



# The Volume of Trauma-Related Emergency Department Visits During the COVID-19 Pandemic

## COVID-19 Salgını Sırasında Travmaya Bağlı Acil Servis Başvurularındaki Değişimler

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### Abstract

**Aim:** After the first case in Wuhan, China in late 2019, COVID-19 quickly spread and affected the whole world. While it had been recommended to postpone healthcare services for non-emergency cases, several studies showed that many emergency cases were decreased as well. In this study, we aimed to investigate whether the trends in visits to the emergency department (ED) were altered during the COVID period.

**Material and Method:** We evaluated the ED visits between July 1, 2019 and June 30, 2020 due to transport injuries, falls, interpersonal violence and self-harm using International Classification of Diseases, 10th revision codes. Pre-COVID period was defined as July 2019-Mar 2020 and COVID period was defined as April-June 2020. To show whether there was a significant change between pre-COVID and COVID periods (monthly), we used piecewise regression analyses.

**Results:** In total, there were 14,958 ED visits due to transport injuries, falls, interpersonal violence and self-harm during the study period. Piecewise regression analysis revealed that ED visits for transport injury ( $p=0.028$ ), falls ( $p=0.006$ ) and interpersonal violence ( $p=0.007$ ) significantly decreased, whereas, there was a significant increase in visits for self-harm ( $p<0.001$ ) in COVID period, when compared with pre-COVID period.

**Conclusion:** This is the first study showing that the number of ED visits for transport injury, falls and interpersonal violence were decreased and those for self-harm were increased during the COVID-19 pandemic. A maximum effort should be made by authorities to understand the reason behind these trends, particularly for self-harm behaviors.

**Keywords:** COVID-19, wounds and injuries, accidental falls, violence, self-injurious behavior, traffic accidents

### Öz

**Amaç:** 2019'un sonlarında Çin'in Wuhan kentinde yaşanan ilk vakanın ardından COVID-19 hızla yayıldı ve tüm dünyayı etkiledi. Acil olmayan vakalar için sağlık hizmetlerinin ertelenmesi önerilmiş olsa da, birkaç çalışmada birçok acil vakanın da azaldığı gösterilmiştir. Bu çalışmada, travma kaynaklı acil servis başvurularının COVID-19 pandemisi sırasındaki değişimini araştırmayı amaçladık.

**Gereç ve Yöntem:** ICD-10 kodları kullanılarak 1 Temmuz 2019 - 30 Haziran 2020 tarihleri arasında trafik kazası, düşme, darp ve özkıyım nedeniyle acil servis başvuran hastalar belirlendi. COVID öncesi dönem Temmuz 2019-Mart 2020, COVID dönemi ise Nisan-Haziran 2020 olarak tanımlandı. COVID öncesi ve COVID dönemleri arasındaki değişimin değerlendirilmesi için parçalı regresyon analizleri kullanıldı.

**Bulgular:** Çalışma döneminde trafik kazası, düşme, darp ve özkıyım nedeniyle toplam 14.958 acil servis başvurusu yapılmıştı. COVID döneminde, COVID öncesi döneme kıyasla trafik kazası ( $p=0,028$ ), düşme ( $p=0,006$ ) ve darp ( $p=0,007$ ) sebebiyle yapılan acil servis başvurularında anlamlı azalma, özkıyım sebebiyle yapılan başvurularda ise anlamlı artma olduğu görüldü ( $p<0,001$ ).

**Sonuç:** COVID-19 salgını sırasında trafik kazası, düşme ve darp nedeniyle yapılan acil servis başvurularının azaldığı, özkıyım nedeniyle yapılan başvuruların ise arttığı görülmektedir. Başvuru sıklıklarındaki bu değişimlerin arkasındaki nedenlerin anlaşılması için azami çaba gösterilmelidir.

**Anahtar Kelimeler:** COVID-19, düşme, darp, özkıyım, trafik kazası



## INTRODUCTION

After the first case in Wuhan, China in late 2019, COVID-19 quickly spread and affected the whole world. By the end of August 2020, almost 25 million cases and 800,000 deaths were reported worldwide.<sup>[1]</sup> Under these circumstances, Center for Disease Control (CDC) have recommended postponing healthcare services for non-emergency cases in an attempt to prevent new cases and to compensate the increasing workload of healthcare professionals.<sup>[2]</sup> In the meantime, governments around the world had implemented measures such as stay-at-home orders, postponing all kinds of scientific, cultural and artistic activities and shutting down the entertainment facilities to prevent the spread of the pandemic.

Scientific reports have confirmed that hospital admissions due to non-COVID related reasons were significantly decreased upon these implementations. A recently published article from the United States showed that visits to emergency departments (ED) were decreased in the first months of the COVID-19 pandemic.<sup>[3]</sup> Several other studies reported a decline in admissions and hospitalizations due to acute myocardial infarction.<sup>[4-7]</sup> Another study utilizing public vehicle collision data showed that the number of vehicle related injuries were decreased.<sup>[8]</sup> These trends suggest that the number of admissions to ED due to trauma might also have been decreased. Recent studies showed that the trends in trauma related hospital admissions during the COVID-19 pandemic were decreased.<sup>[9,10]</sup>

In this study, we aimed to investigate the trends in trauma-related visits to ED during the COVID-19 era. Furthermore, we sought to evaluate whether the hospitalization rates of these patients were altered.

## MATERIAL AND METHOD

### Study design and patient selection

The data for this retrospective observational study were obtained from electronic health records at Ankara City Hospital, a medical institution with the highest bed capacity (3,704 beds) in Europe. The study reports were prepared according to the STROBE guidelines.<sup>[11]</sup> The study was approved by the Local Ethics Committee (Approval No: E1/1076/2020).

We evaluated the ED visits between July 1, 2019 and June 30, 2020 due to transport injuries, falls, interpersonal violence and self-harm, as these external causes account for one of the most frequent causes of deaths in Turkey.<sup>[12]</sup> The International Classification of Diseases, 10<sup>th</sup> revision (ICD-10) codes were used to separate admissions into their respective groups. The ICD-10 codes were derived with respect to Global Burden of Disease Study 2013.<sup>[13]</sup> Such that, codes V00-V86.99, V87.2, V87.3, V88.2, V88.3, V91-V91.9, V93-V98.8 and Z04.1 were categorized as "transport injuries", W00-W19.9 as "falls", "X85-Y08.9, Y87.1, Y87.2, Z04.4-Z04.5, W50, W51" as

"interpersonal violence" and X60-X84.9 as "self-harm". We investigated the number of ED visits for these predefined categories on a monthly basis. Monthly rates of hospitalization were also analyzed for each category to evaluate the potential impact of aforesaid measures on clinical practice. In-hospital mortality were derived from electronic health records and presented for each predefined category.

### Study Periods

The study period was designed as one year, starting from July 1, 2019 (the start date of full-capacity work in ED at our hospital) to June 30, 2020.

The first confirmed COVID-19 case in Turkey was announced on March 11, 2020 and a national stay-at-home order was declared for persons over 65 years of age on March 21, 2020. These measures were expanded on April 3, 2020.<sup>[14]</sup> In addition, several other national precautions including cancellation of large-scale social activities had also been implemented by the end of March 2020. As of June, these measures had been gradually reduced, signaling the beginning of normalization period in Turkey.<sup>[15]</sup> For these reasons, in this study, "pre-COVID period" was defined as July 2019-March 2020, "COVID period with restrictions" was defined as April-May 2020 and "normalization period" was defined as June 2020.<sup>[16]</sup>

### Statistical Analysis

Continuous variables were demonstrated as mean  $\pm$  standard deviation (SD) and categorical variables as frequencies and percentages. Number of visits to ED and hospitalization rates were presented according to quartiles of the study period. Trends for the ED visits due to above-mentioned reasons were plotted for pre-COVID (July 2019-March 2020), COVID (April-May 2020) and normalization (June 2020) periods. Accordingly, hospitalization rates for each subcategory were plotted for the same period.

To show whether there was a significant alteration between pre-COVID and COVID periods (monthly), we used piecewise regression analyses, a useful statistical method to compare the trends of two separate periods,<sup>[17,18]</sup> for each trend including the number of ED visits and hospitalization rates in transport injury, falls, interpersonal violence and self-harm. STATA version 16.1 (STATA Corporation, College Station, Texas) was used for all statistical analysis. Statistical significance was defined as  $p < 0.05$ .

## RESULTS

In total, there were 14,958 ED visits due to transport injuries, falls, interpersonal violence and self-harm during the study period. The mean (SD) age of study population was 34.5 (24.4) years. Of the study population, 8,938 (59.8%) were male. The major reason for ED visits was fall (62.7%), followed by transport injury (25.9%), interpersonal violence (10.7%) and self-harm (1.0%).

Numbers of ED visits per each quartile of the study period were presented in **Table 1**. While the number of visits were relatively stable before the COVID period (n=3,941 in Jul-Sep 2019, n=4,371 in Oct-Dec 2019, n=3,892 in Jan-Mar 2020), there was a decrease to 2,754 in COVID period (Apr-Jun 2020). Numbers of hospitalization due to trauma per each quartile of the study period were presented in **Table 2**. Of 14,958 ED visits, 3,645 (24.4%) were hospitalized. Most of the hospitalized patients were male (61.7%, n=2,250).

In total, 196 patients died in hospital within a median (25th-75th) of 18 (6-87) days. The mean (SD) age of these 196 patients was 75.58 (17.89) years and more than half of them (n=102, 52.0%) were female. Out of these 196 patients, 19 died due to transport injury, 172 due to falls and 5 due to interpersonal violence. None of the patients died due to self-harm. The trends of mortality rates were similar for each quartile of the study period (**Table 3**).

The mean (SD) number of monthly ED visits due to transport injury was 371.7 (55.7) in the pre-COVID period. However, the number of ED visits due to transport injury declined in the COVID period with restrictions (n=90 (75.7% decrease) in April 2020, n=144, (61.0% decrease) in May 2020), compared with the mean number of monthly visits in pre-COVID period. The number of ED visits due to transport injury was similar in the normalization period (June 2020) and pre-COVID period. Piecewise regression analysis revealed that this trend was significant ( $p=0.028$ ). However, there were no significant alterations in hospitalization rates throughout the study period ( $p=0.921$ ) (**Figure 1**).

While the mean (SD) number of monthly ED visits due to falls was 847.2 (113.9) in the pre-COVID period, the number of ED visits decreased by 66.0% in April 2020 (n=284). As shown in **Figure 2**, piecewise regression analyses showed that trends in the number of visits ( $p=0.006$ ) and hospitalization rates ( $p=0.665$ ) due to falls were similar with transport injury.

**Table 1.** Emergency Department visits due to trauma according to quartiles of the study periods

	Total n=14,958	Jul-Sep 2019 n=3,941	Oct-Dec 2019 n=4,371	Jan-March 2020 n=3,892	Apr-June 2020 n=2,754
<b>Age, mean (SD)</b>	34.5 (24.4)	35.4 (23.7)	33.4 (24.5)	34.9 (24.5)	34.6 (25.2)
<b>Sex</b>					
Male, n (%)	8,938 (59.8%)	2,389 (60.6%)	2,558 (58.5%)	2,257 (58.0%)	1,734 (63.0%)
Female, n (%)	6,020 (40.2%)	1,552 (39.4%)	1,813 (41.5%)	1,635 (42.0%)	1,020 (37.0%)
<b>Admission reason to Emergency Department</b>					
Transport injury, n (%)	3,870 (25.9%)	1,006 (25.5%)	1,245 (28.5%)	1,050 (27.0%)	569 (20.7%)
Falls, n (%)	9,378 (62.7%)	2,496 (63.3%)	2,639 (60.4%)	2,413 (62.0%)	1,830 (66.4%)
Self-harm, n (%)	144 (1.0%)	33 (0.8%)	18 (0.4%)	23 (0.6%)	70 (2.5%)
Interpersonal violence, n (%)	1,601 (10.7%)	412 (10.5%)	476 (10.9%)	410 (10.5%)	303 (11.0%)

**Table 2.** Hospitalization due to trauma according to quartiles of the study periods

	Total n=3,645	Jul-Sep 2019 n=796	Oct-Dec 2019 n=944	Jan-March 2020 n=1,090	Apr-June 2020 n=815
<b>Age, mean (SD)</b>	40.6 (26.7)	41.5 (25.8)	40.5 (27.0)	39.9 (26.5)	40.9 (27.5)
<b>Sex</b>					
Male, n (%)	2,250 (61.7%)	506 (63.6%)	583 (61.8%)	650 (59.6%)	511 (62.7%)
Female, n (%)	1,395 (38.3%)	290 (36.4%)	361 (38.2%)	440 (40.4%)	304 (37.3%)
<b>Admission reason to Emergency Department</b>					
Transport injury, n (%)	1,107 (30.4%)	249 (31.3%)	319 (33.8%)	362 (33.2%)	177 (21.7%)
Falls, n (%)	2,274 (62.4%)	494 (62.1%)	558 (59.1%)	636 (58.3%)	586 (71.9%)
Self-harm, n (%)	45 (1.2%)	12 (1.5%)	7 (0.7%)	12 (1.1%)	14 (1.7%)
Interpersonal violence, n (%)	233 (6.4%)	42 (5.3%)	64 (6.8%)	81 (7.4%)	46 (5.6%)

**Table 3.** In-hospital mortality according to quartiles of the study periods

	Total n=196	Jul-Sep 2019 n=51	Oct-Dec 2019 n=57	Jan-March 2020 n=48	Apr-June 2020 n=40
<b>Age, mean (SD)</b>	75.58 (17.89)	71.41 (20.40)	77.59 (16.85)	78.10 (11.31)	75 (21.62)
<b>Sex</b>					
Male, n (%)	94 (1%)	30 (1.2%)	28 (1%)	15 (0.6%)	21 (1.2%)
Female, n (%)	102 (1.6%)	21 (1.3%)	29 (1.5%)	33 (2%)	19 (1.8%)
<b>Admission reason to Emergency Department</b>					
Transport injury, n (%)	19 (0.4%)	4 (0.3%)	5 (0.4%)	3 (0.6%)	7 (1.2%)
Falls, n (%)	172 (1.8%)	45 (1.8%)	49 (1.8%)	45 (1.8%)	33 (1.8%)
Self-harm, n (%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Interpersonal violence, n (%)	5 (0.3%)	2 (0.4%)	3 (0.6%)	0 (0%)	0 (0%)

As shown in **Figure 3**, the mean (SD) number of monthly ED visits due to interpersonal violence was 145 (18.1) in the pre-COVID period. In the piecewise regression analyses, we showed that trends in the number of visits ( $p=0.007$ ) and hospitalization rates ( $p=0.931$ ) due to interpersonal violence were similar with transport injury and falls.

The mean (SD) number of monthly ED visits due to self-harm was 8.4 (2.9) in the pre-COVID period. However, there was a dramatic increase in the number of ED visits due to self-harm (176.3%) ( $p<0.001$ ) with a decreasing hospitalization rate ( $p=0.019$ ) in the COVID period compared with pre-COVID period (**Figure 4**).

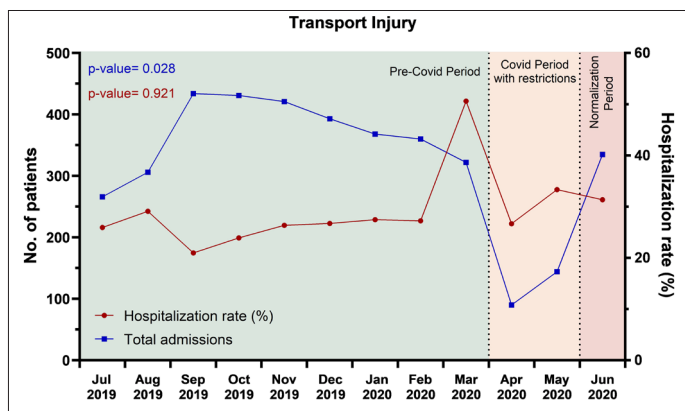
### DISCUSSION

In the “COVID period with restrictions”, ED visits due to transport injury, falls and interpersonal violence were decreased when compared with pre-COVID period. Indeed, the number of ED visits due to transport injury, falls and interpersonal violence were similar in the pre-COVID and normalization periods. While the number of ED visits due to self-harm were increased in the COVID period, the hospitalization rates were decreased when compared with pre-COVID period. To the best of our knowledge, this is the

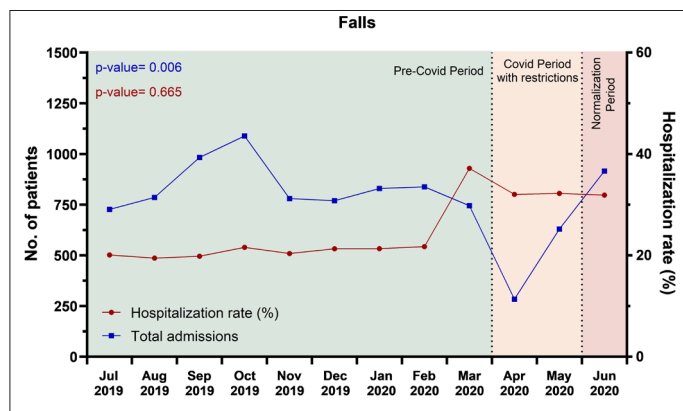
first study showing the trends of ED visits due to specific reasons including transport injury, falls, interpersonal violence and self-harm during the COVID-19 pandemic. Understanding the underlying causes of these changes will enable the development of appropriate healthcare strategies and more effective management of the high patient volume in emergency departments.

A research by Sutherland et al.<sup>[8]</sup> supports our findings regarding the visits related to transport injury. In that study, authors reported that total vehicle collisions and vehicle related injuries decreased during the COVID-19 pandemic, which is similar to our findings. It has been shown that less drivers on the road declined the chance of traffic injury.<sup>[19]</sup> Since many countries have implemented various restrictions to prevent the spread of infection, the density of traffic and volume of accidents may have been decreased. In this regard, Badr et al.<sup>[20]</sup> showed that the mobility decreased in the United States during the COVID period.

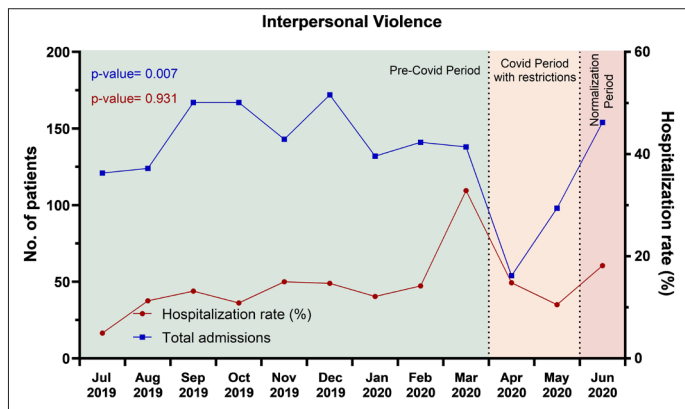
Falls are yet another important reason for trauma-related ED visits. One out of five falls are reported to cause a serious injury such as fractures or a head trauma.<sup>[21]</sup> Each year, 3 million elderly visit emergency departments due to falling.<sup>[22]</sup> At least 800,000 patients are hospitalized each year because of fall-related injuries, most frequently head trauma or hip



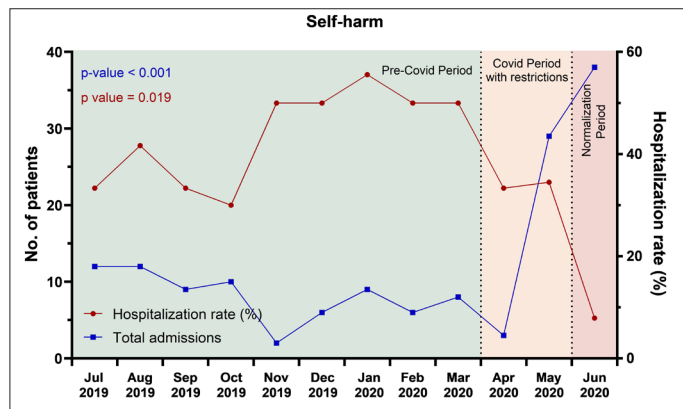
**Figure 1.** ED visits and hospitalization rates due to transport injury during the study period



**Figure 2.** ED visits and hospitalization rates due to falls during the study period



**Figure 3.** ED visits and hospitalization rates due to interpersonal violence during the study period



**Figure 4.** ED visits and hospitalization rates due to self-harm during the study period



fractures.<sup>[23]</sup> Our results show a significant decrease in fall-related ED visits in the COVID period with restrictions. Indeed, the number of fall-related visits were back to pre-COVID levels in the normalization period.

In this study we found that interpersonal violence decreased during the first two months of COVID period when compared to pre-COVID period. Interpersonal violence (violence between individuals) is subdivided into two categories; domestic violence (child maltreatment, intimate partner violence, elder abuse) and community violence (violence and/or assault by acquaintance or strangers). According to "The Shadow Pandemic" report published by the United Nations Entity for Gender Equality and the Empowerment of Women, domestic violence in France has increased by 30% during the COVID lockdown period. Contrary to this, a domestic violence helpline in Italy is reported to receive 55% fewer calls, as asking for help might have been found to be harder during the lockdown. Thus, the decline in interpersonal violence in this study during the first two months of COVID era might be attributed to a reduction in help requests.<sup>[24]</sup>

Similar to our findings that demonstrate the increase in ED visits due to self-harm, Cheung et al.<sup>[25]</sup> reported that suicides increased in Hong Kong during the 2003 severe acute respiratory syndrome (SARS) epidemic. A recent study utilizing Google Trends data showed that acute anxiety queries were 11% higher than expected.<sup>[26]</sup> It is known that the increased anxiety is associated with suicide behaviors,<sup>[27]</sup> so the increased number of ED visits due to self-harm might be related to increase anxiety during pandemic spreading. On the other hand, our results indicate that hospitalizations due to self-harm decreased during the restrictions and normalization periods. As most of the in-patient care capacity of our institute was reserved for the COVID-19 patients, self-harm admissions might have been followed-up and discharged from within the emergency department.

This study provided information about trends in ED visits due to transport injury, falls, interpersonal violence and self-harm. However, this might not represent the true reason of alterations shown in the number of ED visits. Interestingly, ED visits due to self-harm were found to be increased in COVID period. This study can be regarded as a trigger for the actions to prevent self-harm behaviors. Otherwise, a "suicide pandemic" may also arise along with the COVID-19 pandemic due to possible economic adversities, increased fear and anxiety and uncertainty of the future.

There are several limitations to our study. Firstly, this is a retrospective, single center study and may not be adaptable to nationwide trends. Besides, the normalization period analyzed in this study covers only a 1-month period, thus the accuracy of data for this period can be questioned. It is also unknown whether these findings arose from a real drop in the number of incidents, or merely from a drop in ED visits due to concerns of infection. Considering the fact that our hospital has been transformed into a pandemic hospital, it is also

possible that patients have applied to different institutions. Since, July 2019 was the start date of full-capacity work in our hospital, we were not able to capture previous years. As previous studies reported controversial findings about the seasonal trends of injuries, it remains unclear whether these trends were seasonal or not.<sup>[28-30]</sup> Finally, diagnoses were derived from ICD-10 codes, thus, there might be subject to inaccuracies in coding.

## CONCLUSION

This is the first study showing that the number of ED visits for transport injury, falls and interpersonal violence were decreased and those for self-harm were increased during the COVID-19 pandemic. However, no difference was observed in the hospitalization rates between pre-COVID and COVID periods. Similar hospitalization rates despite the decreased number of admissions might be due to the fact that minor cases did not necessarily apply to ED, while only severe cases in need of hospitalization applied to the ED. It was notable that the number of ED visits in the normalization period were similar to pre-COVID era. Further studies examining a longer period and utilizing nationwide data are needed for a better understanding of the reasons behind these trends.

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** The study was carried out with the permission of Ankara City Hospital Ethics Committee (Approval No: E1/1076/2020).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent form was obtained from patients.

**Referee Evaluation Process:** Externally peer-reviewed.

**Conflict of Interest Statement:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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