Medical Science and Discovery
ISSN: 2148-6832

# Effect of covid-19 pandemic on in-hospital mortality

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## ABSTRACT

**Objective:** This study aimed to examine the effect of the pandemic on hospital mortality and patient admission in four months since March 2020 when the Ministry of Health announced the first confirmed COVID-19 case in Turkey and the first wave occurred.

**Material-Method:** This research is a single-centre, retrospective, cross-sectional descriptive study. It covers the periods between March 01 and Jun 30 of 2018, 2019, and 2020.

**Results:** Between 2018-2020, 897522, 972799, and 395438 patients were admitted to our Hospital, respectively. It was observed that the number of admissions decreased by 55-60% in 2020 compared to the previous years (p=0.001). Moreover, 205318 (22.9%) of the admissions in 2018, 229278 (23.6%) of the admissions in 2019, and 1127293 (32%) of the admissions in 2020 were emergency room (ER) admissions. Especially in 2020, there was a significant increase in the overall in-hospital (p=0.001) and ER (p=0.001 mortality rates compared to previous years. In-hospital mortality was found to be higher, especially in patients with suspected COVID-19 (p=0.001). It was found that the number of deaths due to respiratory causes was significantly increased in 2020 compared to the previous years (p=0.001).

**Conclusion:** The COVID-19 pandemic has led to significant changes in mortality rates and causes of mortality compared to previous years. Although the pandemic has affected all healthcare systems, ER and intensive care units (ICU) are seriously affected.

**Keywords:** COVID-19, mortality, emergency room

## INTRODUCTION

Following its first description in Wuhan, China, Coronavirus disease 2019 (COVID-19) has become a severe health problem and has created a global crisis with its economic, sociological, and psychological aspects. The World Health Organization (WHO) declared this outbreak as "a public health emergency of international concern" on Jan 31, 2020 (1). The first case in our country was reported on Mar 11, 2020. As of June 13, 2021, WHO published 175.306.598 confirmed COVID-19 cases globally, and 3.792.777 patients died due to COVID-19 (2). In Turkey, as of June 13, 2021, a total of 5,330,447 COVID-19 cases and 48,721 deaths were reported (3).

Due to the immediate expanse of COVID-19 disease and the high hospitalization rate, it is essential to manage these patients well and organize hospital emergencies and departments to decrease their mortality rate. Analysis of hospital deaths is a crucial source of information for management (4). This research intended to analyze the impact of the pandemic on hospital mortality and patient admission in four months since March 2020 when the Ministry of Health announced the first confirmed COVID-19 case in Turkey and the first wave occurred.

**Research Article**

**Received** 14-06-2021

**Accepted** 24-06-2021

**Available Online:** 25-06-2021

**Published** 30-06-2021

http://dx.doi.org/10.36472/msd.v8i6.561

## MATERIAL and METHODS

This research is a single-center, retrospective, cross-sectional descriptive study. The hospital mortality rates of the last three years (2018-2020) between Mar 01 and Jun 30 were scanned. March 01 to June 30 is the date range of the first pandemic wave in 2020.

The study included in-hospital deaths that occurred on the specified dates, patients brought by 112 ambulance teams while receiving Cardiopulmonary Resuscitation (CPR), and 396 patients brought by their relatives in cardiac arrest, received CPR, and died. After obtaining the study's ethical approval, the patients' files were reviewed through the hospital automation system, and the type of admission, admission complaint, diagnosis, and follow-up process were recorded in the study form by the researcher.

Patients without CPR indication brought to the emergency room (ER) as dead were not included in the study. Patients with thorax computed tomography (CT) findings of viral pneumonia but with negative PCR and patients with an International Classification of Diseases (ICD) code of Z03.0-9 were considered suspected COVID-19.

In contrast, patients with positive reverse transcription-polymerase chain reaction (PCR) or an ICD diagnosis code of U07.3 were considered COVID-19. Moreover, patients whose swab samples were collected and who underwent low-dose thorax CT and prepared for routine operation with negative findings were not considered suspected COVID-19.

The causes of death were divided into seven main classes: admission for the non-traumatic cardiac arrest of unknown cause, malignancy, respiratory causes, internal causes, surgical causes, neurological causes, and traumatic causes.

Admission for Non-traumatic Cardiac Arrest of Unknown Cause: Patients with no trauma in the etiology could not be diagnosed and brought while receiving CPR.

Malignancy: Patients with cancer and admitted for a reason other than respiratory tract pathology.

**Respiratory Causes:** Patients with ICD diagnosis codes of J96, J18, R06, U07.3.

**Internal Causes:** Patients with ICD diagnosis codes of N17, I10, K27, E14, D84, E87, I85, K92, T51, other toxicities, anemias, and extra-respiratory infections.

**Surgical Causes:** Patients with non-traumatic postoperative cardiac arrest, non-traumatic acute abdominal manifestations.

**Neurological Causes:** Patients with ICD diagnosis codes of I60-69, G40.

**Traumatic Causes:** Patients presented with a traffic accident, fall, hanging, firearm injury, sharp object injury.

IBM SPSS (Statistical Package for the Social Sciences) Statistics for Windows, Version 22.0 (IBM Corp. Armonk, NY, USA) was applied to investigate the collected data. Skewness and Kurtosis values were demanded to be in the range of -2/+2 for the data's normal distribution (5). The independent t-test was used for the comparison of customarily distributed measurable data. The Mann-Whitney U test was used for the comparison of non-normally distributed parameters. The chi-square test was applied for the association of qualitative data. A p-value of <0.05 (CI 95%) was considered significant for all analyses.

## RESULTS

Between 2018-2020, 897522, 972799, and 395438 patients were admitted to our hospital, respectively. It was observed that the number of admissions decreased by 55-60% in 2020 compared to the previous years ($\chi^2$=260884.187, p=0.001). Moreover, 205318 (22.9%) of the admissions in 2018, 229278 (23.6%) of the admissions in 2019, and 1127293 (32%) of the admissions in 2020 were ER admissions. Therefore, considering the rate of all hospital admissions, there was a significant increase in ER admissions, although there was a decrease in hospital admissions ($\chi^2$=8159.556, p=0.001).

It was found that 99 people died in the hospital in 2018, 113 in 2019, and 184 people died in the hospital in 2020. Especially in 2020, there was a significant increase in the overall in-hospital ($\chi^2$=479889.770, p=0.001) and ER ($\chi^2$=42.426, p=0.001 mortality rates compared to previous years. There was an approximately four-fold increase in overall hospital mortality and a 2.5-fold increase in ER mortality. On the other hand, the ER share in in-hospital deaths in 2020 significantly decreased ($\chi^2$=12.265), p=0.002).

Of 396 in-hospital deaths in 01 March-30 June in 2018, 2019, and 2020, 159 (40.2%) were female, and 237 (59.8%) were male. Considering the gender distribution of the deceased people by years, there was no significant difference ($\chi^2$=0.414, p=0.813).

When the deceased people were analyzed by age, the mean age of the patients was 62.96 years, and the median age was 66.5, with the youngest age of 1 year and the oldest age of 98 years. Based on the age limit of 50, which is considered the age limit for treatment protocols according to the Health Ministry COVID-19 guideline for 01 March-30 June (6), there was no significant difference in overall hospital deaths by years. However, especially in 2020, there was a significant decrease in ER deaths under 50 years compared to previous years ($\chi^2$=8.135, p=0.017). The patients' admission number by year and mortality rates are given in **Table 1**.

Of 395438 patient admissions in 01 March-30 June 2020, 127293 (32.2%) were ER admissions. In the same period, 29174 (96.5%) of the 30229 COVID-19 suspected patients' admission were ER admissions. Of the 184 patients who died in 2020, 92 (50%) had suspected COVID-19. Of the suspected COVID-19 deaths, 76 (69.1%) occurred in the COVID-19 ward and Intensive Care Unit (ICU), and 16 (29.9%) occurred in the ER.

The COVID-19 ward and ICU mortality rate of patients with suspected COVID-19 was statistically higher than the ER mortality rate ($\chi^2$=37.332, p=0.001). Overall in-hospital mortality was higher, especially in patients with suspected COVID-19 ($\chi^2$=283.673, p=0.001). There was no significant difference between patients' death at the ER, those with suspected COVID-19 and those without ($\chi^2$=0.099, p=0.753). In addition, no suspected COVID-19 deaths under the age of 50 years occurred in the ER.

http://dx.doi.org/10.36472/msd.v8i6.561

The patients' demographic comparison is presented in **Table 2.** When the causes of death by years were analyzed under headings, it was found that the death number due to respiratory causes was significantly increased in 2020 compared to the previous years ($\chi^2$=22.073, p=0.001). Patients diagnosed with COVID-19 were primarily included in deaths due to respiratory causes since they presented with respiratory distress. In addition, there was a statistically notable reduction in deaths due to trauma ($\chi^2$=8.168, p=0.017), malignancy ($\chi^2$=6.907, p=0.032), and internal causes ($\chi^2$=6.536, p=0.038). The mortality causes are shown in **Table 3**.

**Table 1:** Number of hospital admissions by years and mortality rates by age, gender, and unit

| | | 2018 | | 2019 | | 2020 | | p-value |
|---|---|---|---|---|---|---|---|---|
| **Total Number of Admissions** | | 897522 | | 972799 | | 395438 | | p=0.001 |
| **Total ER Admissions** | | 205318 | 22.9% | 229278 | 23.60% | 127293 | 32.2% | p=0.001 |
| **Total Hospital Mortality** | | 99 | 0.01% | 113 | 0.01% | 184 | 0.05% | p=0.001 |
| **Total ER Mortality** | | 43 | 0.02% | 53 | 0.02% | 74 | 0.06% | p=0.001 |
| **Hospital Mortality by Gender** | **Female** | 42 | 42.4% | 46 | 41% | 71 | 38.6% | p=0.812 |
| | **Male** | 57 | 57.6% | 67 | 59% | 113 | 61.4% | |
| **ER Mortality by Gender** | **Female** | 16 | 37.2% | 17 | 32% | 29 | 39% | p=0.709 |
| | **Male** | 27 | 62.8% | 36 | 68% | 45 | 61% | |
| **Hospital Mortality by Age** | **≥50** | 76 | 76.8% | 84 | 74% | 147 | 80% | p=0.526 |
| | **<50** | 23 | 23.2% | 29 | 26% | 37 | 20% | |
| **ER Mortality by Age** | **≥50** | 34 | 79.1% | 33 | 62.3% | 62 | 84% | p=0.017 |
| | **<50** | 9 | 20.9% | 20 | 37.7% | 12 | 16% | |

**Table 2:** Demographic comparison of hospital admissions in 2020 and COVID-19 suspected cases

| | | 2020 | | Suspected COVID-19 | | p-value |
|---|---|---|---|---|---|---|
| **Total Number of Admissions** | | 395438 | | 30229 | 7.6% | |
| **Total ER Admissions** | | 127293 | 32.2% | 29174 | 96.5% | p=0.001 |
| **Total Hospital Mortality** | | 184 | 0.1% | 92 | 0.3% | p=0.001 |
| **Total ER Mortality** | | 74 | 0.1% | 16 | 0.1% | p=0.753 |
| **Hospital Mortality by Gender** | **Female** | 71 | 38.6% | 33 | 35.9% | p=0.639 |
| | **Male** | 113 | 61.4% | 59 | 64.1% | |
| **ER Mortality by Gender** | **Female** | 29 | 39% | 7 | 43.8% | p=0.681 |
| | **Male** | 45 | 61% | 9 | 56.3% | |
| **Hospital Mortality by Age** | **≥50** | 147 | 80% | 78 | 84.8% | p=0.301 |
| | **<50** | 37 | 20% | 14 | 15.2% | |
| **ER Mortality by Age** | **≥50** | 62 | 84% | 16 | 100% | p=0.011 |
| | **<50** | 12 | 16% | 0 | 0% | |

**Table 3:** Distribution of death causes by years

| | | Admission for Non-traumatic Cardiac Arrest of Unknown Cause | Malignancy | Respiratory Causes | Internal Causes | Surgical Causes | Neurological Causes | Traumatic Causes | Total |
|---|---|---|---|---|---|---|---|---|---|
| **2018** | **Count** | 11 | 12 | 21 | 24 | 10 | 10 | 11 | 99 |
| | **%Year** | 11.1% | 12.1% | 21.2% | 24.2% | 10.1% | 10.1% | 11.1% | 100.0% |
| **2019** | **Count** | 13 | 16 | 24 | 22 | 10 | 9 | 19 | 113 |
| | **%Year** | 11.5% | 14.2% | 21.2% | 19.5% | 8.8% | 8.0% | 16.8% | 100.0% |
| **2020** | **Count** | 24 | 9 | 101 | 20 | 14 | 6 | 10 | 184 |
| | **%Year** | 13.0% | 4.9% | 54.9% | 10.9% | 7.6% | 3.3% | 5.5% | 100.0% |
| | | p=0.896 | p=0.032 | p=0.0001 | p=0.038 | p=0.803 | p=0.077 | p=0.017 | |

http://dx.doi.org/10.36472/msd.v8i6.561

## DISCUSSION

Mortality analysis contains essential data in both country population and healthcare system evaluations (7). In this analysis, quality indicators and expected improvement potentials are determined (7). We analyzed hospital mortality during the COVID 19 pandemic, which is the subject of our study. In addition, we aimed to evaluate the effect of the COVID-19 pandemic on hospital admissions and in-hospital mortality from the first announcement of the pandemic in Turkey.

Although the number of overall hospital admissions was significantly decreased in 2020 compared to the same period of the previous two years in our study, there was a statistically significant increase in the rate of ER admissions. Of the 395438 patient admissions during this period, 127293 (32.2%) were ER admissions and 29174 (96.5%) of the 30229 suspected COVID-19 admissions. All suspected COVID-19 patients were admitted to ER; thus, it increased the rate of ER applications. In addition, we think that it is effective that patients do not apply to the hospital without severe complaints due to the risk of COVID-19 transmission. Similarly, Ensar&Fatih reported that ER applications decreased due to the COVID-19 pandemic close to our study period (8).

While there was an increase in overall hospital mortality rates, there was a significant decrease in deaths due to trauma, malignancy, and internal causes. The decreasing hospital admission could be due to the measures taken by the state against the COVID-19, such as curfews for specific age groups on weekends and at certain hours, restriction on the number of passengers in public transport, closure of shopping and entertainment centers, travel restrictions, providing formal education online. As well as increasing the follow-up of chronic patients in the healthcare system by family physicians, postponing all elective operations, hospital reorganization, warning of the public through the media frequently also had a positive impact on it. Accordingly, the number of patient admissions with a diagnosis other than COVID-19 has decreased. In support of this, Ensar&Fatih stated that the number of trauma cases applying to the ER during the pandemic period decreased significantly with the curfew (9).

Peter Wever et al. reported high mortality rates for ER and ICU, especially in 2020, COVID-19. In particular, they reported the ER mortality rate as 2.0% and the ICU mortality rate as 5.0% (10). In our study, the period of 01 March-30 June, which covers the first wave of the pandemic, was evaluated compared to the same period of the previous two years, and the mortality rates were lower than the mortality rates reported by this study. However, the ER and ICU mortality rates were increased in 2020, similar to this study. Therefore, it can be thought that the proportional difference between these studies may be the pandemic's peak in different regions.

It was found that the number of both in-hospital and ER deaths over 50 years was increased, especially in 2020. In the literature, studies conducted in China and Italy have emphasized that adults aged 65 and over have the highest mortality in terms of epidemiological characteristics (11–13). Even though overall hospital mortality under 50 years old was decreased in 2020, there was no statistical difference between the years. The analysis of the ER mortality revealed a significant decrease in the number of deaths under 50 years of age. Between our study dates, there were no ER deaths under 50 years of age with suspected COVID-19. We believe that the significant decrease in traumatic arrest cases may be due to the curfew restrictions within the scope of the measures taken in the COVID-19 pandemic, online education, and the reduction in vehicle traffic due to the transition to the flexible working system.

Yehia et al. emphasized that in the COVID-19 pandemic, the number of admissions of female cases was higher than that of males, but the male patients' mortality was 1.23 times more than females. Some other studies have emphasized that the male gender is a risk factor for deaths from COVID-19 disease (14, 15). Although our study supports these studies, there was a high rate of male deaths in years before the COVID-19 pandemic in our study, but it was not statistically significant.

When the mortality causes were analyzed for the three years evaluated within the scope of the study, it was notable that deaths occurred primarily due to respiratory causes in 2020. There was a notable increase in deaths due to respiratory causes in the three years and the current year 2020. As is known, COVID-19 disease presents with respiratory tract infection and progresses rapidly, and its mortality is higher than other respiratory tract infections (16, 17). Especially the involvement of the lower respiratory tract by the COVID-19 disease from the beginning and the development of multi-organ failure in the later period support the results of our study.

## CONCLUSIONS

The Covid-19 pandemic has commenced meaningful changes in mortality rates and causes of mortality compared to previous years. However, the pandemic has affected all healthcare systems, especially ER and ICU. It is fundamental to improve inpatient and emergency healthcare services to decrease Covid-19 mortality.

**Acknowledgments:** We would like to thank the Ministry of Health University of Health Science Kanuni Sultan Suleyman Research and Training Hospital management for allowing the data to be taken.

**Author Contributions: RÜ, RG, DA, AE, EA, BC:** Project design, Data collection, Statistical Analyzes, **RÜ:** Article writing and revisions

**Financial & competing interest's disclosure**: The authors have no relevant affiliations or financial involvement with any organisation or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

**Conflict of interest:** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. This research did not receive and specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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