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Effects of COVID-19 lockdown strategies on emergency medical services

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ABSTRACT

Introduction: The aim of this study is to evaluate the change in the number of EMS cases by comparing the lockdown period, the non-lockdown period, and the pre-pandemic period.
Methods: In our study, 3 periods of EMS cases were compared to evaluate the effect of lockdown. The first period (Period A) included in the study was the lockdown period (01-12-2020 and 31–01–2021. The second period (period B) is the period between 01 and 10-2020 and 30–11–2020, where there was no lockdown despite the pandemic. The third period (period C) in the study is the period between 01 and 12-2019 and 31–01–2020 before the pandemic.
Results: A total of 120,989 cases in 3 periods were included in the study. It was determined that the highest number of patients were in period C (42,703, 35.3%), while the least was in period A (39,054, 32.2%). On the other hand, it was found that the number of calls was highest in period A (246,200, 35.1%), while the least was in period C (212,267, 30.2%). Response times were longer in the pandemic period than in the pre-pandemic period. Mean talk time were longer during the pandemic period. The most frequent diagnosis in period A (21.6%) and B (42.2%) was COVID-19. The second most frequent disease group in these two periods was cardiovascular diseases.
Conclusion: While the number of EMS cases decreased during the pandemic period, it decreased even more during the lockdown period. However, the number of calls increased significantly during the lockdown period, and the response times and talk times increased accordingly.

1. Introduction

Coronavirus 2019 (COVID-19), which first emerged as viral pneumonia cases of unknown etiology in Wuhan, China, at the end of 2019, has become a pandemic that has affected the whole world over time [1,2]. The clinic presentation of the disease ranges from asymptomatic patients to very severe cases of pneumonia with acute respiratory distress syndrome, septic shock, and multiorgan failure, which may result in death [3]. From the date of the first case to October 2021, there have been 238,521,855 confirmed cases of COVID-19, including 4,863,818 deaths [4].

Human-to-human transmission of the disease [5] and the fact that it became a worldwide pandemic in a short time forced governments to take certain measures. These measures have included lockdowns, partial or complete closures of schools and businesses, quarantines in certain geographic areas, and restrictions on international travel [6]. For example, the Italian government enforced a severe nationwide lockdown after the number of confirmed cases of COVID-19 exceeded 35,000 and deaths due to COVID-19 exceeded 3000 [7]. In Turkey, after December 1, 2020, lockdown was applied on weeknights (from 21:00 to 05:00 every day) and weekends (from 21:00 on Friday to 05:00 on Monday).

Dey et al., in their study, evaluated lockdown-induced altered sleep/wake circadian rhythms, health complaints, and stress within the scope of COVID-19 measures [6]. In a study by Loewenthal et al., it was found that the duration of the lockdown was more important than the degree of application in terms of effectiveness [7]. Although there are studies in the literature on the effects of the national lockdown in Turkey, there is no study on its effect on emergency medical services (EMS). Therefore, the aim of this study is to evaluate the change in the number of EMS cases by comparing the lockdown period of the pandemic, the non-lockdown period of the pandemic, and the pre-pandemic period.

2. Material and methods

This study was designed to evaluate Ankara EMS cases retrospectively. The study started with a total of 121,184 cases. However, 195 cases were excluded due to incomplete information in the database

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and the study was completed with 120,989 cases. This study was approved by the Non-Invasive Ethics Committee of the Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital (Number: 2021–03/1060).

The Government of the Republic of Turkey, within the scope of COVID-19 measures, applied a partial national lockdown on weeknights (from 21:00 to 05:00 every day) and weekends (from 21:00 on Friday to 05:00 on Monday) from December 1, 2020. A continuous lockdown was applied for individuals <18 years old and > 65 years old.

In Turkey, EMS is provided as a free-of-charge public service by the Ministry of Health throughout the country that includes land, air, and sea ambulance services. These ambulance services are offered independently of the fire, police, and gendarmerie services. Only the call number is common with the fire, police, and gendarmerie services which are 1–1-2. Incoming calls to 1–1-2 are evaluated by the recipients and directed to the institution that concerns them. Each institution has its own separate administrative functioning under different ministries.

In our study, EMS cases from three periods were compared to evaluate lockdown effects. The first period (Period A) included in the study was the lockdown period between December 1, 2019, and January 31, 2020, before the pandemic. The second period (Period B) was the period between October 1, 2020, and November 30, 2020, when there was no lockdown despite the pandemic. It was aimed to evaluate differences due to lockdown effects between the first period and the second period. The third period (Period A) in the study was the period between December 1, 2020, and January 31, 2021. In Period A, it was evaluated whether there was a significant difference between lockdown hours (weeknights from 21:00 to 05:00 every day and weekends from 21:00 on Friday to 05:00 on Monday) and lockdown-free hours in terms of the number of EMS cases. For this period, we included all the cases that Ankara EMS assigned an ambulance, except for the patients whose data is missing in the ASOS Database. Our aim for this period was to compare the numbers of cases in the pre-pandemic period and the pandemic period.

The data of the study were obtained from the ASOS Database, created by the Turkish Ministry of Health to record EMS cases. Data on the numbers, ages, genders, and pre-diagnoses of patients were retrieved from the ASOS Database together with the number of calls, dispatcher response times, talk times per case, and times to arrival at the scene. We did not create a data entry form for the study. We filtered the data was from ASOS Database retrospectively.

2.1. Statistical analysis

All data were analyzed using IBM SPSS 25.0 for Windows (IBM Corp., Armonk, NY, USA). In addition to descriptive statistics (frequency, percentage, mean, standard deviation), the chi-square (χ^2) test was used to compare qualitative data. The compliance of the data to normal distribution was evaluated by Kolmogorov-Smirnov test, skewness-kurtosis, and graphical methods (histogram, Q-Q plot, stem and leaf plot, boxplot). The independent samples *t*-test and one-way analysis of variance (ANOVA) were used to evaluate quantitative data compatible with normal distribution. When there was a difference in multiple comparisons, the post hoc Tukey HSD test was used to find the cause of the difference. Statistical significance was accepted as $\alpha = 0.05$.

3. Results

A total of 120,989 cases in 3 periods [Period A: 42,703 (35.3%), Period B: 39,232 (32.4%), Period C: 39,054 (32.3%)] were included in the study. Of all patients, 60,626 (50.1%) were men. While the mean age of female patients was 52.4 ± 24.7 years, it was 49.4 ± 23.6 years for male patients (Table 1).

Considering the number of cases in the considered periods, it was determined that the highest number of patients was seen in Period A (42,703, 35.3%), while the lowest number was seen in Period C (39,054, 32.2%). On the other hand, the number of calls was highest in Period C (246,200, 35.1%), while it was lowest in Period A (212,267, 30.2%). There was a statistically significant difference in terms of the number of cases and calls between lockdown hours (night:21:00–04:59) and lockdown-free hours (day:05:00–20:59) ($p < 0.001$). The highest number of calls in lockdown-free hours was seen in Period B (177,936), while the highest number of calls in lockdown hours was seen in Period C (74,643). The highest number of cases in lockdown-free hours was in Period A (31,074), while the highest number of cases in lockdown hours was in Period C (11,731) (Table 2). A graphic of the number of cases and calls by hours is given in Fig. 1.

Response times were longer in the pandemic period than in the pre-pandemic period ($p < 0.001$). Response times in lockdown-free hours in Period C (69.9 ± 39.4 s, $p < 0.001$) and Period B (80.2 ± 4.7 s, $p < 0.001$) were longer than in Period A (48.7 ± 24.1 s). The response times in lockdown hours were significantly longer in Period C (30.2 ± 15.0 s) compared to other periods ($p < 0.001$). Mean talk times (all day, in both lockdown hours and lockdown-free hours) were longer during the pandemic period (Periods C and B) than during Period A (Table 3).

Times to arrival at the scene were shorter in Period A [for the whole day (324.8 ± 156.9 s), for lockdown-free hours (332.4 ± 160.1 s), and for lockdown hours (304.8 ± 146.0 s)] than in the other periods. Times to arrival at the scene were longest in Period B. There was a statistically significant difference between all periods in terms of arrival times in both lockdown and lockdown-free hours. Arrival times were longer in Period B compared to other periods for both lockdown and lockdown-free hours (Table 3).

Considering the diagnoses of the patients, the most frequent diagnosis in both Period C (21.6%) and Period B (42.2%) was COVID-19. After the diagnosis of COVID-19, the second most frequent disease group in these two periods was cardiovascular disease (CVD). However, in Period A, the most frequent diagnosis group was CVD. CVD was most frequent in Period C (17.0%), while it was least frequent in Period B (10.3%). All other diagnoses were found to be most frequent in Period A (Table 4).

There was a statistically significant difference in terms of diagnoses between periods ($p < 0.001$). It was found that the rate of traffic accidents in Period C was lower than in other periods. There was a significant difference between the three periods in terms of all other diagnoses (Table 4).

Table 1
Gender and age data of the patients according to the periods.

		Period A	Period B	Period C	Total
Women	n (%)	21,511 (50.4%)	19,355 (49.3%)	19,497 (49.9%)	60,363 (49.9%)
Age (Years)*		51.7 ± 26.1	53.3 ± 23.5	52.4 ± 24.1	52.4 ± 24.7
Men	n (%)	21,192 (49.6%)	19,877 (50.7%)	19,557 (50.1%)	60,626 (50.1%)
Age (Years)*		48.0 ± 24.9	50.5 ± 22.7	49.9 ± 22.9	49.4 ± 23.6
All	n (%)**	42,703 (35.3%)	39,232 (32.4%)	39,054 (32.3%)	120,989 (100.0%)
Age (Years)*		49.9 ± 25.5	51.8 ± 23.2	51.1 ± 23.6	50.9 ± 24.2

* Mean ± SD.
** Percentage in row.

Table 2
Comparison of the number of cases, number of calls, response times, and talk times according to periods and hour intervals.

		Period A	Period B	Period C	Total	P	There is difference between the periods...
Number of Calls	Day[#]	158,047 (74.5%)	177,936 (73.2%)	171,557 (69.7%)	507,540 (72.4%)	**<0.001**[a]	A&B&C
	Night[##]	54,220 (25.5%)	65,015 (26.8%)	74,643 (30.3%)	193,878 (27.6%)	**<0.001**[a]	A&B&C
Total[*]		246,200 (35.1%)	242,951 (34.6%)	701,418 (100.0%)	212,267 (30.3%)		
Number Of Cases	Day[#]	31,074 (72.8%)	29,194 (74.4%)	27,323 (70.0%)	87,591 (72.4%)	**<0.001**[a]	A&B&C
	Night[##]	11,629 (27.2%)	10,038 (25.6%)	11,731 (30.0%)	33,398 (27.6%)	**<0.001**[a]	A&B&C
Total[*]		39,054 (32.3%)	39,232 (32.4%)	120,989 (100.0%)	42,703 (35.3%)		
Response time (in seconds)	Day[#]	48.7 ± 24.1	80.2 ± 4.7	69.9 ± 39.4	66.2 ± 29.8	**<0.001**[b]	C & A,B
	Night[##]	6.5 ± 2.7	3.9 ± 3.6	30.2 ± 15.0	13.6 ± 14.9	**<0.001**[b]	A & B,C
Total		50,1 ± 35,7	42,1 ± 38,5	39,9 ± 35,3	27,6 ± 27,2	**<0,000**[b]	C & A,B
Talk Time (in seconds)	Day[#]	45.0 ± 6.5	57.9 ± 8.7	58.5 ± 5.7	53.8 ± 9.4	**<0.001**[b]	C & A,B
	Night[##]	49.8 ± 8.1	59.6 ± 6.9	61.7 ± 7.3	57.0 ± 9.1	**<0.001**[b]	C & A,B
Total		60.1 ± 6.7	58.8 ± 7.9	55.4 ± 9.4	47.4 ± 7.7	**<0.001**[b]	C & A,B

[a] Chi-Square Test.
[b] One-Way Anova Test (Post-Hoc: Tukey).
[*] Percentage in row.
[#] 05:00–20:59.
[##] 21:00–04:59.

4. Discussion

The rapid spread of COVID-19 all over the world forced all countries to take measures to control the disease. Turkey likewise declared a partial lockdown to take control of the pandemic. In this study, it was found that the number of calls increased and response times were prolonged in Period C compared to Periods B and A. There was no difference between periods in terms of non-COVID-19 diagnoses. In addition, it was found that times to arrival at the scene were longer in Period B than in the other periods ($p < 0.001$).

According to the literature, the number of calls has increased both nationally and regionally in the COVID-19 pandemic [7]. In a study conducted in Italy, Perlini et al. reported that the number of emergency calls increased by 440% at the beginning of the pandemic [8]. In our study, parallel to the literature, the highest number of calls was seen in Period C (246,200, 35.1%) and the lowest in Period A (212,267, 30.2%). On the other hand, in our study, the number of cases assigned an ambulance was highest in Period A (42.703, 35.3%) and lowest in Period C (39,054, 32.2%). In a study by Şan et al., it was determined that the number of EMS cases increased by 9.8% at the beginning of the pandemic [9]. Müller et al. reported that the lockdown decreased the number of patients by 40% during the pandemic period [10]. In addition, it was reported that the number of emergency room admissions decreased during the pandemic period in studies conducted in both France (41.47%) and Finland (35.9%) [11,12]. Although the number of calls per case seems to have increased in our study, not all of these calls are emergency calls. We suggest that this increase in the number of calls during the pandemic period is due to the fact that both COVID-19 patients and non-patients have been contacting the emergency call center as an easy and accessible way to ask questions about COVID-19. Contrary to the increase in the number of calls, the decrease in the number of ambulance-assigned cases may be due to the establishment of mobile treatment teams caring for COVID-19 patients at home during the pandemic period. Following the increase in calls for consultation, we created a separate COVID-19 consultation call center with 60 staff members. Despite this consultation calls to the EMS Command and Control Center continued. Therefore, we established a separate subteam consisting of 8 personnel in the EMS Command and Control

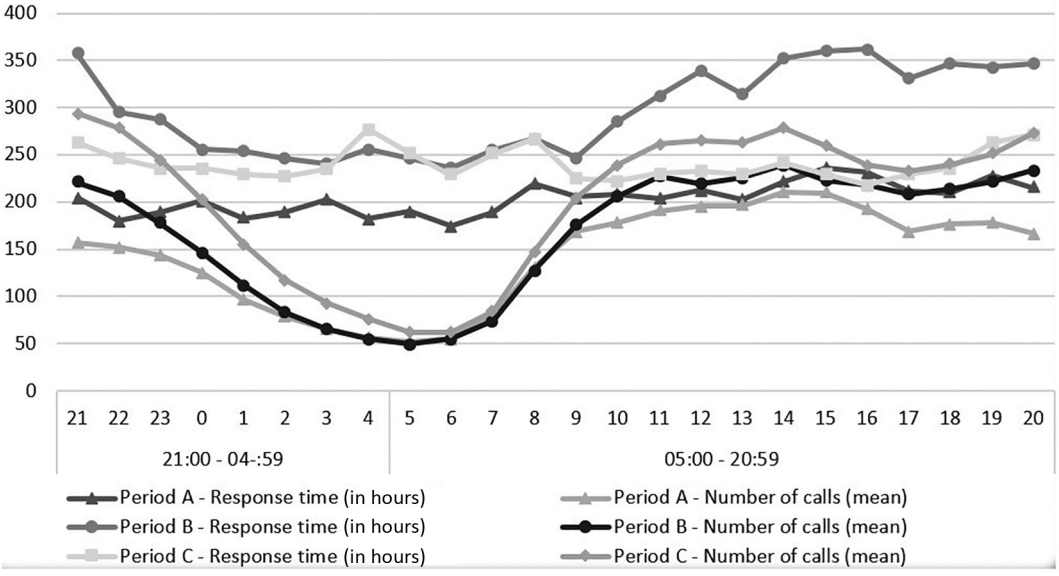

Fig. 1. Response times and number of calls by hours.

Table 3
Comparison of arrival times (seconds) according to periods and hour intervals (mean ± SD).

	Period A	Period B	Period C	Total	p*	There is difference between the periods...**
Day#	332.4 ± 160.1	379.7 ± 173.3	343.8 ± 159.6	351.4 ± 165.6	**<0.001**	A&B&C
Night##	304.8 ± 146.0	350.0 ± 160.2	331.5 ± 151.1	327.6 ± 153.2	**<0.001**	A&B&C
Total	**324.8 ± 156.9**	**371.9 ± 170.5**	**340.1 ± 157.2**	**344.7 ± 162.6**	**<0.001**	A&B&C
P* **	**<0.001**	**<0.001**	**<0.001**	**<0.001**		

* One-Way ANOVA.
** Post-Hoc: Tukey Test.
*** Independent Samples t-Test.
# 05:00–20:59.
21:00–04:59.

Center. This team responded to the consultation calls. In this way, we separated calls for advice from emergencies. Thus, our response time to emergency calls was shortened. In addition, patients' avoidance of applying to emergency services due to the risk of transmission of COVID-19 and patients not applying to EMS in relatively non-urgent cases may also have caused this.

In a study by Jensen et al., considering the number of EMS cases by hours, it was found that most occurred between 07:00 and 22:59 h [13]. Similarly, in our study, 72.4% of the cases were between 05:00 and 20:59. In our study, it was also seen that the number of cases occurring within lockdown hours was significantly higher in Period C compared to the other periods. This may be due to the fact that the patients could not go to the hospital with their own vehicles without being stopped due to the lockdown and thus preferred to go by ambulance.

In a study conducted in Denmark, it was found that the response time, which was an average of 2 min and 23 s before the pandemic, increased to an average of 12 min and 2 s during the pandemic [13]. In a study by Lim et al. evaluating cardiac arrest cases during the COVID-19 period, it was found that the EMS response time increased compared to the pre-pandemic period [14]. In our study, the response time increased significantly during the pandemic period, in line with the literature. During the pandemic period, there was no overall statistical difference in response times between Period C with lockdown and Period B without lockdown. However, response times during the lockdown hours (night:21:00–04:59) were found to be significantly longer in Period C (30.2 ± 15.0 s) compared to other periods ($p < 0.001$).

In a study conducted in Iran, talk time decreased by 20% during the pandemic period compared to the pre-pandemic period [15]. In our study, however, there was an increase in phone talk time during the pandemic period compared to the pre-pandemic period. During the pandemic period, there was no statistical difference in talk time between Period C with lockdown and Period B without lockdown. We suggest that this increase in talk time during the pandemic period is due to the increase in the number of cases. Another reason for this may be that patients have been contacting the EMS call center to consult on their health problems during the pandemic period.

In Tijuana, Mexico, the time to arrival at the scene was 16.4 min in the pre-pandemic period (2019), while it was 20.5 min during the pandemic period (2020). Similarly, the time to arrival at the scene was extended from 6.5 min to 9.5 min in Manhattan, New York City, and to 11 min in the Bronx [16]. In our study, similar to the literature, the arrival time increased during the pandemic period (Period B: 371.9 ± 170.5 s, Period C: 340.1 ± 157.2 s) compared to the pre-pandemic Period A (324.8 ± 156.9 s). We suggest that the shorter arrival times in Period C compared to Period B were due to reduced traffic density because of the lockdown.

Jaffe et al. reported that EMS calls during the pandemic period were most frequently due to COVID-19-related issues. In that study, it was also found that calls due to CVD decreased in frequency [17]. In another study, cardiac cases were seen to decrease during the pandemic lockdown period [18]. Other authors reported that CVD cases decreased by 45% during the pandemic period compared to the pre-pandemic period, while traffic accidents decreased by 47.7% and cerebrovascular diseases by 2.9% [9]. In our study, the numbers of CVD, cerebrovascular accident (CVA), and traffic accident cases decreased during the pandemic period (Period B) compared to the pre-pandemic period. We also found that the numbers of CVD and CVA cases were higher in Period B than in Period C. We suggest that this was due to the fact that patients generally used their own vehicles to apply to hospitals in Period B, while they preferred to be transferred to the hospital by ambulance due to lockdown in Period C. In addition, the period with the lowest number of traffic accident cases in our study was Period C. This was likely due to reduced traffic density due to the lockdown.

4.1. Limitations

The most important limitation of our study is that it covers only 2 months of the lockdown period. Conducting a similar study over a longer period of time would produce clearer results. There may be various covariates in our study, such as weather conditions, rural cases, which affect the number of calls and cases, but we could not evaluate them because these data were not available in our database. In addition, we

Table 4
Comparison of diagnoses.

	Period A	Period B	Period C	Total	P*	There is difference between the periods...
2019-nCOV	–	16,562 (42.2%)	8454 (21.6%)	25,016 (20.7%)	**<0.001**	A&B
Cardiovascular System Diseases	6643 (15.6%)	4027 (10.3%)	6632 (17.0%)	17,302 (14.3%)	**<0.001**	A&B&C
Cerebrovascular, Neurological and Neuromuscular Diseases	5348 (12.5%)	2752 (7.0%)	3769 (9.7%)	11,869 (9.8%)	**<0.001**	A&B&C
Gastrointestinal System Diseases	4682 (11.0%)	2406 (6.1%)	3612 (9.2%)	10,700 (8.8%)	**<0.001**	A&B&C
Falls	3777 (8.8%)	2264 (5.8%)	2646 (6.8%)	8687 (7.2%)	**<0.001**	A&B&C
Respiratory System Diseases	4826 (11.3%)	1376 (3.5%)	1828 (4.7%)	8030 (6.6%)	**<0.001**	A&B&C
Traffic accidents	2463 (5.8%)	2260 (5.8%)	1626 (4.2%)	6349 (5.2%)	**<0.001**	A & B,C
Mood Disorders and Neuropsychiatric Diseases	1907 (4.5%)	972 (2.5%)	1472 (3.8%)	4351 (3.6%)	**<0.001**	A&B&C
Others	13,057 (30.6%)	6613 (16.9%)	9015 (23.1%)	28,685 (23.7%)	**<0.001**	A&B&C

* Chi-Square Test (n / %).

could not obtain data for patients waiting in the call queue during the increasing call density. Furthermore, we could not evaluate the effects of lockdown on the prognosis of the patients. It would be worthwhile to evaluate lockdown effects from this perspective in future studies.

5. Conclusion

While the COVID-19 pandemic has put an extra burden on the overall health system, it has also seriously affected EMS operations. While the number of EMS cases decreased during the pandemic period, it decreased even more during the lockdown period. However, the number of calls increased significantly during the lockdown period, and the response times and talk times increased accordingly. Therefore, measures such as preparing EMS for extraordinary conditions, training personnel in this regard, and establishing a new call center for only COVID-19 will facilitate access to ambulance services.

CRediT authorship contribution statement

Burak Bekgöz: Writing – review & editing, Writing – original draft. **Ebru Erek Kazan:** Methodology, Data curation. **Ahmet Fatih Kahaman:** Writing – original draft, Methodology. **İshak Şan:** Formal analysis.

Declaration of Competing Interest

None.

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