.

25. García-Altés A, Pérez K. The economic cost of road traffic crashes in an urban setting. *Inj Prev*. 2007;13(1):65-8.

26. World Health Organization. Global status report on road safety 2015. Geneva: World Health Organization; 2015.

27. Emamgholipour S, Raadabadi M, Dehghani M, et al. Analysis of hospital costs in road traffic injuries. *Bull Emerg Trauma*. 2021;9(1):36-41.

28. Bock JO, König HH, Brenner H, et al. Associations of frailty with health care costs: results of the ESTHER cohort study. *BMC Health Serv Res*. 2016;16:128.

29. Butler A, Gallagher D, Gillespie P, et al. Frailty: a costly phenomenon in caring for elders with cognitive impairment. *Int J Geriatr Psychiatry*. 2016;31(2):161-8.

30. Van Der Vlegel M, Haagsma JA, Geraerds AJLM, et al. Health care costs of injury in the older population: a prospective multicentre cohort study in the Netherlands. *BMC Geriatr*. 2020;20(1):417.