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Original Article

# Association between COVID-19 Mortality and Underlying Disease; Tehran, Iran

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**Abstract**

**Introduction:** Coronavirus disease has emerged as one of the major health challenges in the 21st century. This study aimed to investigate the association between COVID-19 mortality and underlying disease in Tehran.

**Methods:** The retrospective, epidemiological study was conducted from January 1, 2019, to May 31, 2021, in hospitals in Tehran, Iran based on the International Classification of Diseases (ICD-11). Data concerning coronary cases with underlying disease (8018) and related demographic and clinical characteristics are collected by hospitals. Additionally, logistic regression was examined to determine the association between COVID-19 mortality and underlying disease.

**Results:** The result shows that incurable diseases (47.3%) and cancer (67.7%) had the lowest while; pulmonary disease showed the highest recovery day (80.7%) between various underlying conditions. In addition, cancer and pulmonary disease show 10.41 and 7.3 hospitalization days, respectively. The logistic regression analysis revealed that mortality in cases with cancer as an underlying disease is 4.72 times higher than in cases without cancer (95% CI: 4.08-5.46). Moreover, the adjusted regression analysis showed that the mortality in multiple underlying conditions such as cancer, respiratory issues, cardiovascular problems, and diabetes are 5.48, 2.75, 4.081, and 3.162 times higher, respectively ($P<0.05$).

**Conclusion:** The findings of this study provide valuable insights into how specific underlying health conditions can increase the risk of COVID-19 mortality, hospitalization, and recovery time.

## Introduction

The COVID-19 pandemic has had a profound global impact, leading to widespread infections and a substantial number of fatalities across the world. However, last research indicates that individuals with pre-existing medical conditions face an elevated risk of experiencing severe illness and increased mortality associated with COVID-19. Therefore, this finding underscores the importance of investigating the relationship between COVID-19 mortality and underlying health conditions. Similarly, these studies are crucial for enhancing preventive strategies and improving patient outcomes.[1,2] In this regard, comorbidities, including hypertension, diabetes, obesity, and cardiovascular disease, have been identified as significant risk factors contributing to severe manifestations of COVID-19 and associated mortality. This finding emphasizes the critical need for enhanced management strategies for individuals suffering from underlying conditions. However, the underlying medical issues substantially heightens the probability of experiencing severe symptoms, necessitating hospitalization, and correlates with increased mortality cases diagnosed with COVID-19.[3] In the study that was conducted in the United States, it was revealed that over 75% of mortality associated with COVID-19 were attributable to underlying medical conditions. This finding underscores the importance of understanding the relationship between COVID-19 mortality and pre-existing health issues, as

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such insights are essential for informing effective public health policies and interventions. The global impact of the COVID-19 pandemic has been profound, affecting millions of individuals worldwide and significantly influencing global health dynamics.[4] In Iran, many people with COVID-19 also have health issues like hypertension, diabetes, and heart disease. These conditions are quite common and are linked to higher mortality and poorer recovery results.[5] Moreover; the most of the COVID-19 cases are also dealing with conditions like hypertension, diabetes, and heart disease in Iran. These health issues are so common and are linked to higher mortality and not-so-great recovery results.[6] In the research it was found that people with hypertension or diabetes are at a much higher risk of dying from COVID-19 than those who do not have these health issues in Iran so it is so important to grasp how COVID-19 interacts with these underlying conditions. On the other hands, knowing which comorbidities are most common in COVID-19 cases and how they affect the severity of the disease, mortality, and treatment options is key to finding better ways to manage and prevent the virus. Furthermore, it is essential to investigation of the potential interactions between COVID-19 and pharmacological treatments for underlying conditions that are critical for enhancing patient management strategies throughout the pandemic.[7] Current study was novelty aimed to conducts on the comparative analysis of the mortality and recovery in COVID-19 cases with underlying health conditions in Tehran, the capital city of Iran. Therefore, a localized focus provides critical insights into the pandemic's impact on a specific urban population. In this context, systematically categorizing comorbidities can significantly enhance our understanding of how pre-existing conditions influence COVID-19 outcomes.

## Materials and Methods

### *Study Design and Data Collection*

This retrospective epidemiological study was conducted from January 1, 2019, to May 31, 2021, in hospitals across Tehran, Iran, based on the International Classification of Diseases (ICD-11). Data were collected on 8,018 coronary cases with underlying health conditions, along with demographic and clinical characteristics. Logistic regression analysis was performed to assess the association between COVID-19 mortality and underlying diseases. A census sampling method was used to analyze coronary cases with underlying conditions, including diabetes, chronic obstructive pulmonary disease (COPD), asthma, immunosuppression, hypertension, cancer, and cardiovascular disease.

### *Statistical Analysis*

Descriptive analyses of the variables were expressed as mean ± SD. In addition, logistic regression analysis conducted to examine for the mortality, taking into account gender, age, and underlying conditions. Additionally, logistic regression was examined to determine association between COVID-19 mortality and underlying disease. The data were analyzed using the SPSS version 11.0.

## Results

The data indicates that out of total of 80 377 confirmed cases of the condition (90% without underlying disease, and 10% with underlying disease). Also, most cases (66%) were 52.6% male. However, out of the total cases, 58 756% has recovered. Moreover, cardiovascular disease was the most common underlying condition (38%), while incurable disease was the least common (2%). Notably, incurable diseases had the lowest recovery (47.3%) and cancer (67.7%). Pulmonary disease showed the highest recovery percentage (80.7%) among various underlying conditions. Analysis of hospitalization days in COVID-19 cases with different underlying conditions indicated that cancer had the longest duration (10.41 days). Moreover, pulmonary disease had the shortest duration, lasting 7.3 days. Conversely, COVID-19 cases without underlying conditions had hospitalization period 3.65 days (Table 1).

### *Association between COVID-19 Mortality and Underlying Disease*

The logistic regression analysis revealed that mortality in cases with cancer as an underlying disease is 4.72 times higher than in those without cancer (95% CI: 4.08 - 5.46) (Table 2). Moreover, the adjusted regression analysis showed that the mortality for individuals with multiple

**Table 1.** Descriptive statistic coronary cases with underlying disease

| Underlying disease | | | Gender | | | | Outcome | | | | Age | Hospitalization |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male | | Female | | Recovery | | Mortality | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | | |
| Cardiovascular disease | 3048 | 38 | 1665 | 21 | 1383 | 17 | 2244 | 28 | 796 | 1 | 68.3(0.2) | 7.3(0.3) |
| Cancer disease | 854 | 11 | 509 | 6 | 345 | 4 | 578 | 7 | 275 | 3 | 49.9(0.1) | 10.2(0.2) |
| Diabetes disease | 2476 | 31 | 1211 | 15 | 1265 | 16 | 1929 | 24 | 532 | 7 | 64.3(10.8) | 7.3(0.2) |
| Pulmonary disease | 349 | 4 | 207 | 3 | 142 | 2 | 281 | 3 | 67 | 1 | 57.3(0.6) | 7(1.2) |
| Other disease | 1296 | 16 | 725 | 9 | 571 | 7 | 954 | 11 | 341 | 4 | 51.2(0.6) | 7.3(0.2) |
| Total | 80378 | 100 | 43079 | 54 | 37299 | 46 | 73414 | 73 | 7947 | 16 | 51.6(0.1) | 4(0.5) |

underlying conditions such as cancer, respiratory issues, cardiovascular problems, and diabetes are 5.48, 2.75, 4.081, and 3.162 times higher, respectively ($P$ value < 0.05) (Table 3).

### *Compression between Hospitalization Days with Underlying Disease*

Cramer's V and Eta were used to determine association between independent variables and the outcome. The results of the non-linear correlation coefficient (η) indicate a positive correlation between underlying conditions and hospitalization days (Eta-squared = 0.142).

## Discussion

Current study highlights the association between underlying diseases and a higher probability of hospitalization and mortality in COVID-19 cases. According to results, individuals without underlying conditions demonstrate a higher probability of recovering from COVID-19 (92.2%). On the other hand, cases that are facing terminal illnesses and cancer show lower recovery, at 47.3% and 67.7% respectively. Interestingly, the data hints at a possible connection between pulmonary disease and enhanced recovery, as those with this underlying condition have a recovery of 80.7% in COVID-19 cases. Furthermore, it was resulted that individuals with underlying conditions face an increased susceptibility to COVID-19, with more risks depending on age. Additionally, the data also highlights differences in hospitalization period across COVID-19 cases with different underlying conditions. However, cancer cases tend to have the longest average hospital stay, 10.41 days, while those with pulmonary issues have a shorter average hospitalization period of 7.3 days. Conversely, individuals without underlying conditions experience a notably shorter hospitalization period (3.65 days). It was evident that individuals with underlying medical conditions, particularly those with cardiovascular disease and terminal illnesses, face an elevated risk of hospitalization and show decreased recovery from COVID-19. Recognizing these associations is crucial for shaping public health interventions and allocating resources effectively to mitigate disparities in COVID-19 outcomes among different population groups. Additionally, it is important to note that various factors play a role in the comparatively higher recovery observed among COVID-19 cases with pulmonary disease.[8] In this regard, pulmonary disorders typically manifest as chronic conditions necessitating ongoing care and treatment. Moreover, respiratory cases ailments are prone to frequent medical assessments and benefit from consistent monitoring by healthcare professionals. This heightened medical oversight can lead to earlier identification and management of COVID-19, consequently fostering better prognosis and treatment outcomes.[9] Moreover, various medications prescribed for managing pulmonary disorders, like corticosteroids and bronchodilators, possess anti-inflammatory characteristics. COVID-19 has been associated with instigating a cytokine storm; an exaggerated immune response that can result in substantial inflammation and respiratory issues.[10] In addition, anti-inflammatory properties of medications mitigate the severity of COVID-19 symptoms in patients with pulmonary conditions. Furthermore, pulmonary diseases cases exhibit greater adherence to respiratory hygiene practices, such as mask-wearing and social distancing[11] that play a crucial role in curbing the transmission of COVID-19 and may potentially reduce the severity of the disease in infected individuals. Nonetheless, these factors may provide insight into why individuals with pulmonary conditions tend to demonstrate a higher recovery than those with other underlying health issues. The findings reveal a significant correlation between the duration of hospital stays for individuals with underlying coronary disease and mortality in COVID-19 cases. Furthermore, the data suggest that individuals with underlying pulmonary, cardiovascular, diabetes, and

**Table 2.** Association between COVID-19 mortality and underlying disease

| | Underlying disease | B | SE | OR | 95% CI of the Difference | | Sig |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| Mortality | Cancer disease | 1.55 | 0.07 | 4.72 | 4.08 | 5.46 | 0.00 |
| | Cardiovascular disease | 1.30 | 0.04 | 3.69 | 3.39 | 4.02 | 0.00 |
| | Diabetes disease | 1.01 | 0.05 | 2.76 | 2.50 | 3.05 | 0.00 |
| | Pulmonary disease | 0.83 | 0.13 | 2.3 | 1.77 | 3.02 | 0.00 |

**Table 3.** Adjusted regression for comorbidity of underlying disease with COVID-19 mortality

| | Underlying disease | B | SE | OR | 95% CI of the Difference | | Sig |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| Mortality | Cardiovascular disease | 1.40 | 0.043 | 4.08 | 3.74 | 4.44 | 0.00 |
| | Cancer disease | 1.70 | 0.074 | 5.48 | 4.73 | 6.34 | 0.00 |
| | Diabetes disease | 1.15 | 0.051 | 3.16 | 2.86 | 3.49 | 0.00 |
| | Pulmonary disease | 1.01 | 0.137 | 2.75 | 2.10 | 3.59 | 0.00 |

cancer conditions are at an elevated risk of mortality due to COVID-19. These results are consistent with prior research indicating that individuals with chronic underlying conditions face a greater risk of severe illness and mortality associated with COVID-19.[12-14] Moreover, logistic regression analysis result indicates that individuals with underlying cardiovascular disease, cancer, diabetes, pulmonary diseases, and other comorbidities are at an increased risk of contracting COVID-19. Additionally, findings provide valuable insights into the impact of underlying conditions on health outcomes, thereby informing clinical management strategies and public health interventions aimed at mitigating the effects of the pandemic. A recent study conducted in Mexico revealed that the mortality for diabetes cases, COPD, immunosuppression, hypertension, chronic kidney disease, cardiovascular disease, and other comorbidities were 2.5 to 4 times higher than those of individuals without such underlying conditions. Although the exact mechanisms remain unclear, several potential factors have been proposed[15] but one of the potential mechanisms is that individuals with underlying conditions, such as cardiovascular disease, diabetes, or pulmonary disease, may experience compromised immune function. This weakened immunity could make them more vulnerable to COVID-19 infection and increase risk of developing severe disease.[16] Additionally, individuals with underlying conditions may possess pre-existing inflammation that could intensify the inflammatory response initiated by a COVID-19 infection, potentially resulting in a more severe manifestation of the disease.[17] Another potential mechanism is that individuals with underlying conditions may be more likely to have comorbidities such as obesity or hypertension which are associated with an increased risk of severe COVID-19 and mortality. Moreover, certain underlying conditions, such as cardiovascular disease and diabetes, are linked to endothelial dysfunction. This dysfunction can result in microvascular damage and a heightened risk of thrombotic complications in coronary disease.[18] It is crucial to recognize that the mechanisms behind the heightened risk of severe mortality with underlying conditions are likely intricate and multifaceted. Further research is essential to comprehensively understand these mechanisms and identify effective interventions to mitigate the impact of underlying conditions on COVID-19 outcomes.[19,20] In addition, various factors such as age, comorbidities, and disease severity can influence how underlying conditions are associated with the discharge statuses of COVID-19. Furthermore, previous research indicates that individuals with specific underlying conditions, such as cancer, diabetes, and cardiovascular issues, may face a higher risk of severe COVID-19 outcomes. Therefore, understanding the connection between underlying conditions and COVID-19 outcomes can guide public health strategies and resource allocation during the pandemic.

## Conclusion

The study highlights the impact of underlying conditions on COVID-19 outcomes, especially cardiovascular and chronic conditions leading to increased hospitalizations. It was resulted that while incurable diseases and cancer are associated with lower recovery, those without underlying conditions show higher recovery. Moreover, pulmonary disease may correlate with better recovery and shorter hospital stays. In this regard, individuals with cardiovascular and chronic disease face higher hospitalization risks and lower recovery. While, individuals with pulmonary, cardiovascular, diabetes, and cancer conditions are at high risk of COVID-19 mortality. However, the exact mechanisms are not fully understood, these findings can guide clinical and public health interventions to address COVID-19 disparities. Further research is necessary to confirm and explore the underlying mechanisms, but these results offer valuable insights for public health strategies and resource allocation in combating the pandemic. Significant limitations of the study include potential recall bias or incomplete information due to retrospective data collection and the limited generalizability of findings due to sample size and population characteristics.

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### Authors' Contribution

**Conceptualization:** Alireza Atarodi, Laleh R. Kalankesh.
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**Writing–review & editing:** Alireza Hajighasemkhan, Laleh R. Kalankesh.

### Competing Interests

There is no conflict of interest in this study.

### Data Availability Statement

The datasets generated during and/or analysed during the

### Research Highlights

**What is the current knowledge?**

- Recently, the number of studies on how underlying disease can effect on COVID-19 mortality procedures has increased. There is no suitable information, tailored to the local conditions coronary cases with each underlying disease for manage and health policy during a pandemic.

**What is new here?**

- The study significantly enhances understanding of how underlying conditions affect COVID-19 outcomes.

current study are available from the corresponding author on reasonable request.

## Ethical Approval

This study received ethical approval and waiver of informed consent from Shahid Beheshti University of Medical Sciences (IR.SBMU.PHNS.REC.1402.059).

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