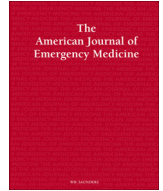




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# Impact of COVID-19 pandemic on visits of an urban emergency department

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## ABSTRACT

**Objective:** The aim of this study was to reveal how the pandemic process affected the number of ED visits and the reasons for application.

**Methods:** The daily number of ED visits during the pandemic were analyzed in 3 different periods; prepandemic period (February 1st to March 11th, declaration of the first COVID-19 case in Turkey), early pandemic period (March 12th to May 31st, period of strict measures), and late pandemic period (June 1st to July 31st, period of new norms). The pandemic periods were compared with the same timeframes in 2019 (comparison periods). Demographic variables and complaints of the patients on admission were investigated.

**Results:** The total number of ED visits in the study period in 2020 was 78,907, which was only the half of the applications in the same period in 2019 (n: 149,387). Data showed a sharp decrease at the number of daily visits to green and yellow zones after the announcement of the first case however red zone applications were more than twice that of the previous year. During pandemic nonspecific complaints was decreased and there was an increase at the percentages of respiratory, cardiac, and neurological complaints.

**Conclusion:** Number of ED visits during the pandemic were decreased by half when compared to the previous year. It was an advantage of the pandemic to decrease ED visits due to “nonemergent” complaints, and thus, unnecessary patient burden. However, on the other hand, patients avoided seeking medical attention, even for life-threatening conditions which led to increased mortality and morbidity.

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## 1. Introduction

COVID-19 is a novel coronavirus with high infectivity and mortality that might cause severe respiratory complaints [1]. The virus spread around the world in a short period of time after emerging in the Wuhan Province of China on December 2019 and the World Health Organization (WHO) declared COVID-19 a pandemic on March 11th, 2020 [2]. In the United States and most European countries, the patient burden caused by the virus overwhelmed the local health care systems and the capacities of hospitals were exceeded [3].

Turkey, with high emergency department (ED) demand and overcrowded EDs, is a country whose annual number of ED visits is greater than the whole population [4]. After announcement of the first coronavirus case in Turkey on March 11th, measures such as the termination of international flights, closing of schools, closing of all public gathering places, and curfews for special age groups and metropolitan municipalities were taken by the government to prevent the spread of the disease [5]. Health system measures, such as coronavirus pandemic hospitals, postponement of elective surgeries, and banning healthcare workers

from leaving their posts, were announced [5]. No collapse of the health system was observed Turkey during this period. In fact, clinical experience suggested the patient burden at EDs was below the prepandemic period. As of June, the restrictions began ease throughout the country and daily life continued under “new norms”, including enhanced hygiene measures, the use of masks, and social distancing.

The aim of this study was to reveal how the pandemic process affected the profile of the patients admitted to the ED. During the prepandemic, early pandemic, and late pandemic periods, changes in the number of ED visits and the reasons for application were examined.

## 2. Methods

This was a retrospective observational study conducted in an urban hospital in the capital city with the approval of the Institutional Review Board. The hospital covered a catchment area of more than 650,000 inhabitants and had 335,000 annual ED visits in 2019. The daily number of ED visits during the pandemic were analyzed in 3 different periods, comprising the prepandemic period (February 1st to March 11th, declaration of the first COVID-19 case in Turkey), early pandemic period (March 12th to May 31st, period of strict measures), and late pandemic period (June 1st to July 31st, period of new norms). To quantify the

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**Table 1**

Number of ED visits to green, yellow and red zones at pre-pandemic, early pandemic, late pandemic and comparison periods.

| Time period                               | Number of ED visits | Total number of ED visits | Number of ED visits to Green zone | Number of ED visits to Yellow zone | Number of ED visits to Red zone |
|---|---------------------|---------------------------|-----------------------------------|------------------------------------|---------------------------------|
| In general                                |                     |                           |                                   |                                    |                                 |
| 2020                                      |                     | 78,907                    | 62,836                            | 15,721                             | 350                             |
| 2019 comparison                           |                     | 149,389                   | 119,678                           | 29,540                             | 171                             |
| Δn  |                     | %47.2 ↓                   | %47.5 ↓                           | %46.7 ↓                            | %104.6 ↑                        |
| Pre-pandemic period (1st Feb-11th Mar)    |                     |                           |                                   |                                    |                                 |
| 2020                                      |                     | 35,515                    | 29,478                            | 5875                               | 162                             |
| 2019 comparison                           |                     | 31,413                    | 24,420                            | 6943                               | 50                              |
| Δn  |                     | %13 ↑                     | %20.7 ↑                           | %15.3 ↓                            | %224 ↑                          |
| Early-pandemic period (12th Mar-31st May) |                     |                           |                                   |                                    |                                 |
| 2020                                      |                     | 23,466                    | 18,365                            | 4988                               | 113                             |
| 2019 comparison                           |                     | 66,133                    | 53,257                            | 12,800                             | 76                              |
| Δn  |                     | %64.5 ↓                   | %65.5 ↓                           | %61 ↓                              | %48.6 ↑                         |
| Late-pandemic period (1st Jun-31st Jul)   |                     |                           |                                   |                                    |                                 |
| 2020                                      |                     | 19,926                    | 14,993                            | 4858                               | 75                              |
| 2019 comparison                           |                     | 51,843                    | 42,001                            | 9797                               | 45                              |
| Δn  |                     | %61.5 ↓                   | %64.3 ↓                           | %50.4 ↓                            | %66.6 ↑                         |

Abb: ED: emergency department, Δn: 2020–2019.

effect of COVID-19 on ED visits, the pandemic periods were compared with the same timeframes in 2019 (comparison periods).

Any patients admitted to the ED for any reason at those time periods were included in the study. If the same patient visited the ED 2 or more times, each clinical visit was counted separately. Any patient who presented to our ED was evaluated by a registered nurse who recorded the chief complaint, obtained a brief history, recorded vital signs and assigned a triage category based on the Turkish Republic Ministry of Health Triage rules. Priority for treatment are defined with colors in this rules as, “red” for immediate, “yellow” for delayed, “green” for minor. After examination, laboratory and imaging studies (if necessary) and follow up, final diagnosis of the patient was recorded to the hospital data registration system by physicians. Since official registration is required in order to benefit from emergency health services in our country and basic data which were essential for registration were examined, missing data in the study is unlikely.

**Table 2**

Gender and age distribution among pandemic and comparison periods

| Variable                                  | Gender         |                |  | *P value | Age                |         |
|---|----------------|----------------|--|----------|--------------------|---------|
|   | Female         | Male           |  |          | Median (IQR 25–75) | P value |
| In general                                |                |                |  |          |                    |         |
| – 2020                                    | 41,553 (%52.7) | 37,354 (%47.3) |  | <0.001   | 36 (24–50)         | <0.001  |
| – 2019 comparison                         | 83,283 (%55.7) | 66,106 (%44.3) |  |          | 35 (24–49)         |         |
| Pre-pandemic period (1st Feb-11th Mar)    |                |                |  |          |                    |         |
| – 2020                                    | 19,839 (%55.9) | 15,676 (%44.1) |  | 0.031    | 36 (24–51)         | 0.242   |
| – 2019 comparison                         | 17,808 (%56.7) | 13,605 (%43.3) |  |          | 35 (24–51))        |         |
| Early-pandemic period (12th Mar-31st May) |                |                |  |          |                    |         |
| – 2020                                    | 11,737 (%50)   | 11,729 (%50)   |  | <0.001   | 34 (24–49))        | <0.001  |
| – 2019 comparison                         | 36,774 (%55.6) | 29,359 (%44.4) |  |          | 37 (26–51)         |         |
| Late-pandemic period (1st Jun-31st Jul)   |                |                |  |          |                    |         |
| – 2020                                    | 9977 (%50.1)   | 9949 (%49.9)   |  | <0.001   | 35 (23–49)         | 0.642   |
| – 2019 comparison                         | 28,701 (%55.4) | 23,142 (%44.6) |  |          | 35 (23–49)         |         |

Abb: IQR: inter quartile range.

\* p value shows the difference between 2019 and 2020.

Demographic variables and complaints of the patients on admission were investigated using this electronic registration system of the hospital. Diagnostic codes of the patients were categorized into 10 groups according to the systems, as nonspecific/pain related complaints (nonspecific pain, fatigue, and myalgia), respiratory complaints (upper respiratory tract infections, lower respiratory tract infections, asthma, chronic obstructive pulmonary disease, pneumonia etc.), gastrointestinal complaints (abdominal pain, gastroenteritis, nausea, vomiting, etc.), psychiatric complaints (suicide, anxiety), neurological complaints (headache, vertigo, stroke, epilepsy, etc.) cardiac complaints (chest pain, heart failure, palpitation, etc.), trauma (stab wounds, burn, bone fractures, soft tissue injuries, etc.), obstetric and gynecologic complaints, urinary complaints (renal colic, urinary tract infections, renal failure), and others. This categorization and abstraction of whole data were done by researchers ourselves.

### 2.1. Statistical analyses

The statistical analysis was performed using Microsoft Excel and IBM SPSS Statistics for Windows 22.0 (IBM Corp., Armonk, NY, USA). After assessing normal distribution using the Shapiro-Wilk test, variables were described in terms of the median and interquartile range (IQR) (25%–75%) and categorical variables were defined as the number and frequencies. The Mann-Whitney U and chi-square tests were used to determine the differences between the groups. The results were further depicted in graphs.  $P < 0.05$  was considered statistically significant.

### 3. Results

The total number of ED visits in the study period in 2020 was 78,907, which was only the half (52.8%) of the applications in the same period in 2019 (n: 149,387). The data demonstrated that, in the prepandemic period, the number of ED visits was 13% higher than in the comparison period of 2019, but the number of daily visits was sharply decreased after the announcement of the first case on March 11th. To understand if the severity of the disease or the complaints affected the decision to visit the ED, the number of daily visits according to the triage codes were also analyzed. Especially after the pandemic announcement, the data showed a decrease by half in the green and yellow zone applications when compared to the previous year, while the red zone applications were more than twice that of the previous year (Table 1).

Among all of the visitors in 2020, 52.7% (n: 41,553) were female, while this was 55.7% (n: 82,283) in 2019 ( $P < 0.001$ ). The data showed a slight female predominance among the ED visitors in both time

**Table 3**  
Distribution of complaints at admission to ED at pandemic and comparison periods

| Complaint (%)*                     | Cardiac | Respiratory | Trauma | Gastroenterological | Psychiatric | Neurologic | Urinary | Obstetric | Nonspecific | Others |
|------------------------------------|---------|-------------|--------|---------------------|-------------|------------|---------|-----------|-------------|--------|
| In general                         |         |             |        |                     |             |            |         |           |             |        |
| – 2020<br>(n = 78,907)             | 5.9     | 21.3        | 15.8   | 12.3                | 0.8         | 7.5        | 5       | 0.8       | 25          | 5.7    |
| – 2019 comparison<br>(n = 149,389) | 2.7     | 19.3        | 17     | 14.2                | 0.4         | 5.4        | 3.3     | 0.8       | 35.5        | 1.5    |

\* Percentages of the related complaint among total number of visits at mentioned time period was given.

periods, except the early and late pandemic periods, when the gender distribution among the visitors was nearly equal. The median age of the visitors was 36 years (IQR 24–50) during the pandemic period, which was significantly higher than that of the previous year ( $P < 0.001$ ) (Table 2).

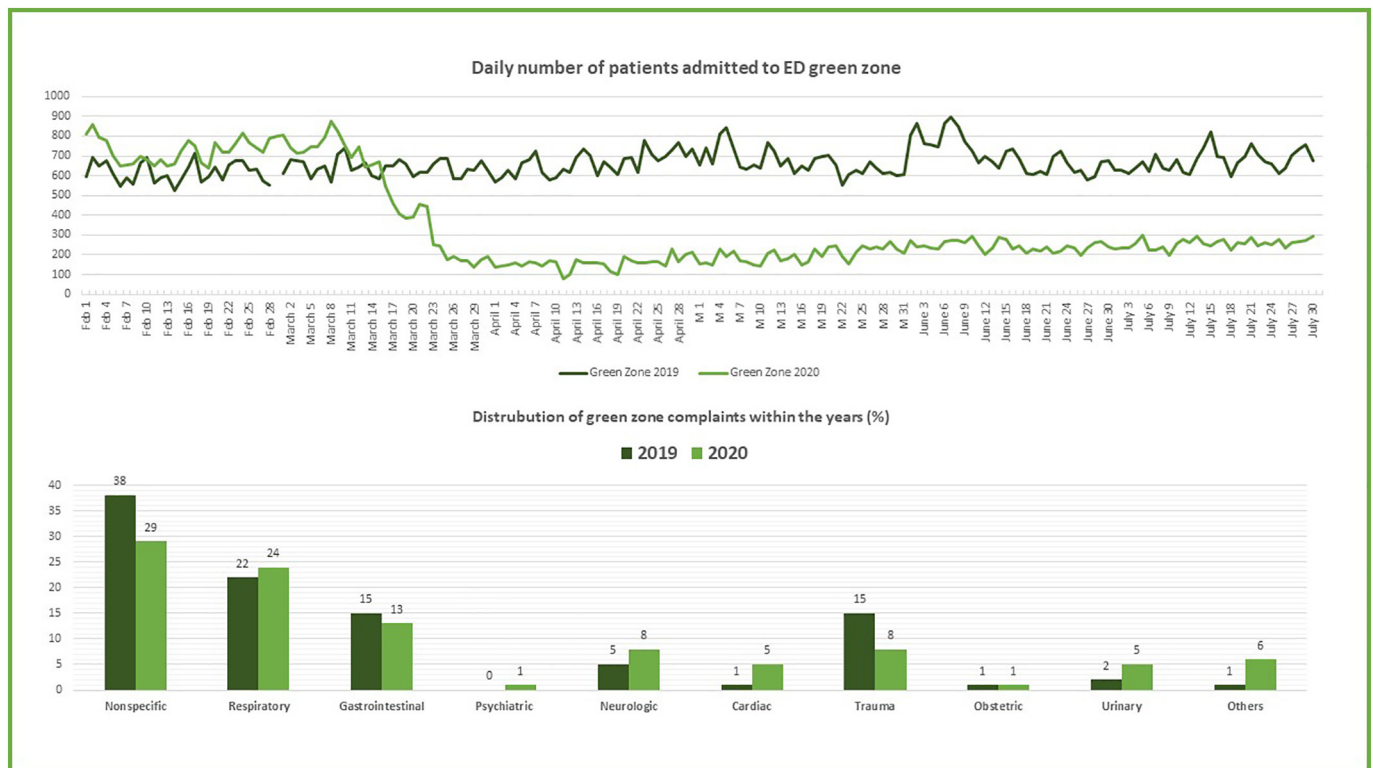
During the pandemic period, the most common complaints during ED admissions were nonspecific pain-related (25%), respiratory (21.3%) and trauma-related (15.8%) complaints. However, when compared with the previous year, the data showed that the percentage of nonspecific complaints was decreased and there was an increase at the percentages of respiratory, cardiac, and neurological complaints. (Table 3). The number of ED admissions during those time frames and the distribution of the complaints on admission according to the triage codes are also given as graphs in Figs. 1–3. In the graphs, a decrease in the percentages of nonspecific and trauma-related admissions in the green zone can be observed during the pandemic period; however, there was an increase in the percentages of respiratory- and trauma-related complaints in the yellow zone.

Total number of ED admissions due to nonspecific complaints was 72,657 (52,961 in 2019, 19,696 in 2020); and 87.2% of them had green triage code. When the gender distribution was analyzed in this patient

group, data demonstrated a female predominance in 2019 (56% female, 44% male,  $p < 0.001$ ) but in 2020 gender distribution was nearly equal. (Table 4).

**4. Discussion**

This study demonstrated that although the number of ED admissions was 13% higher than in the previous year in the prepandemic period, there was a sharp decrease at the daily number of ED visits after the announcement of the first official COVID-19 case on March 11th, and in general, the number of ED visits during the pandemic was just the half of that of the previous year in the same period. Many studies have shown that the situation was the same in many parts of the world [6,7]. There might be many factors affecting this decline. One of which might be considered to be curfews (which were applied during weekends and national holidays in the early pandemic period in Turkey), but although there was a slight decrease in ED applications on the days of the curfews, this did not make a clear difference. The main reason for the continuous decrease in ED admissions during the pandemic period might have been the fears of the patients about being exposed to COVID-19 [8].



**Fig. 1.** Daily number of patients admitted to emergency department green zone and distribution of the complaints during admission in the study period as percent.

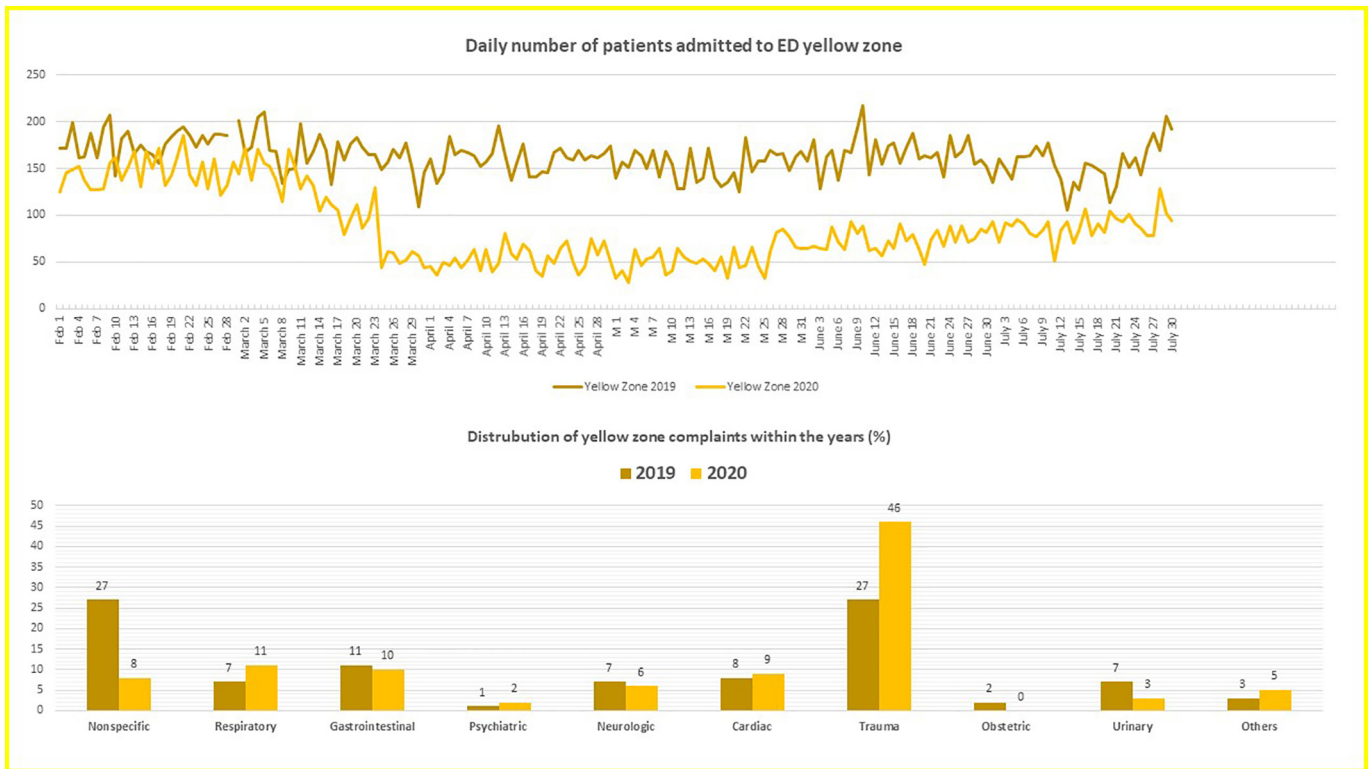


Fig. 2. Daily number of patients admitted to emergency department yellow zone and distribution of the complaints during admission in the study period as percent.

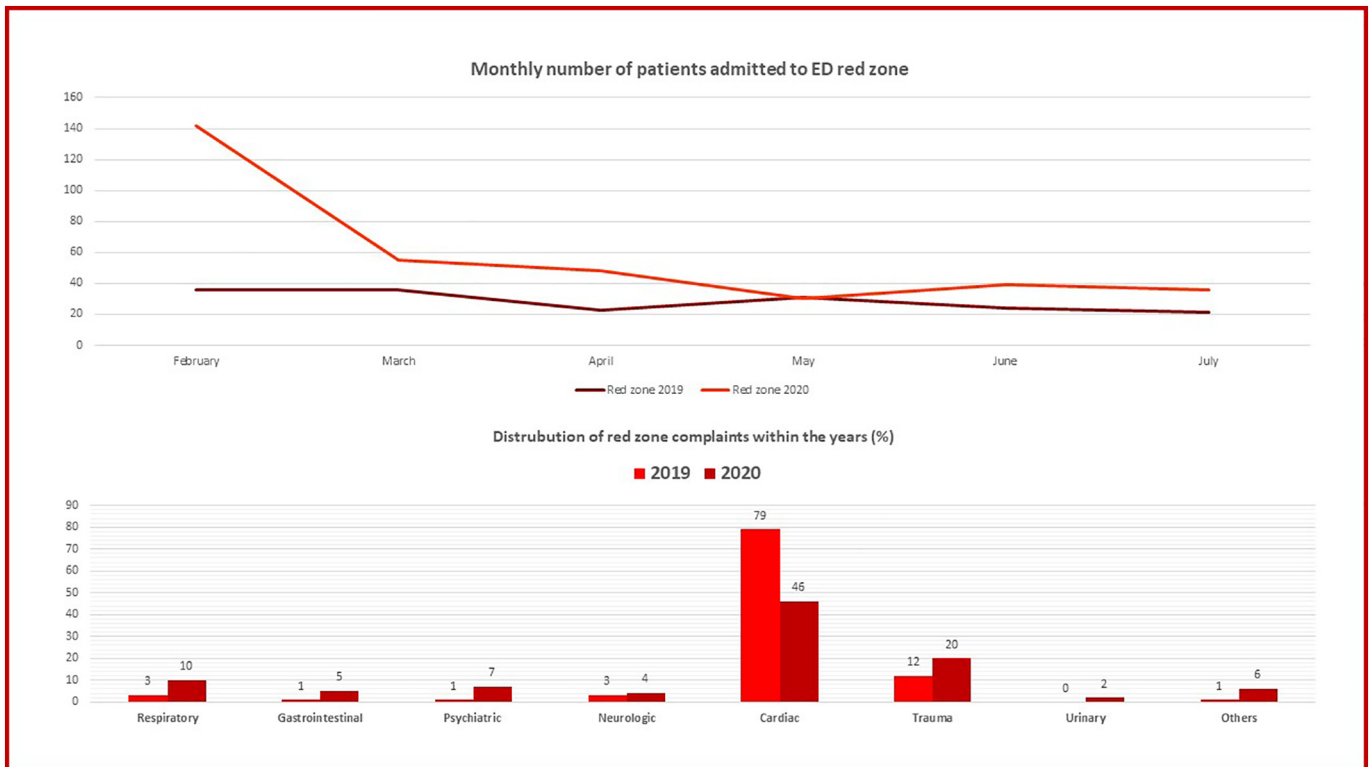


Fig. 3. Monthly number of patients admitted to emergency department red zone and distribution of the complaints during admission in the study period as percent.



**Table 4**  
Triage and gender distribution of patients admitted to ED due to non-specific complaints

| N:72657 | In 2019        | In 2020        | P value |
|---------|----------------|----------------|---------|
| Gender  |                |                |         |
| Female  | 29,640 (56.0%) | 9718 (49.3%)   | <0.001  |
| Male    | 23,321 (44.0%) | 9978 (50.7%)   |         |
| Triage  |                |                |         |
| Green   | 44,971 (84.9%) | 18,392 (93.4%) | < 0.001 |
| Yellow  | 7990 (15.1%)   | 1304 (6.6%)    |         |

This fear of contracting a “deadly condition” might have led patients to avoid seeking medical attention, and therefore, a delay in seeking care could have led to increased mortality and morbidity, especially for time-sensitive acute life-threatening conditions [9]. Kim et al. reported a significant reduction in cardiac and neurologic diagnoses during the early pandemic period, but an increase in out-of-hospital cardiac arrests [10]. Similarly, the current study showed a two-fold increase in red zone admissions despite the significant decrease in ED visits. Jeffrey et al. supported this finding in their study, which showed an increased rate of hospital admissions from the ED, despite a decrease in ED visits by more than 40% [11].

Turkey is a country that normally has overcrowded EDs, and many of the applications comprise nonspecific complaints, which are “nonemergent” in reality [4]. This study showed a sharp reduction at applications to the ED due to nonspecific complaints after the declaration of the pandemic. On the other hand, the rate of applications due to specific complaints, such as cardiac and neurological complaints had increased. This situation might have been the result of the patients having avoided coming to the hospital for nonemergent complaints during the pandemic, and thus, the unnecessary patient burden was decreased in this process. Looking at the gender distribution of the ED visitors, it was observed that there was a slight female predominance in the prepandemic period, while the rate of female and male referrals in the postpandemic period was approximately the same. This led to the belief that ED applications due to nonemergent complaints were a bit higher among females than males. In another study conducted in Turkey, it was reported similarly, where the biggest decrease was seen in patients with a green triage code and female patients [12].

#### 4.1. Limitations

This study has some limitations. First it was conducted by assuming that the recorded data was correct, however there might be errors in the final diagnosis and triage codes. Since it was a retrospective study it was impossible to prevent or correct those “possible” errors. Secondly, increased mortality and morbidity was interpreted as a consequence of delayed hospital admissions in life-threatening clinical conditions. However, another reason for that increase in mortality and morbidity might be COVID-19 disease and its complications, itself.

## 5. Conclusion

In conclusion, the number of ED visits during the pandemic were decreased by half when compared to the previous year. It was an advantage of the pandemic to decrease ED visits due to “nonemergent” complaints, and thus, unnecessary patient burden. However, on the other hand, because the fear of what patients might get was greater than the fear of what they had, patients avoided seeking medical attention, even for life-threatening conditions. Therefore, as it can be seen from the increased number of red zone applications, this delay in seeking care might have led to increased mortality and morbidity.

## Declaration of Competing Interest

None.

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