





Trends in Emergency Department Visits, and Hospital Admissions Pre- and During Covid 19 Pandemic

Savaş Sezik¹  Onur Hakoğlu¹  Oktay Okuş²  Omay Sorgun¹ 

1 Ödemiş State Hospital, Department of Emergency Medicine, İzmir, Turkey.

2 Ödemiş State Hospital, Department of Anesthesiology and Reanimation, İzmir, Turkey.

Abstract

Background: During the Coronavirus Disease 2019 pandemic period, the unnecessary use of the emergency department (ED) affects the motivation of health care providers leading the healthcare services to be far from being efficient, delays the care of the patients having an actual emergency situation and reduces the quality of education in teaching clinics.

Methods: Diagnoses in the visits were classified based on International Statistical Classification of Diseases and Related Health Problems, Tenth Revision categories and were analysed into subgroups based on common reasons for ED visits.

Results: While the number of ED visits in the first year of the pandemic period decreased by 26% compared to the previous year, the frequency of admissions in the circulatory system, stomach and intestinal system, nervous system, trauma, infectious disease, endocrine system, muscular system and connective tissues, gynecology and pregnancy, environmental emergencies, mental and behavioral disorders, examination and encounter for administrative purposes was higher than expected and the frequency of admission and referral was also significantly more than the expected value ($p < 0.001$).

Conclusions: In addition to the significant decrease in the number of ED visits during the pandemic, the fact that higher admission and referral frequency were observed indicating that the patients visited the emergency service in the late phases with severe clinical conditions.

Keywords: COVID-19 pandemic, Emergency Departments, ICD Codes, Patient Admission, Outpatients.

Cite this article as: Sezik S, Hakoğlu O, Okuş O, Sorgun O. Trends in Emergency Department Visits, and Hospital Admissions Pre- and During Covid 19 Pandemic. Arch Curr Med Res. 2023;4(1):47-57

Corresponding Author:

Savaş Sezik, Ödemiş State Hospital, Department of
Emergency Medicine, İzmir, Turkey.
E-Mail: savassezik@gmail.com



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INTRODUCTION

Since the start of the COVID-19 (Coronavirus Disease 2019) pandemic, the burden on emergency services has increased in Turkey and around the world. Many people who experience COVID-19 symptoms rush to the emergency department (ED) of hospitals for urgent treatment, along with individuals with other acute conditions. Throughout the pandemic so far, many factors have caused a reduction in the use of health services especially for emergencies, such as failure of patients with serious or life-threatening conditions (including those not related to COVID-19) to seek care, avoiding ED visits for elective situations, and shifting emergency care to telemedicine (1). In addition, it is estimated that more than one third of all ED visits have been non-urgent even though the strict implementation of social distancing, quarantine rules, and stay-at-home orders by the local governments due to the infection risk are notably affecting the ED visits (2, 3).

Studies have shown that there has been a fall in the number of ED visits during the pandemic even though the information on the changes in the distributions of patient visits and hospital outcomes (outpatient treatment, admission, and referral) is limited (1). The purpose of this study was to analyze the impact of the COVID-19 pandemic on ED visits and to compare the distributions of the outcomes. The first hypothesis was that there has been no significant difference in the distribution of ED visits before and during the pandemic. The second hypothesis was concerning the outcome distribution: that there has been no difference in the distribution (outpatient treatment, admission, and referral) of patients who visited the ED before the pandemic and who have visited it so far during the current pandemic. The third hypothesis was that there has been no difference in the distribution of outcomes (outpatient treatment, admission, and referral) according to ED visits before and during the pandemic.

MATERIALS AND METHODS

Study Design

The study hospital is 110 km away from the İzmir province center, has a 300-bed capacity, and serves an approximately 250,000 population. Its ED is staffed by physicians 24 hours a day, 7 days a week. The study was a retrospective, observational, and before-and-during

cohort analysis approved by the Clinical Research Ethics Committee of the University of Health Sciences, İzmir Dr. Suat Seren Chest Diseases, Surgery Training and Research Hospital (Date 14.01.2022, Decision Number 2021/78-/6). It was guided by the ethical guidelines of the Declaration of Helsinki.

Study Population

All ED patient visits (including visits by children 0–17 years of age) within the period from March 15, 2019 to March 31, 2021 were examined. Data were extracted directly from a systematic query of the electronic health records as part of the health data management solution system. The first COVID-19 patient in Turkey was diagnosed on March 13, 2020. Two time-based cohorts were defined and analyzed in this study: the before pandemic term (March 15, 2019 to March 15, 2020) and the pandemic term (March 16, 2020 to March 31, 2021). The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) was used to identify the principal diagnosis groups. See the appendix for the coding details.

The patients with more than one diagnostic coding were separated. The ICD-10 codes were determined on the basis of the main complaints of the patients. The patients who could not be grouped, whose files could not be accessed or adequately obtained, or whose files did not contain a single ICD-10 code were excluded from the study.

The outcomes of the patients diagnosed under the ICD-10 code were recorded as outpatient treatment, admission, or referral. Outpatient ED visits were the visits to the ED of the hospital by all the patients who were discharged from the ED within one day. The admission category was created for all the patients who were admitted to the relevant service and intensive care units of the hospital. The referral category was created for all the patients who were referred to a center in the province because there was no available specialist physician, service, and/or bed in the hospital.

Data Analyses

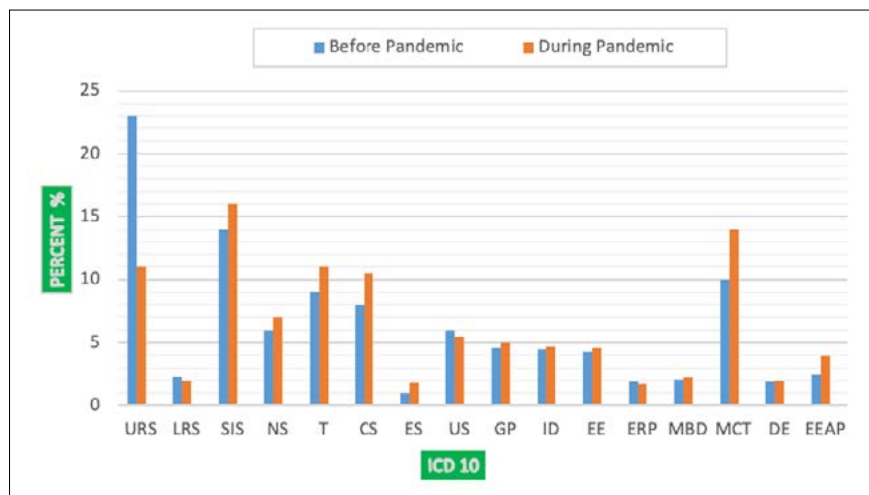
The categorical variables were compared through χ^2 tests. The adjusted residuals were calculated for each cell in the cross-tabulation. In cases where the adjusted residuals were < -1.96 and > 1.96 , the adjusted residuals were considered significant according to the Ho hypotheses (4). All the analyses were performed using IBM SPSS Statistics

for Windows 27.0 (IBM Corp., Armonk, NY, USA). The threshold for statistical significance was $p < 0.05$.

RESULTS

The number of ED visits was recorded as 233.078 for the pre-pandemic period and 171.859 for the pandemic period, with a 26% decrease observed in the ED visit rate during the pandemic. A total of 297.810 patients (pre-pandemic period: 191.152; pandemic period: 106.658) were included in this study. Fifty-two percent of the patients in the pre-pandemic period and 47% of those in the pandemic period were women. The mean ages of the patients in the pre-pandemic and pandemic period were 48.50 18.76 and 49.91 17.49, respectively ($p > 0.005$). The numbers of admissions and referrals were 7,113 and 6,058 in the before pandemic period, respectively, and 1,147 and 1,133 in the pandemic period. The percentages of decrease in the sub diagnosis groups were as follows: upper respiratory system (URS), 73%; lower respiratory system (LRS), 46%; stomach and intestinal system (SIS), 40%; nervous system (NS), 41%; trauma (T), 35%; circulatory system (CS), 32%; endocrine system (ES), 22%; urinary system (US), 49%; gynecology and pregnancy (GP), 33%; infectious diseases (ID), 38%; environmental emergencies (EE), 29%; ear and respiratory passage (ERP), 51%; mental and behavioral disorders (MBD), 34%; muscular system and connective tissues (MCT), 25%; diseases of the eye (DE), 23%; and examination and encounter for administrative purposes (EEAP), 7%.

The distribution of ICD-10 groups by periods (before and during pandemic) is shown in Figure 1. The frequency of ED visits in the before pandemic period was higher than expected for the URS, US, and ERP groups whereas the frequency of ED visits in the pandemic period were higher for the CS, SIS, NS, ID, ES, MCT, GP, EE, MBD, and EEAP groups. Except for the LRS group, all the groups contributed to the distribution of differences (Table 1). The comparison of the hospital outcomes by pandemic period and by independent diagnosis groups is shown in Graph 2. The frequency of outpatients in the before pandemic period and the frequency of admissions and referrals in the pandemic period were higher than expected (Table 2). The hospital outcomes (outpatient, admission, and referral) in the before pandemic and pandemic periods in the ICD-10 groups are compared in Table 3. The US, EE, ERP, DE, and EEAP groups did not contribute to the distribution of differences. When the LRS, NS, and ES groups were evaluated, it was found that the outpatient treatments under indifference in the before pandemic period and the admissions in the pandemic period were higher than expected. When the MCT, ID, GP, CS, T, SIS, and URS groups were analyses, it was observed that the outpatient treatments under indifference in the before pandemic period and the admissions and referrals in the pandemic period were higher than expected. In the MBD group, the outpatient treatments under indifference in the before pandemic period and the referrals in the pandemic period were also higher than expected.



See at Appendix for URS, SIS, NS, T, CS, ES, US, GP, ID, EE, ERP, LRS, MBD, MCT, DE, EEAP

Figure 1. Comparison of the distributions of the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD 10) groups by period

Table 1. Comparison of the distributions of the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD 10) groups by period.

	Before Pandemic	During Pandemic	Total (n*)	P
URS	44298	11584	55882	<0.001
n	23.2%	10.9%		
%	82.5	-82.5		
Adjusted residuel				
LRS	4795	2569	7364	
n	2.5%	2.4%		
%	1.7	-1.7		
Adjusted residuel				
SIS	27856	16617	44473	
n	14.6%	15.6%		
%	-7.4	7.4		
Adjusted residuel				
NS	10965	6464	17429	
n	5.7%	6.1%		
%	-3.6	3.6		
Adjusted residuel				
T	17847	11533	29380	
n	9.3%	10.8		
%	-13	13		
Adjusted residuel				
CS	15935	10875	26810	
n	8.3%	10.2		
%	-17	17		
Adjusted residuel				
ES	1860	1442	3302	
n	1%	1.4%		
%	-9.5	9.5		
Adjusted residuel				
US	11754	5956	17710	
n	6.1%	5.6%		
%	6.2	-6.2		
Adjusted residuel				
GP	7969	5321	13290	
n	4.2%	5%		
%	-10.4	10.4		
Adjusted residuel				
ID	8040	4971	13011	
n	4.2%	4.7%		
%	-5.8	5.8		
Adjusted residuel				
EE	6471	4593	11064	
n	3.4%	4.3%		
%	-12.7	12.7		
Adjusted residuel				
ERP	2586	1264	3850	
n	1.4%	1.2%		
%	3.9	-3.9		
Adjusted residuel				
MBD	4434	2923	7357	
n	2.3%	2.7%		
%	-7.1	7.1		
Adjusted residuel				
MCT	19194	14431	33625	
n	10%	13.5%		
%	-28.8	28.8		
Adjusted residuel				
DE	3291	2527	5818	
n	1.7%	2.4%		
%	-12.2	12.2		
Adjusted residuel				
EEAP	3857	3588	7445	
n	2%	3.4%		
%	-22.6	22.6		
Adjusted residuel				

The threshold for statistical significance was $p < 0.05$. n: Number of patients. See at Appendix for URS, SIS, NS,T, CS, ES, US, GP, ID, EE, ERP, LRS, MBD, MCT, DE, EEAP

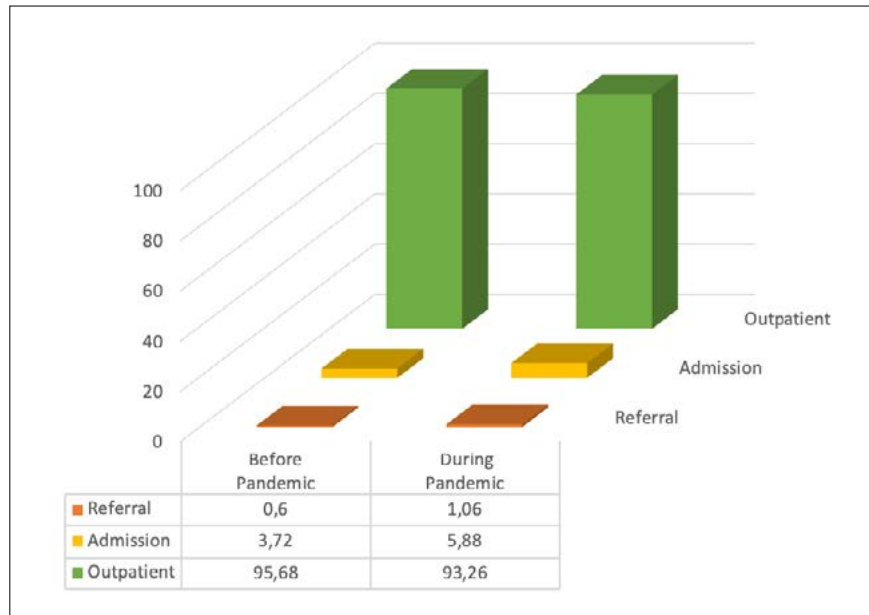


Figure 2. Comparison of hospital outcomes (outpatient, admission, referral) by period

Table 2. Comparison of hospital outcomes (outpatient, admission, referral) by period.

	<i>Before Pandemic</i>	<i>During Pandemic</i>	<i>Total (n*)</i>	<i>p</i>
Outpatient				<0.001
n	182892	99467	282359	
%	95.7%	93.3%		
Adjusted residual	28.6	-28.6		
Admission				
n	7113	6058	13171	
%	3.7%	5.7%		
Adjusted residual	-24.9	24.9		
Referral				
n	1147	1133	2280	
%	0.6%	1.1%		
Adjusted residual	-13.9	13.9		

The threshold for statistical significance was $p < 0.05$. n: Number of patients

Table 3. Comparison of hospital outcome (outpatient, admission, referral) by period in the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD 10) groups

		Outpatient N* % Adjusted residuel	Admission N* % Adjusted residuel	Referral N* % Adjusted residuel	Total N*	P
URS	Before Pandemic	43892 99.08% 26.8	395 %0.89 -26.4	11 %0.02 -4.4	44298	<0.001
	During Pandemic	11064, 95.51% -26.8	506 %4.37 26.4	14 %0.12 4.4	11584	
LRS	Before Pandemic	4005 83.5% 2.9	681 14.2% -3.3	109 2.3% 0.6	4795	0.004
	During Pandemic	2077 80.8% -2.9	439 17.1% 3.3	53 2.1% -0.6	2569	
SIS	Before Pandemic	26000 93.3% 7	1684 6 % -6.3	172 0.6% -3.1	27856	<0.001
	During Pandemic	15213 91.6% -7	1259 7.6% 6.3	145 0.9% 3.1	16617	
NS	Before Pandemic	10305 94% 6.6	587 5.4% -6.4	73 0.7% -1.8	10965	<0.001
	During Pandemic	5903 91.3% -6.6	502 7.8% 6.4	59 0.9% 1.8	6464	
T	Before Pandemic	17213 96.4% 7.1	575 3.2% -5.7	59 0.3% -5	17847	<0.001
	During Pandemic	10926 94.7% -71.	520 4.5% 5.7	87 0.8% 5	11533	
CS	Before Pandemic	14938 93.7% 9.4	392 2.5% -6.5	605 3.8% -6.7	15935	<0.001
	During Pandemic	9858 90.6% -9.4	417 3.8% 6.5	600 5.5% 6.7	10875	
ES	Before Pandemic	1497 80.5% 5	329 17.7% -4.6	34 1.8% -1.4	1860	<0.001
	During Pandemic	1055 73.7% -5	350 24.3% 4.6	37 2.6% 1.4	1442	
US	Before Pandemic	11492 97.8% 1.5	250 2.1% -1.7	12 0.1% 0.4	11754	0.23
	During Pandemic	5801 97.4% 1.5	150 2.5% 1.7	5 0.1% -0.4	5956	

Table 3. (Continue) Comparison of hospital outcome (outpatient, admission, referral) by period in the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD 10) groups

		Outpatient N* % Adjusted residuel	Admission N* % Adjusted residuel	Referral N* % Adjusted residuel	Total N*	P
GP	Before Pandemic	6501 81.6% 4.5	1465 18.4% -3.8	3 0% -5.7	7969	<0.001
	During Pandemic	4172 78.4% -4.5	1121 21.1% 3.8	28 0.5% 5.7	5321	
ED	Before Pandemic	7607 94.6% 8.3	398 5% -7.7	35 0.4% -2.8	8040	<0.001
	During Pandemic	4516 90.8% -8.3	414 8.3% 7.7	41 0.8% 2.8	4971	
EE	Before Pandemic	6295 97.3% 1.5	158 2.4% -1.5	18 0.3% -0.3	6471	0.29
	During Pandemic	4445 96.8% -1.5	134 2.9% 1.5	14 0.3% 0.3	4593	
ERP	Before Pandemic	2578 99.7% 1.8	8 0.3% -1.1	0 0% -2.0	2586	0.67
	During Pandemic	1255 99.3% -1.8	7 0.6% 1.1	2 0.2% 2.0	1264	
MCT	Before Pandemic	19077 99.4% 6.6	108 0.6% -5.6	9 0% -3.9	19194	<0.001
	During Pandemic	14244 98.7% -6.6	160 1.1% 5.6	27 0.2% 3.9	14431	
MBD	Before Pandemic	4418 99.6% 2.5	15 0.3% -0.7	1 0% -3.5	4434	0.002
	During Pandemic	2900 99.2% -2.5	13 0.4% 0.7	10 0.3% 3.5	2923	
DE	Before Pandemic	3288 99.9% 0.3	3 0.1% -0.3		3291	1.00
	During Pandemic	2524 99.9% -0.3	3 0.1% 0.3		2527	
EEAP	Before Pandemic	3786 98.2% 0.7	65 1.7% -0.2	6 0.2% -1.4	3857	0.38
	During Pandemic	3514 97.9% -0.7	63 1.8% 0.2	11 0.3% 1.4	3588	

The threshold for statistical significance was $p < 0.05$. N: Number of patients

See at Appendix for URS, SIS, NS, T, CS, ES, US, GP, ID, EE, ERP, LRS, MBD, MCT, DE, EEAP

DISCUSSION

The three hypotheses established in the study, which intended to evaluate the effect of the pandemic on ED visits and to compare the outcomes of ED visits, were all rejected. This was one of the few studies designed to associate the reasons for visiting the ED (classified according to the ICD-10 groups) with hospital outcomes, and significant results were found. Medical admissions fell dramatically with the spread of COVID-19 in March and April 2020. Subsequent surveys sampling patient behavior indicated fears surrounding COVID-19 as a valid reason for this avoidance and delay in seeking care, with up to 12% avoiding urgent or emergency care (5). Several studies have shown that pandemic-related infection-independent effects (myocardial infarction and ischemic stroke) have led to a massive reduction in patient visits to healthcare facilities for non-COVID-19 concerns (6). Santana et al. reported that the total number of ED visits within a month (March 2020) during the COVID-19 outbreak significantly decreased by 48% (7). In a single-center report of an urban hospital in the United States, Westgard et al. reported a 35% decline in ED visits compared with the previous year (2019) (8). In another study, the number of ED visits was found to have been reduced by 30.9% in 2020 compared to 2019 (9). Hendrikse et al. (10) ascertained a 15% decrease in the number of ED visits in 2020 compared to the previous year, and a 35% decrease in the period after the full lockdown compared to the previous period. In the study by Birkmeyer et al., which examined approximately one million medical visits, it was found that the hospital admissions decreased dramatically with the onset of the COVID-19 pandemic, and that these reductions exceeded 20% for all primary admission diagnoses (5). In this study, similar to the aforementioned studies, a 26% reduction in ED patient volumes was observed in the study hospital during the COVID-19 pandemic.

Jeffery et al., in their cross-sectional study of 24 EDs in five healthcare systems in the USA (Colorado, Connecticut, Massachusetts, New York, and North Carolina), observed a rapid decline in ED visits in March 2020 (41.5% in Colorado; 63% in New York). They reported that the rates of admission from the ED remained stable until an increase in the number of COVID-19 cases was found locally, followed by a relative increase of 22–149% in the subsequent periods (1). Giamello et al. reported a 50%

decrease in the number of ED visits in Italy during the pandemic compared to the previous year, but an 11% and 21% increase in admissions depending on the time (11). In this study, as in the aforementioned studies, a decrease in the number of ED visits and an increase in the frequency of admission and referral were observed during the pandemic.

Kansagra et al. stated that the acute stroke cases declined by 39% during the pandemic (12). Bulrich et al. reported that although the number of stroke cases decreased by 20% in 2020 compared to 2019, the number of admissions did not change (13). In this study, there was an increase in the number of hospital admissions (due to the increase in the number of patients who came with more severe conditions) and a decrease of approximately 41% in the neurological diagnosis group.

Erol et al. stated that there was a 47.1% decrease in acute myocardial infarction (AMI) admissions during the pandemic, and the hospital admission process was prolonged for ST-segment-elevation myocardial infarction (STEMI) and non-STEMI (14). Kuitunen et al. reported that the number of ED visits declined by 16% and the number of admissions, by 15%, in the 6-week timeframe before and after the lockdown while the rates of AMI and stroke remained stable (15). In our study, the ED visits decreased but the hospital admission rate in the NS group and the admission and referral rates in the CS group increased. These differences may have been related to the duration of the studies. Similar to the results of the study by Giamello et al. (11), who found a decrease in the admission rates of patients with trauma, acute coronary syndrome, heart failure, and stroke, a decrease in ED visits was observed in the trauma, acute coronary syndrome, heart failure, and stroke groups in our study. It is thought that the curfews and the fear of infection risk by the patients were the reasons for the decreases in admission rates in the aforementioned study.

In a study conducted in France, it was determined that there was a 15% decrease in trauma patients during the pandemic's lockdown period (16). Nunez et al. reported that although there were significant reductions in the ED visit and hospital admission rates due to occupational accidents, traffic accidents, and other trauma causes during the pandemic, the osteoporotic hip fracture visits remained stable (17). In our study, a 37% decrease in the

number of outpatient trauma patients and an increase in the admission and referral rates were observed. It is thought that these were due to the unprecedented level of quarantine and travel ban that the Turkish government had implemented during the pandemic, as in many other countries in the world.

Gonçalves-Pinho et al. reported that there was a 52.2% decrease in the ED admission rate due to psychiatric conditions during the pandemic (18). Capuzzi et al. reported that the number of hospital admissions was higher despite this decrease, which they found to be similar to the results of other studies (19). Our results showed a decrease in the number of ED visits and an increase in the number of referrals for admission, which are in line with the results of both the aforementioned studies. This is justified by the fact that the referral outcomes during the pandemic were higher than expected, and can also be explained by the fact that the study hospital does not have inpatient service, thus referring the patients to other institutions for admission.

Cano-Valderrama et al. found a 58.9% decrease in the ED visits of patients with acute abdomen complaints, and that the admission period was prolonged (20). Similarly, the increase in admission rate in the present study may have been due to the late patient admissions.

In another study conducted in Italy, Morello et al. reported a 66.4% decrease in ED visit rates after the first wave of the pandemic, and a 23.5% decrease in the following periods. They also reported that the rate of admissions decreased by 39.5% at the beginning of the pandemic and by 12.2% in the following periods. In their study, the oncological, metabolic, endocrine, and hematological diagnosis rates were reported as unchanged and significant reductions in other diagnoses (infectious, psychiatric, non-COVID-19 respiratory, gastrointestinal, urological, obstetrical/gynecological diseases, and trauma) in the following periods were also reported. Again, in such study, the decline in non-emergency codes was evaluated as an indicator of the inappropriate use of the ED (21). In the present study, the increases in admission and referral rates, in addition to the decreases in ED visits for all the diagnostic groups, support the perspective that the emergency service was used inappropriately. Also,

Morello et al. reported that there were less differences between the diagnostic groups in the centers where the patients were referred due to service limitations. This might explain why the aforementioned findings differed from those in our study.

While Carret et al. (22) stated that the rate of inappropriate use of emergency services varies between 20% and 40%, this rate is reported as 9.6% in Singapore, 11.7% in England, and 19.6% in Italy (23–25). The inappropriate use of the ED leads to adverse consequences for patients, staff, and the health system (26). In an article published by the American College of Emergency Physicians, the situations caused by the inappropriate use of the ED were listed as follows: examination of patients and their families in areas not considered suitable for their privacy, increased mortality and morbidity, longer admission period of admitted patients, decreased patient satisfaction, decreased satisfaction of emergency service personnel, significant delay in the evaluation and treatment of emergency conditions, patients leaving before the treatment completion, and increased cost and loss of reputation of the institution (27). The fact that there were no differences between the US, EE, ERP, DE, and EEAP groups in terms of numbers of outpatient visits, admissions, and referrals without the effect of the pandemic showed that the patients in these groups used the emergency services appropriately, as opposed to the other groups. Only the decrease in hospital admissions of the T group may be considered normal due to the curfews that were imposed at certain times in Turkey.

During the COVID-19 pandemic, temporal associations between decrease in ED visits and increase in hospital admission rates were observed. These findings suggest that practitioners and public health officials should emphasize the importance of visiting the ED during the COVID-19 pandemic for serious symptoms, illnesses, and injuries that cannot be managed in other settings.

There has been a decrease in the number of ED visits during the pandemic, and late patient admission may lead to conditions with a more severe clinical course and may increase hospital admissions. Additionally, emergency services have also been used inappropriately, except for certain clinics. Healthcare authorities should consider taking the necessary precautions by paying attention to these matters during a pandemic.

Moreover, while non-emergency patients are praised for not visiting the ED, for those with conditions such as chest pain, neurological symptoms, and shortness of breath, which worsen with time, a delayed ED visit can lead to serious complications. It is important to raise patients' awareness of the acute conditions that require immediate medical attention to prevent potentially fatal situations.

Study Limitations

The present study had some limitations, including the fact that the age, sex, and other sociodemographic characteristics, and the comorbidities, of the patients who visited the ED and of those who were hospitalized were not studied. This study was a retrospective study that utilized aggregated health data from the health data management solution system. There may have been errors caused by the user physician, and the accuracy of the electronic records was not confirmed. In addition, the findings of the study cannot be generalized as the study was conducted in a single center.

Funding sources

This research did not receive any specific grant from any funding agency in the public, commercial, or not-for-profit sector.

Declaration of Interest

The authors have no potential conflicts of interest to declare.

This study was approved by the Attending Physician of Emergency Medicine, Division of Emergency Medicine, Odemiş State Hospital, Izmir, Turkey (Date 14.01.2022, Decision Number 2021/78-/6).

Appendix

1. Upper Respiratory System (URS): J00, J02, J03, R05, R52, R53
2. Lower Respiratory System (LRS): J18, J22, J44, J45.9
3. Stomach and Intestinal System (SIS): R10, R10.4, R11, R14, K21, K29, K30, K52, K92.2
4. Nervous System (NS): I69, R42, R55, G43.9, R51
5. Trauma (T): W01, W19, W45, V29, V49, S61, S00, S01.3, S01, S51, S41, S50, S60, S63, S90, S93, T15, Y28
6. Circulatory System (CS): I10, I20, I21, I21.0, I21.1, I21.2, I21.3, I21.4, I21.9, I46, I48, I50.9, R00, R00.0, R00.2, R07.4
7. Endocrine System (ES): D64, D68, E10, E11
8. Urinary System (US): N22, N23, N30, N39.0

9. Gynecology and Pregnancy (GP): N94.6, O26, Z32, Z33
10. Infectious Diseases (ID): A09, K52.9, L08, R50, R50.9, Z23.5
11. Environmental Emergencies (EE): L50, W54, W55, X22, X23, X44
12. Ear and Respiratory Passage (ERP): H60, H65.0, J30.3, R04.0
13. Mental and Behavioral Disorders (MBD): F23.2, F33, F41, F41.0, F41.1, F41.2, F41.3, F41.8, F41.9
14. Muscular System and Connective Tissues (MCT): M54.4, M79, M79.7
15. Diseases of the Eye (DE): H10
16. Examination and Encounter for Administrative Purposes (EEAP): Z02

REFERENCES

1. Jeffery MM, D'Onofrio G, Paek H, Platts-Mills TF, Soares WE 3rd, Hoppe JA, et al. Trends in Emergency Department Visits and Hospital Admissions in Health Care Systems in 5 States in the First Months of the COVID-19 Pandemic in the US. *JAMA Intern Med.* 2020;180(10):1328-1333.
2. Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Emergency department visits for nonurgent conditions: systematic literature review. *Am J Manag Care.* 2013;19(1):47-59.
3. Durand AC, Gentile S, Devictor B, Palazzolo S, Vignally P, Gerbeaux P, et al. ED patients: how nonurgent are they? Systematic review of the emergency medicine literature. *Am J Emerg Med.* 2011;29(3):333-45.
4. Everitt BS. *The analysis of contingency tables.* 2nd ed. Chapman and Hall/CRC; 1992.
5. Birkmeyer JD, Barnato A, Birkmeyer N, Bessler R, Skinner J. The Impact Of The COVID-19 Pandemic On Hospital Admissions In The United States. *Health Aff (Millwood).* 2020;39(11):2010-2017.
6. Alwood S, Musso MW, Jones GN, Mosley J, Wippel B, Theriot L, et al. The impact of the COVID-19 pandemic and governor mandated stay at home order on emergency department super utilizers. *Am J Emerg Med.* 2021;48:114-119.
7. Santana R, Sousa JS, Soares P, Lopes S, Boto P, Rocha JV. The Demand for Hospital Emergency Services: Trends during the First Month of COVID-19 Response. *Port J Public Health* 2020;38:30-6.
8. Westgard BC, Morgan MW, Vazquez-Benitez G, Erickson LO, Zwank MD. An Analysis of Changes in Emergency Department Visits After a State Declaration During the Time of COVID-19. *Ann Emerg Med.* 2020;76(5):595-601.
9. Baugh JJ, White BA, McEvoy D, Yun BJ, Brown DFM, Raja AS, Dutta S. The cases not seen: Patterns of emergency department visits and procedures in the era of COVID-19. *Am J Emerg Med* 2021;46:476-481.
10. Hendrikse C, Parak M, Van Hoving DJ. A descriptive analysis of the effect of the national COVID-19 lockdown on the workload and case mix of patients presenting to a district-level emergency centre in Cape Town, South Africa. *S Afr Med J.* 2020;110(11):113-18.
11. Giamello JD, Abram S, Bernardi S, Lauria G. The emergency department in the COVID-19 era. Who are we missing? *Eur J Emerg Med.* 2020;27(4):305-06.
12. Kansagra AP, Goyal MS, Hamilton S, Albers GW. Collateral Effect of Covid-19 on Stroke Evaluation in the United States. *N Engl J Med.* 2020;383(4):400-401.

13. Bres Bullrich M, Fridman S, Mandzia JL, Mai LM, Khaw A, Vargas Gonzalez JC, et al. COVID-19: Stroke Admissions, Emergency Department Visits, and Prevention Clinic Referrals. *Can J Neurol Sci.* 2020;47(5):693-696.
14. Erol MK, Kayıkçıoğlu M, Kılıçkap M, Güler A, Yıldırım A, Kahraman F, et al. Treatment delays and in-hospital outcomes in acute myocardial infarction during the COVID-19 pandemic: A nationwide study. *Anatol J Cardiol.* 2020;24(5):334-342.
15. Kuitunen I, Ponkilainen VT, Launonen AP, Reito A, Hevonkorpi TP, Paloneva J, et al. The effect of national lockdown due to COVID-19 on emergency department visits. *Scand J Trauma Resusc Emerg Med.* 2020;28(1):114.
16. Moyer JD, Abback PS, Hamada S, Martinez T, Werner M, James A, Traumabase®Group. Effect of 2020 containment strategies on trauma workflow in Ile-de-France region: another benefit of lockdown? *Scand J Trauma Resusc Emerg Med.* 2021;29(1):135.
17. Nuñez JH, Sallent A, Lakhani K, Guerra-Farfan E, Vidal N, Ekhtiari S, et al. Impact of the COVID-19 Pandemic on an Emergency Traumatology Service: Experience at a Tertiary Trauma Centre in Spain. *Injury.* 2020;51(7):1414-1418.
18. Gonçalves-Pinho M, Mota P, Ribeiro J, Macedo S, Freitas A. The impact of COVID-19 pandemic on psychiatric emergency department visits - a descriptive study. *Psychiatr Q.* 2021;92(2):621-631.
19. Capuzzi E, Di Brita C, Caldiroli A, Colmegna F, Nava R, Buoli M, et al. Psychiatric emergency care during Coronavirus 2019 (COVID 19) pandemic lockdown: results from a Department of Mental Health and Addiction of northern Italy. *Psychiatry Res.* 2020;293:113463.
20. Cano-Valderrama O, Morales X, Ferrigni CJ, Martín-Antona E, Turrado V, García A, et al. Reduction in emergency surgery activity during COVID-19 pandemic in three Spanish hospitals. *Br J Surg.* 2020;107(8):e239.
21. Morello F, Bima P, Ferreri E, Chiarlo M, Balzaretto P, Tirabassi G, et al. After the first wave and beyond lockdown: long-lasting changes in emergency department visit number, characteristics, diagnoses, and hospital admissions. *Intern Emerg Med.* 2021;16(6):1683-1690.
22. Carret ML, Fassa AC, Domingues MR. Inappropriate use of emergency services: a systematic review of prevalence and associated factors. *Cad Saude Publica* 2009;25(1):7-28.
23. Oh HC, Chow WL, Gao Y, Tiah L, Goh SH, Mohan T. Factors associated with inappropriate attendances at the emergency department of a tertiary hospital in Singapore. *Singapore Med J* 2020;61(2):75-80.
24. McHale P, Wood S, Hughes K, Bellis MA, Demnitz U, Wyke, S. Who uses emergency departments inappropriately and when - a national cross-sectional study using a monitoring data system. *BMC Medicine* 2013;11:258.
25. Bianco A, Pileggi C, Angelillo IF. Non-urgent visits to a hospital emergency department in Italy. *Public Health.* 2003;117(4):250-5.
26. Morley C, Unwin M, Peterson GM, Stankovich J, Kinsman L. Emergency department crowding: A systematic review of causes, consequences and solutions. *PLoS One* 2018 30;13(8):1-42.
27. American College of Emergency Physicians. Crowding. 2019. Available at <https://www.acep.org/patient-care/policy-statements/crowding/> Accessed September 25, 2021.