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# Are Asthma and COPD Risk Factors for Poor Outcomes in COVID-19? A Single-center Observational Study in the South of Iran

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## ABSTRACT

Asthma and Chronic Obstructive Pulmonary Disease (COPD) are prevalent chronic respiratory conditions that may impact clinical outcomes in patients with COVID-19. This study aimed to evaluate the influence of asthma and COPD on the outcomes of hospitalized COVID-19 patients.

This retrospective observational study, conducted in 2021 at Shahid Mohammadi Hospital, Bandar Abbas, Iran, included 1777 COVID-19 patients. Data on demographics, comorbidities, and clinical parameters were retrieved from the hospital's COVID-19 registry. Logistic regression analysis was used to evaluate the impact of asthma and COPD on clinical outcomes.

Asthma was diagnosed in 83 patients (4.7%) and COPD in 19 patients (1.0%), with a mean age of 50.5±17.5 years. The mortality rate was highest in the COPD group (31.6%), followed by the asthma group (20.5%) and the group without obstructive diseases (13.5%). No significant differences were found in intensive care unit (ICU) admission, mechanical ventilation, or mortality associated with asthma or COPD. Age and comorbidities were significant factors influencing mortality.

This study found no significant impact of asthma or COPD on ICU admission, mechanical ventilation, or mortality rates among hospitalized COVID-19 patients.

**Keywords:** Asthma; Chronic obstructive pulmonary disease; COVID-19; Mortality; Risk factors

## INTRODUCTION

COVID-19, caused by the SARS-CoV-2 virus, is a respiratory infection initially characterized by cough, fever, and sometimes shortness of breath, with a 32.2% prevalence of acute respiratory distress syndrome.[1] Although high mortality rates were initially reported, advancements in vaccines and treatments have improved control over the disease. However, further understanding is needed, particularly regarding chronic respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD), which are prevalent and might influence COVID-19 outcomes.[2-4] COPD, a progressive disease affecting the airways and

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lung tissue, is often caused by smoking and other irritants.[5-7] Asthma, characterized by airway inflammation and hyperresponsiveness, can lead to symptoms like coughing and shortness of breath.[8] Studies have shown varying prevalence rates of chronic respiratory diseases among COVID-19 patients, with some indicating that patients with pre-existing conditions who are hospitalized for COVID-19 may have poorer outcomes.[2,9,10]. This study aims to explore the impact of asthma and COPD on COVID-19 outcomes in patients hospitalized at Shahid Mohammadi Hospital in Bandar Abbas in 2021, focusing on whether these conditions increase the risk of severe complications from COVID-19.

## MATERIALS AND METHODS

### Methodology

This retrospective, observational, single-center study was conducted at Shahid Mohammadi Hospital in Bandar Abbas in 2021. A total of 1777 patients with COVID-19, diagnosed either through positive polymerase chain reaction (PCR) tests (R-RT PCR Kit, Pishtaz Teb., Iran) or classified as probable cases based on radiological findings, were evaluated. Patient data were systematically collected from the COVID-19 Registry System. The system was established under the oversight of Hormozgan University of Medical Sciences (HUMS) in collaboration with a multidisciplinary team of experts in health, information technology, and epidemiology. Retrospective data collection from the province's healthcare centers ensured the comprehensive inclusion of relevant clinical information.

### Study Design

The data collected for these patients included demographic variables (age and gender), radiological findings, COVID-19 laboratory results, average length of hospitalization, ICU admission rates, mortality rates, and the utilization of ventilators (Respina P1, Saadat., Iran) and non-invasive ventilation (Astral 150, ResMed., USA). Additionally, we categorized patients into 2 groups based on the presence or absence of asthma and COPD, using ICD-10 codes (J43-44 for COPD and J45 for asthma). All patient-related information was gathered via the hospital's COVID-19 registry system.

### Statistical Design

SPSS software (Version 21, IBM Corp., USA) was utilized for data analysis, employing descriptive statistical methods, including frequency and percentage for qualitative observations. Quantitative observations were described using the mean and standard deviation (mean ± standard deviation). To evaluate the impact of asthma and COPD on COVID-19 outcomes, a univariate logistic regression was initially applied, followed by a multivariate logistic regression for variables with a $p$ value<0.2. A $p$ value<0.05 was established as the threshold for statistical significance in all tests. This study was conducted with the approval of the hospital's ethics committee and adhered to all relevant ethical guidelines and regulations.

## RESULTS

A total of 1777 patients requiring hospitalization for COVID-19 were included in the study, with 918 (51.7%) female and 859 (48.3%) males, mean age was 50.5±17.5 years [19-100]. Nineteen patients (1.0%) and 83 (4.7%) had been diagnosed with COPD and asthma, respectively. The Shapiro-Wilk test results indicated that the data followed a normal distribution. The mean age for patients with COPD was 53.5±17.5 years, for patients with asthma 50.2±17.6 years, and for those without obstruction 50.8±17.5 years. Analysis of gender distribution across the groups revealed that males comprised 36.8% of the COPD group, 51.8% of the asthma group, and 48.3% of the group with no obstruction. no statistically significant differences were observed in age ($p$=0.106) or gender distribution ($p$=0.495) among the groups. Hypertension affected 10.5% of COPD patients, 19.3% of asthma patients, and 20.2% of those without obstruction, while acute kidney injury was reported in 10.5%, 7.2%, and 4.3% of these groups, respectively. Cardiovascular disease was more common in the COPD group (21.1%) than in the asthma group (19.3%) or the no obstruction group (14.3%). On the other hand, the asthma group showed a notably higher prevalence of diabetes (33.7%) compared to both COPD patients (10.5%) and patients without obstruction (19.6%). However, none of these comorbidities demonstrated statistically significant differences across the groups ($p$>0.05). Upon admission, vital signs such as body temperature, respiratory rate, and blood oxygen saturation were recorded for all patients. The differences

in vital signs between the groups were not statistically significant (Table 1).

76.5% of patients with COPD required invasive mechanical ventilation, compared to 87.3% of asthma patients and 89.8% without obstruction. Intensive care unit (ICU) admission was necessary for 73.7% of COPD patients, 76.5% of asthma patients, and 83.8% of those without obstruction. Mortality rates were highest in the COPD group, with 31.6% of these patients succumbing to the disease, while the death rate was 20.5% for asthma patients and 13.5% for patients without obstruction. Though these outcomes present a clear trend of higher severity for COPD patients, no significant differences were provided for mechanical ventilation, ICU admission, or death (Table 1**)**.

**Table 1. Clinicodemographic characteristics stratified according to the presence of COPD and asthma**

| | With COPD | With asthma | No obstruction | All patients | *p* |
|---|---|---|---|---|---|
| | N (%) | | | | |
| Demographics | | | | | |
| Age, y | 53.5±17.5 | 50.2±17.6 | 50.8±17.5 | 50.5±17.5 | 0.106* |
| Male | 7 (36.8) | 43 (51.8) | 809 (48.3) | 859 (48.3) | 0.495** |
| Female | 12 (63.2) | 40 (48.2) | 866 (51.7) | 918 (51.7) | |
| Comorbidities | | | | | |
| Hypertension | 2 (10.5) | 16 (19.3) | 338 (20.2) | 356 (20.0) | 0.566* |
| Cardiovascular disease | 4 (21.1) | 16 (19.3) | 240 (14.3) | 260 (14.6) | 0.235* |
| Acute kidney injury | 2 (10.5) | 6 (7.2) | 72 (4.3) | 80 (4.5) | 0.202* |
| Diabetes | 2 (10.5) | 28 (33.7) | 328 (19.6) | 358 (20.1) | 0.244* |
| Vital signs at admission | | | | | |
| Body temperature (°C) | 37.1±0.4 | 37.1±2.0 | 37.3±2.2 | 37.3±2.3 | 0.708* |
| Respiratory rate (breaths/min) | 19.3±3.9 | 19.5±4.6 | 19.8±4.6 | 19.8±4.6 | 0.704* |
| Blood oxygen saturation (%) | 90.2±7.2 | 92.0±7.5 | 92.6±7.5 | 92.6±7.5 | 0.159* |
| Outcome | | | | | |
| Invasive mechanical ventilation | 13 (76.5) | 69 (87.3) | 1,433 (89.8) | 1,515 (85.3) | - |
| ICU admission | 14 (73.7) | 62 (76.5) | 1,357 (83.8) | 1,433 (80.6) | |
| Death | 6 (31.6) | 17 (20.5) | 226 (13.5) | 249 (14.0) | |
| Total | 19 (1/0) | 83 (4/7) | 1,675 (94/3) | 1,777 (100.0) | |

ICU: intensive care unit; * chi-square; ** Mann-Whitney

**Risk Factors for Invasive Mechanical Ventilation:**

Based on the results of the univariate logistic regression analysis, all variables studied, except for asthma ($p$=0.502), COPD ($p$=0.125), and sex ($p$=0.066), have a significant impact on mechanical ventilation. Multiple logistic regression results showed each additional year of age increases the likelihood of mechanical ventilation by 1% (OR=1.01; 95% CI, 1.0–1.1). Acute kidney disease elevates this likelihood 2.23-fold (OR=2.23; 95% CI, 1.22–4.40), while hypertension increases it by 80% (OR=1.80; 95% CI, 1.2–2.7)**.**

**Risk Factors for Intensive Care Unit Admission**

The univariate logistic regression analysis showed that all studied variables, except asthma ($p$=0.94) and COPD ($p$=0.379), significantly impact ICU admission. Based on the final multiple logistic regression results each additional year of age increases the likelihood of

ICU admission by 1% (OR=1.01; 95% CI, 1.0–1.2). Acute kidney disease elevates this likelihood twice (OR=2.02; 95% CI, 1.4–3.5), while diabetes increases it by 64% (OR=1.64; CI, 1.2–2.7).

**Risk Factors for Death**

The univariate logistic regression analysis revealed that all variables studied, except for asthma ($p$=0.85) and COPD ($p$=0.71), significantly impact mortality. Finally, the results from this analysis are presented in Table 2. Each additional year of age increases mortality risk by 3% (OR=1.03; 95% CI, 1.0–1.4). Men with COVID-19 face a 32% higher risk of mortality compared to women (OR=1.32; 95% CI, 1.0–1.5). Additionally, the risk of mortality is 96% greater in individuals with cardiovascular disease than in those without this condition (OR=1.96; 95% CI, 1.3–2.9), and those with acute kidney disease have over a 5-fold increased risk compared to those without it (OR=5.04; 95% CI, 2.8–8.5) (Table 2).

**Table 2. Factors associated with death during hospital admission due to SARS-CoV2 infection: the results of the logistic regression analysis**

| | N | Simple logistic regression | | Logistic regression adjusted for age and gender | | Multiple logistic regression final model | |
|---|---|---|---|---|---|---|---|
| | | OR (95% CI) | *p* | OR (95% CI) | *p* | OR (95% CI) | *p* |
| Age, y | 1777 | 1.05 (1.0–1.1) | **<0.001** | - | - | 1.03 (1.0–1.4) | **<0.001** |
| Male gender | 859 | 1.47 (1.2–1.9) | **0.006** | - | - | 1.32 (1.0–1.5) | **0.027** |
| Hypertension | 356 | 2.92 (1.2–3.9) | **<0.001** | 1.77 (1.2–2.3) | **<0.001** | 1.37 (0.9–2.0) | 0.096 |
| Cardiovascular disease | 260 | 2.82 (2.1–3.9) | **<0.001** | 2.57 (1.7–3.6) | **<0.001** | 1.96 (1.3–2.9) | **<0.001** |
| Acute kidney injury | 80 | 4.81 (3.0–7.7) | **<0.001** | 5.12 (2.9–9.0) | **<0.001** | 5.04 (2.8–8.5) | **<0.001** |
| Diabetes | 358 | 1.94 (1.4–2.6) | **<0.001** | 1.05 (0.7–1.4) | 0.78 | - | - |
| COPD | 19 | 2.33 (0.9–6.0) | 0.071 | 1.35 (1.0–2.4) | 0.62 | - | - |
| Asthma | 83 | 1.62 (0.9–2.8) | 0.085 | 1.25 (0.6–2.5) | 0.54 | - | - |
| Body temperature (°C) | 1777 | 0.65 (0.5–0.8) | **<0.001** | 0.63 (0.5–0.8) | **<0.001** | 0.62 (0.5 – 0.8) | **<0.001** |
| Respiratory rate (breaths/min) | 1777 | 1.10 (1.1–1.2) | **<0.001** | 1.05 (1.0–1.8) | **<0.001** | 1.06 (1.0 – 1.3) | **<0.001** |
| Blood oxygen saturation (%) | 1777 | 0.59 (0.8– 0.9) | **<0.001** | 0.86 (0.8–0.9) | **<0.001** | 0.87 (0.8 – 0.9) | **<0.001** |

CI: confidence interval; COPD: chronic obstructive pulmonary disease; OR: odds ratio. Bold *p* values denote significance.

## DISCUSSION

The findings of this study align closely with the majority of existing research, which consistently identifies non-modifiable risk factors such as age, gender, and underlying health conditions, including cardiovascular disease, diabetes, kidney disease, and hypertension, as well as certain clinical parameters like body temperature, respiratory rate, and blood oxygen levels. From the outset of the pandemic, age was recognized as a significant risk factor for COVID-19.[11] Evidence strongly suggests that older adults are at greater risk for severe outcomes from the disease. Furthermore, research has shown that approximately 60% of COVID-19-related deaths have occurred in men, which is consistent with our findings.[12] This may be attributed to several factors, including biological differences in immune responses, the higher prevalence of smoking among men, and greater adherence to health behaviors by women.[13,14]

The Centers for Disease Control and Prevention (CDC) reports that individuals with chronic conditions


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such as hypertension, kidney disease, diabetes, or cardiovascular disease are at increased risk of contracting COVID-19 and experiencing severe illness. This aligns with the findings of our study. However, in our study, COPD and asthma were not significant factors affecting mortality in hospitalized COVID-19 patients. Our study's findings revealed no significant differences in demographic characteristics, clinical parameters, or underlying health conditions among COVID-19 patients across 3 groups: those with asthma, those with COPD, and those without any obstructive pulmonary disease. The clinical parameters examined, including body temperature, blood oxygen saturation, and respiratory rate, were significantly associated with COVID-19 mortality and disease severity. This is consistent with the results of other studies.[15,16]

Consistent with our results, Hansen et al [11] Found that COPD patients had slightly worse clinical parameters compared to the other 2 groups (asthma and no obstructive pulmonary disease). However, when data were standardized, this difference did not result in a higher risk and was not statistically significant. Furthermore, our study indicates that individuals with asthma and COPD do not have a higher risk of COVID-19 mortality compared to those without obstructive pulmonary disease. One hypothesis is that these patients' underlying respiratory issues and fear of severe respiratory infections may lead them to adhere more strictly to preventive measures, such as social distancing and mask-wearing, thus increasing their motivation to follow health protocols more precisely. Another plausible hypothesis suggests that the use of inhaled corticosteroids may provide some protection to the lungs of asthma and COPD patients against damage caused by respiratory viruses.

Our study also showed no significant differences in the need for intensive care, such as ICU admission or invasive ventilation, between patients with asthma or COPD and those without these conditions. Calmes et al [17] also did not identify asthma and COPD as risk factors for ICU admission or COVID-19-related mortality. Similarly, the Lekdonian cohort study[18] Found that increased mortality in COPD patients was due to other underlying conditions rather than COPD itself. Conversely, Wang et al [19] identified COPD as a significant risk factor for worsening COVID-19 symptoms and the need for intensive care, while asthma patients were less likely to require ICU admission. The difference in results between Wang's study and ours may be due to the difference in the average age of participants, $67.2 \pm 17.5$ years compared to $50.5 \pm 17.5$ years respectively.

In contrast to our results, Prohan et al [20] and Hashim et al [21] identified COPD and asthma as risk factors for higher mortality due to COVID-19. It is crucial to recognize that correlation does not necessarily imply causation. While this research indicates a relationship between these factors, further studies are needed to understand the underlying reasons fully.

There were no significant differences in demographic characteristics or clinical parameters among COVID-19 patients with asthma, COPD, or those without obstructive lung disease. Clinical factors, including body temperature, blood oxygen saturation, and respiratory rate, were associated with the severity and mortality of COVID-19. Patients with asthma or COPD did not face a higher risk of death or a greater need for intensive care compared to those without these conditions. Age, gender, and comorbidities such as cardiovascular disease and diabetes were identified as non-modifiable risk factors for COVID-19.

## STATEMENT OF ETHICS

The study was approved by the Ethics Committee of Hormozgan University of Medical Sciences (IR.HUMS.REC.1401.030)

## FUNDING

Not applicable.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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## DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding authors upon reasonable request.

## AI ASSISTANCE DISCLOSURE

Not applicable.

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