# Risk-Factor for COVID-19 Patients with Ventilator Status at Sanglah Hospital: Cross-Sectional Study

# *Faktor Risiko Pasien COVID-19 dengan Status Ventilator di RSUP Sanglah: Studi Cross-Sectional*

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**Abstract**

Corona Virus Disease 19 is a contagious infectious disease that has a major impact on all aspects of life**.** This study explores the factors associated with the need for ventilators use in COVID-19 patients**.** This cross-sectional study uses secondary data from medical records, taken by total sampling technique, of patients treated at Sanglah Hospital from March 2020 to August 2020. Only complete and clear medical record of patients diagnosed with COVID-19 were analyzed using chi-square and stepwise logistic regression with SPSS for windows 25 software. This study had received ethical approval from the Udayana University independent ethics commission with the number 1839/UN 14.2.2.VII/LT/2020. Patients with aged ≥ 50 years (OR 2.8; 95% CI 1.45—5.54)), BMI > 25 kg/m$^2$ (OR 4.5; 95% CI 1.57—13.03), alcohol consumption history (OR 3.8; 95% CI 1.35—10.81), hemoglobin level <10 g/dl (OR 3.8; 95% CI 1.74—9.15), or WBC ≥ 12.000 (OR 2.3; 95% CI 1.05—5.12), were at higher risk to use ventilator. Gender, smoking history, employment history, length of stay, having comorbidity had no significant difference in the need for a ventilator. **T**he most dominant risk factor causing worsening outcomes of COVID-19 was BMI > 25 kg/m$^2$.

Keywords: risk factor, ventilator status, COVID-19, body mass index

***Abstrak***

*Corona Virus Disease 19 merupakan penyakit menular yang berdampak besar pada semua aspek kehidupan. Studi ini mengeksplorasi faktor-faktor yang berhubungan dengan kebutuhan penggunaan ventilator pada pasien COVID-19. Penelitian ini merupakan studi potong lintang menggunakan data sekunder dari rekam medis. Pengumpulan data menggunakan teknik total sampling dengan melakukan eksplorasi rekam medis pasien yang dirawat mulai bulan Maret 2020 sampai Agustus 2020 di RSUP Sanglah. Kriteria rekam medis yang digunakan dalam penelitian adalah rekam medis yang lengkap dan jelas dari pasien terdiagnosis COVID-19. Analisis dilakukan secara deskriptif dan analitik menggunakan uji chi-square, dan regresi logistik bertahap dengan software SPSS dari windows versi 25. Penelitian ini telah mendapatkan persetujuan etik dari komisi etik independen Universitas Udayana nomor 1839/UN 14.2.2.VII/LT/2020. Total sebanyak 331 rekam medis yang dianalisis. Pasien berumur ≥ 50 tahun (OR 2,8; 95%CI 1.45-5.54), indeks massa tubuh > 25 kg/m$^2$ (OR 4.5; 95% CI 1.57—13.03), riwayat konsumsi alkohol (OR 3.8; 95% CI 1.35—10.81), kadar hemoglobin <10 g/dl (OR 3.8; 95% CI 1.74—9.15), jumlah lekosit ≥ 12.000 (OR 2.3; 95% CI 1.05—5.12), mempunyai risiko lebih besar untuk menggunakan ventilator selama perawatan. Jenis kelamin, riwayat merokok, riwayat pekerja migran, lama perawatan di rumah sakit, dan komorbiditas tidak berhubungan bermakna dengan penggunaan*

*ventilator. Indeks massa tubuh >25 kg/m$^2$ merupakan faktor risiko paling dominan terhadap perburukan pasien COVID-19 yang dinilai dari penggunaan ventilator selama dirawat di rumah sakit*

*Kata kunci: indeks massa tubuh, penggunaan ventilator, faktor risiko, COVID-19*

## Introduction

Corona Virus Disease 19 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The most affected aspects socio-economic life and health. The most pronounced socio-economic life is the loss of work for most people, especially the private sector and tourism as a result of restrictions on community activities for the prevention of COVID-19. The case of COVID-19 was first discovered in Wuhan, Hubei Province, China which then spread rapidly across the world until it was finally declared as pandemic by WHO on March 11, 2020. Cases of COVID-19 disease are increasing and as many as 29 countries have confirmed cases of COVID-19 and showed positive cases as many as 60.331 with a death toll of 1.369 more. WHO data dated June 18, 2020, showed as many as 216 countries with 8.242.999 confirmed cases and a death toll of 445.535.[1]

The 2019 novel coronavirus epidemic has spread to several countries. The impact of an epidemic depends on the number of people infected, the transmission of infection, and the spectrum of clinical severity.[2,3] Up to 7734 confirmed cases in China as of and another 90 cases have also been reported from several countries with the case fatality rate calculated to be 2.2%.[4] The first confirmed case of COVID-19 infection in the United States led to the description, identification, diagnosis, clinical course, and management of this case. This included the patient's initial mild symptoms and progressed to pneumonia on day 9 of illness.[5]

The most common symptoms at the onset of COVID-19 illness are fever, cough, and fatigue, while other symptoms include phlegm production, headache, hemoptysis, diarrhea, dyspnoea, and lymphopenia.[6,7] Several risk factors were associated with an increase in cases of death such as the age factor 65 years which was found in the study to have a relationship and as a predictor with high mortality in COVID-19 patients.[8] Dong et al study involving 2135 patients found children of all ages appeared to be susceptible to COVID-19 but there was no significant gender difference. Obesity has a detrimental effect on lung function, reducing forced expiratory volume and forced vital capacity. The high-fat mass associated with adverse changes is relevant to emerge reports of greater critical illness than COVID-19 in certain ethnicities.[10]

Data on the number of cases in Indonesia, based on June 18, 2020, obtained 42.762 positive cases with 16.798 recovered and 2.339 deaths. Data of COVID-19 in Bali Province also showed a fairly high increase in cases. On June 18, 2020, there were 895 positive cases (879 Indonesian citizens and 16 foreigners) with 553 recovering cases and 6 deaths (4 Indonesian citizens and 2 foreigners), and 336 still in the treatment process. Cases of patient visits to the COVID-19 patient post from Marchto May 2020 experienced a significant increase in cases. Medical records can be used as source document to explore cases related to COVID-19 so that they can help health institutions as learning materials for the management of COVID-19 patients in reducing poor outcomes.

Several risk factors are known to contribute to the aggravation and death of patients with COVID-19, such as age, sex, employment history[11], nutritional status, smoking history[12], alcohol consumption[13], and comorbid factors. Older age and a higher number of comorbidities are associated with higher severity and mortality in patients with COVID-19.[14] Cases of premature death from the COVID-19 outbreak have occurred mainly in the elderly, perhaps due to a weakened immune system that allows faster development of viral infections. The prevalence of COVID-19 disease and severity were related to sex, smoking, and was associated with higher ACE2 expression. Gender tendencies were associated with higher smoking rates in men than in women.[15] Obesity is an independent and causal risk factor for the development of immune-mediated disease.[16] Prevalence of comorbidities in COVID-19 patients and found that underlying diseases, including hypertension, respiratory system disease, and cardiovascular disease, may be risk factors for severe patients.[15] This

study generally aims to explore factors related to COVID-19 patients outcome especially the need for ventilator use at Sanglah Hospital.

## Method

This study is a cross-sectional using secondary data from medical records. First, case identification was carried out, and then retrospectively the patients were looked for demographic factors and factors related to the outcome of worsening conditions based on the need for intubation and the use of ventilators in COVID-19 patients treated at Sanglah Hospital Denpasar. This study used a total sampling technique by exploring the medical records of patients treated at Sanglah Hospital from March 2020 to August 2020. The medical record criteria used in the study were complete and clear medical records of patients diagnosed with COVID-19. Incomplete and unclear medical records were excluded.

Data taken from medical records was recorded and stored in files that could only be accessed by the research team. Patient data was anonymous and identified by medical record numbers. The study variables included age, sex, body mass index, smoking history, alcohol history consumption, employment history, laboratory results of hemoglobin and white blood cell examination, length of stay, comorbidity, and ventilator use. The data were analyzed descriptively in the form of mean and standard deviation and frequency, and analytically with Chi-Square, and stepwise logistic regression analysis using SPSS for windows 25 software. This study had received ethical approval from the Udayana University independent ethics commission with the number: 1839/UN 14.2.2.VII/LT/2020.

## Results

This study was conducted at Sanglah Hospital Denpasar by reviewing the medical records of COVID-19 patients. This study evaluated patient characteristics and factors that influence the outcome of patients who had been treated in a period of 6 months since pandemic. The study involved 331 medical records of confirmed COVID-19 patients.

Table 1 shows the mean age of all patient with a ventilator was 52.2 years (SD: 14.08), while of patients without ventilator was 44.4 years (SD: 17.7). There were more male than female in the ventilator group and non-ventilator group. The BMI mean of the ventilator group was 23.5 kg/$m^2$ (SD: 2.9), while of the non-ventilator was 22.7 kg/$m^2$ (SD: 2.5 kg/$m^2$). There were more smokers among ventilator patients than non-ventilator patients, as well as alcohol consumption history. Characteristics based on employment showed none of the patients with ventilator was migrant while 6 of 282 non-ventilator patients were migrant worker.

The mean of hemoglobin in the ventilator group was 12.3 gr/dl (SD: 3.4) while in the non-ventilator group was 12.6 gr/dl (SD: 2.3). The mean of white blood cell (WBC) in the in the ventilator group was 11.5 (SD: 8.4) while the mean of WBC in non- ventilator was 9.4 (SD: 5.1). The mean of the length of stay in the ventilator group was shorter (11 days: SD 7.5) than the mean the length of stay in non-ventilator group (13.7 days: SD 8.6). Accompanying conditions obtained sequentially are diabetes mellitus, heart disease, chronic kidney disease, gravida conditions, hypertension, malignancy, unspecified HIV (B24), dengue fever, transaminitis, and typhoid. The top three comorbidities were diabetes mellitus, chronic kidney disease, and heart disease.

Table 2 showed that patients with older age, BMI >25, smoking history, alcohol consumption history, hemoglobin level <10 g/dl, WBC ≥ 12.000, having comorbidity were at higher risk (OR 1.8—2.9) to use ventilator. Gender, employment history, and length of stay had no significant difference with respect to the need of ventilator.

The multivariate analysis aimed to determine the most dominant risk factors that influence the need for ventilator of COVID-19 patients treated at Sanglah Hospital.

Table 3 showed that BMI had the highest OR value. BMI > 25 kg/$m^2$ can cause the outcome of being on a ventilator in COVID-19 patient 4.5 time higher than patient with BMI ≤25 kg/$m^2$.

## Discussion

### Age and COVID-19 Patient Ventilator Status

The results showed that older age patients, 50 years above, were at higher risk to have poor outcome compared to patient aged < 50 years,

**Table 1. Characteristics of COVID-19 Confirmed Patients by the Need of Ventilator Support**

| Characteristics of subject | Outcome | |
|---|---|---|
| | Ventilator (n=49) | Non-ventilator (n=282) |
| Age (mean ±SD) | 52.2±14.08 | 44.4±17.7 |
| Gender (n, %) | | |
| Male | 30 (61.2%) | 146 (51.8%) |
| female | 19 (38.8%) | 136 (48.2%) |
| BMI (mean ±SD) | 23.5±2.9 | 22.7±2.5 |
| History of smoking (n, %) | | |
| Yes | 6 (12.2%) | 9 (3.2%) |
| No | 43 (13%) | 273 (96.8%) |
| Alcohol history (n, %) | | |
| Yes | 8 (16.3%) | 13 (4.6%) |
| No | 41 (83.7%) | 269 (95.4%) |
| Employment history (n, %) | | |
| Migrant | 0 (0%) | 6 (2.1%) |
| Non-migrant | 49 (100%) | 276 (97.9%) |
| Routine blood (mean ±SD) | | |
| Hemoglobin | 12.3±3.4 | 12.6±2.3 |
| WBC | 11.5±8.4 | 9.4±5.1 |
| Length of stay (mean ±SD) | 11±7.5 | 13.7±8.6 |
| Comorbidity (n, %) | | |
| No co-morbidities | 24 (49.0%) | 188 (66.7%) |
| Diabetes mellitus | 7 (14.2%) | 22 (7.8%) |
| Heart disease | 4 (8.2%) | 21 (7.4%) |
| Hypertension | 2 (4.1%) | 12 (4.3%) |
| Chronic kidney diseases | 7 (14.2%) | 13 (4.6%) |
| Malignancy | 1 (2.0%) | 8 (2.8%) |
| Gravida/pregnant | 1 (2.0%) | 16 (5,7%) |
| B24 (unspecified HIV disease) | 1 (2.0%) | 1 (0.4%) |
| Other (Dengue, transaminitis, thypoid) | 2 (4.1%) | 1 (0.4%) |

with adjuster odds ratio 2.8 (95% CI: 1.45-5.54). The results of this study are consistent with that of Biswas et al (2021)however, evidence for the association of sex, age, and comorbidities on the risk of mortality is not well-aggregated yet. It was aimed to assess the association of sex, age, and comorbidities with mortality in COVID-2019 patients. Methods: Literatures were searched using different keywords in various databases. Relative risks (RRs who found that patients aged 50 years were associated with a 15.4-fold significantly increased risk of death compared to patients aged <50 years (RR 15.44: 95% CI 13.02-18.31) ; p < 0.00001). This gives the conclusion that patients aged ≥50 years need more attention for the occurrence of worsening conditions. Older age and a high number of co-morbidities are associated with higher severity and mortality in patients with COVID-19.[17] The mean age of all patients admitted to the ICU in the Sayad et al study was 65.1 years ± 17.1 years, with a mean age in males of 61.4 ± 18.5 years (23-90 years) and a mean age of 70.5 ± 13.2 years (39–89 years) in women.[14]

The results of the same study with different age categories aged 60 years showed more severe clinical manifestations, greater severity, and a longer course of disease compared to those aged <60 years so that closer monitoring and more

**Table 2. The Correlation of Age, Gender, Employment History, Bmi, Smoking History, Alcohol Consumption History, Hemoglobin, Wbc, Comorbidity, and Length of Stay with Ventilator Status**

| Variable | Outcome | | | | OR | 95%CI | p |
|---|---|---|---|---|---|---|---|
| | Ventilator | | Non ventilator | | | | |
| | n | % | n | % | | | |
| Age | | | | | 2.3 | 1.35-3.97 | 0.002* |
| ≥ 50 years old | 31 | 21.9 | 110 | 78.1 | | | |
| < 50 years old | 18 | 9.4 | 172 | 90.6 | | | |
| Gender | | | | | 1.3 | 0.81-2.36 | 0.221* |
| Male | 30 | 17.0 | 146 | 83.0 | | | |
| Female | 19 | 12.2 | 136 | 87.8 | | | |
| Employment History | | | | | 1 | 1.12-1.23 | 0.303* |
| Migrant | 0 | 0 | 6 | 100 | | | |
| Non-migrant | 49 | 15.0 | 276 | 85.0 | | | |
| BMI | | | | | 2.5 | 1.33-5.01 | 0.009* |
| > 25 kg/m2 | 7 | 35.0 | 13 | 65.0 | | | |
| 18 -25 kg/m2 | 42 | 13.5 | 269 | 86.5 | | | |
| Smoking history | | | | | 2.9 | 1.49-5.79 | 0.005* |
| Yes | 6 | 40.0 | 9 | 60.0 | | | |
| No | 43 | | 273 | | | | |
| Alcohol consumption history | | | | | 2.8 | 1.55-5.32 | 0.002* |
| Yes | 8 | 38.0 | 13 | 62.0 | | | |
| No | 41 | 13.2 | 269 | 86.8 | | | |
| Haemoglobin | | | | | 2.3 | 1.34-4.13 | 0.004* |
| < 10 gr/dl | 12 | 30.0 | 28 | 70.0 | | | |
| ≥ 10 gr/dl | 37 | 12.7 | 254 | 87.3 | | | |
| WBC | | | | | 2.3 | 1.28-3.88 | 0.006* |
| ≥ 12.000 | 13 | 28.2 | 33 | 71.8 | | | |
| < 12.000 | 36 | 12.6 | 249 | 87.4 | | | |
| Co-morbid | | | | | 1.8 | 1.12-3.14 | 0.015* |
| Yes | 25 | 21.1 | 93 | 78.9 | | | |
| No | 24 | 11.2 | 189 | 88.8 | | | |
| Length of stay | | | | | 0.7 | 0.41-1.23 | 0.224* |
| ≥ 12 days | 18 | 12.1 | 130 | 87.9 | | | |
| < 12 days | 31 | 16.9 | 152 | 83.1 | | | |

*Chi-Square

**Table 3. Risk Factors of Ventilator Use in COVID-19 Patients at Sanglah Hospital**

| Variable | B | Adj OR | 95% CI | p |
|---|---|---|---|---|
| Age | 1.004 | 2.8 | 1.45-5.54 | 0.002* |
| BMI | 1.510 | 4.5 | 1.57-13.03 | 0.005* |
| Alcohol comsumption history | 1.343 | 3.8 | 1.35-10.81 | 0.011* |
| White blood count | 0.842 | 2.3 | 1.05-5.12 | 0.038* |
| Haemoglobin | 1.384 | 3.9 | 1.74-9.15 | 0.001* |

*Regression logistic stepwise

needed for the elderly.[18]. Further evaluation of the age distribution based on morbidity to prepare for the type and possibility of a second wave of COVID-19.[19]

**Gender and COVID-19 Patients Ventilator Status**

The proportion of male patient with ventilator was higher than female patient but not statistically significant in this study. The results of this study differ from Biswas et al (2021) however, evidence for the association of sex, age, and comorbidities on the risk of mortality is not well-aggregated yet. It was aimed to assess the association of sex, age, and comorbidities with mortality in COVID-2019 patients. Methods: Literatures were searched using different keywords in various databases. Relative risks (RRs that male COVID-19 patients were associated with a significantly increased risk of death compared to women (RR 1.86: CI:1.67-2.07;p <0.00001). Cases of death in male tended to be more serious than female (p= 0.035) and those who died from COVID-19 were 2.4 times that of female (70.3 vs 29.7%, p = 0.016) so that male with COVID-19 is more at risk for poorer outcomes and death, regardless of age.[17]Female hormonal protection, the female immune system is superior to male. Women exhibit more protective behaviors (eg. handwashing) and follow more protective guidelines, which greatly reduces the chance of infection.[20]

Some evidence obtained from various clinical reports also confirmed a higher prevalence of respiratory tract infections in men compared to women including some acute viral infections.[21] The underlying mechanisms behind these differences are complex and involve several factors including behavioral, genetic, hormonal, and immunological factors. Androgen-dependent TMPRSS2 expression may also explain the prevalence of COVID-19 among the male population. Males show higher expression of pro-inflammatory cytokines.[13]

**Employment History and COVID-19 Patient Ventilator Status**

The results showed that a history of work as a migrant was not associated with poor outcomes in COVID-19 patients, such as the use of ventilators. At the beginning of the COVID-19 pandemic, the government was very concerned about the existence of migrant workers. This is due to the repatriation of migrant workers as a result of the pandemic. Research by Kusumastuti et al (2020) conducted a survey and the findings showed that Indonesian migrant workers had implemented health protocols well to avoid the spread of COVID-19.[11]

Pandemics affect most migration movements around the world. Country of origin and destination implement strict entry and/or exit rules, to control the pandemic.[22] The pandemic has increased stigma and discrimination against migrants for having been accused of contributing to the spread of disease. Migrant families and communities in the countries of origin of migrants are expected to be significantly affected as the decline in income primarily affects food security, nutrition, and access to basic services, such as health care and education.[23]

**Nutritional Status and COVID-19 Patients Ventilator Status**

A better understanding of the behavior of the SARS-CoV-2 virus and the possible risk factors involved in poor outcomes has become an urgent need[16.] The results of this study showed that there was a relationship between BMI and the need of ventilator for COVID-19 patients with adjusted OR 4.5 (95% CI 1.57-13.03). BMI > 25 kg/m2 can be a risk factor for worsening outcomes for COVID-19 patients.

The results of the study by Peres et al (2020) found that obesity predicts poor clinical evolution in patients with COVID-19. Obesity body mass index may be a risk factor for severe COVID-19 infection as it reduces cardiorespiratory protective reserves and potentiates the emerging immune dysregulation, at least to prevent progression to critical illness and organ failure in a proportion of patients with COVID-19. Concerning immune response, there is a clear association between obesity and basal inflammatory status characterized by higher circulating interleukin and C-reactive protein levels.[10]

Adipose tissue in obesity is proinflammatory with increased expression of

cytokines and particularly adipokines. Weight and muscle mass begins to decrease with advancing age but relative fat mass increases especially in those with comorbidities such as cardiovascular and respiratory. Obesity increases thrombosis which is relevant to severity, prothrombotic disseminated intravascular coagulation, and high venous thromboembolism. Obesity also has adverse effects on lung function, reducing forced expiratory volume and vitality capacity.[10]

**Smoking History and COVID-19 Patients Ventilator Status**

The results showed that there was a relationship between smoking history and the ventilator status of COVID-19 patients with odds ratio 2.9 (95% CI 1.49-5.79) but after adjusted with other variables it was not significant. Early research suggests a higher incidence of chronic disease (i.e. hypertension), risk and/or health-seeking behavior (i.e. smoking) among men, as well as immunological differences. Men appear to be more severely affected than women reflecting gender differences in tobacco use. Similarly, gender differences in physical activity, eating habits, occupational exposure to smoke and dust, and related comorbidities can play a role.[12]

COVID-19 deaths were also significantly associated with certain co-morbidities such as diabetes, kidney disease, hypertension, and cardiovascular disease. This condition is very closely related to smoking and alcohol consumption which has a higher relationship with men, especially in Asian and African countries.[13] History of smoking found 1.4 times (RR = 1.4, CI: 0.98-2.00) had severe symptoms of COVID-19 and about 2.4 times had the chance to be admitted to the ICU with the need for mechanical ventilation or die compared to nonsmokers. Smoking is associated with worsening and adverse outcomes of COVID-19.[24]

**History of Alcohol Consumption with COVID-19 Patients Ventilator Status**

The results showed that there was a relationship between a history of alcohol consumption and the ventilator status of patients with adjusted OR 3.8 (95% CI 1.35-10.81). History of alcohol consumption can be a risk factor for worsening outcomes of patients. Alcohol was identified as the most widely used psychoactive substance (73%). More than 30% changed their drinking habits due to the pandemic with 16% drinking less, while 14% consuming more. Stress-related coping strategies found that current alcohol drinkers were significantly less able to find anything positive about a pandemic situation and were mentally less able to cope. Those who drank more were now found to be drinking more intensively before the pandemic began.[25] Monitoring consumption levels both during and after the pandemic will be necessary to understand the effects of COVID-19 as well as to differentiate it from existing alcohol control policies.[26]

**Comorbidity and COVID-19 Patient Ventilator Status**

The results of the study showed that there was a relationship between comorbid disease and the outcome of patients with odds ratio 1.8 (95% CI 1.12-3.14) but after adjusted with other variables, it was not significant. The results of this study also found one patient with typhoid who had a worsening condition. This result is in line with study [27] which found there was a relationship between typhoid disease and the severity of COVID infection. Comorbid diseases can be a risk factor for worsening outcomes for COVID-19 patients. Comorbidities are also associated with a significantly increased risk of death such as kidney disease, cerebrovascular disease, cardiovascular disease, respiratory disease, diabetes, hypertension, and cancer but not liver disease.[15] The renin-angiotensin system plays an important role in human physiology by regulating blood pressure and electrolyte fluid homeostasis. SARS-CoV-2 interacts with the renin-angiotensin system via the ACE2 receptor present in cell membranes.[28] ACE2 acts as a defensive protein under various disease conditions such as hypertension, diabetes, and cardiovascular. Patients with these comorbidities come under the category of high risk of SARS-CoV-2 infection and have a much higher mortality rate than patients without these comorbidities. The interaction of ACE2 with the SARS virus is considered to be the main factor responsible for

its massive pathogenicity.[29]Diabetes is considered a risk factor for the rapid progression and poor prognosis of Covid. Intensive attention should be paid to patients with diabetes.[30] Diabetes mellitus or high risk of diabetes mellitus, obesity, and excess fat ectopic for impaired insulin resistance and reduced cell function. COVID-19 may directly disrupt pancreatic cells through an interaction with the angiotensin-converting enzyme 2.[10]

**Hemoglobin, Leukocyte Levels and COVID-19 Patient Ventilator Status**

The results showed that there was a relationship between hemoglobin and the ventilator status of patients with adjusted odds ratio 3.9 (95% CI: 1.74-9.15). Hemoglobin can be a risk factor for worsening outcomes in COVID-19 patients. Evaluation of laboratory indicators early and during COVID-19 can help to tailor appropriate treatment and provide specialized and appropriate care for those in need (31). Hemoglobin disorders are generally not associated with a respiratory condition. However, complications involving the heart, lungs, and immune system can occur in SARS-CoV-2 positive patients and lead to very serious complications.[32]

The study of Algassim et al (2021)LDH, and ferritin, all have been associated with the poor prognosis of COVID-19. In a disease where there are acute inflammation and compromised oxygenation, we investigated the impact of initial hemoglobin (Hgb found lower baseline hemoglobin than those admitted outside the ICU. The prevalence of anemia (Hgb < 12.5 g/dL) was 65% in ICU-treated patients while 43% in non-ICU patients. Direct agglutination test for all anemic patients showed that 14.7% of ICU patients and 9% of non-ICU patients had autoimmune hemolytic anemia.[33] Pneumonia in COVID-19 results in diffuse alveolar damage and impairs gas exchange.[34] COVID-19 can cause a progressive decrease in hemoglobin.[35] SARS-CoV-2 in infected individuals causes autoimmune hemolytic anemia (AIHA). AIHA is associated with many infections especially viral infections. [36, 37]The average Hgb level was 140.2 ± 24.3 g/L in all patients. A total of 26 patients out of 74 respondents (35.1%) required tracheal intubation with a mean Hgb level of 137.3 ± 23 g/L compared with a mean level of 141.8 ± 25.1 g/L in 48 patients who did not require intubation (P=0.44). The prevalence of anemia in patients is related to the worsening of the condition of COVID-19 patients.[38] Clinical laboratories provide important information regarding the COVID-19 diagnosis, prognosis, and response to therapy. The results showed that there was a relationship between WBC and the outcome of patients with adjusted odds ratio 2.3 (95% CI 1.05 - 5.12). The study of [14] showed a significant relationship between leukocytosis and mortality in COVID-19 patients. The different results of COVID-19 severity were not associated with white blood cells but instead, a high basophil count was associated with the risk of COVID-19 severity. Efforts to increase basophil production may be an effective therapeutic strategy.[39] The coronavirus-2 syndrome often results from alveolar injury that impedes airway capacity and multi-organ failure. Both of these are associated with cytokine hyperproduction, also known as cytokine storm or cytokine release syndrome. The severity of the disease results in changes in the circulating leukocyte subset and cytokine secretion.[40]

**Length of Stay and COVID-19 patient Ventilator Status**

The results showed that there was no relationship between the length of stay and the use of ventilator in COVID-19 patients. Length of stay is not a risk factor for worsening outcomes for COVID-19 patients. The study of [41] found that the length of treatment was longer compared to other places because of the different criteria for treatment and the different timing in determining the pandemic.[41] The length of treatment depends on the level of care required, as well as the geographic setting to vary the COVID-19 treatment guidelines.[42] Significant differences between capacity and care needs require the calculation of patient characteristics to provide an accurate prediction of the number of beds needed.[43]

**Research Limitations**

Concomitant conditions were found to be related to the outcome of worsening of the patient's condition but in this study, we did not explore in-depth the effect of comorbid

conditions such as diabetes mellitus, heart disease, hypertension, chronic kidney disease, malignancy, pregnant conditions, unspecified HIV disease (B24) and dengue fever, on the worsening of the patient. COVID-19 patients have various clinical manifestations including the results of laboratory indicators. This study is limited to only examining hemoglobin and WBC on patient outcomes, so further research is needed that explores parameters of blood test results such as platelets, lymphocytes, basophils, and monocytes.

## Conclusion

The results of the study and discussion can be concluded that there is an association of age, BMI, alcohol consumption history, hemoglobin level, and white blood cell count with the need of ventilator in COVID-19 patients treated in hospital. Gender, smoking history, employment history, length of stay, having comorbidity had no significant difference with respect to the need of ventilator. Body mass index was found to be the most dominant risk factor causing worsening outcomes in COVID-19 patients. Body mass index was found to be the most dominant risk factor causing worsening outcomes in COVID-19 patients.

The result of this study could be a guideline for health worker in managing the handling of COVID-19 patients by controlling risk factors that are known to play a role in the outcomes. This research can provide valuable knowledge in handling COVID-19 patients and can be used as a basis for further research. Suggestions for evaluation of laboratory indicators early and during COVID-19 can help tailor appropriate care and provide specialized and prompt care for those in need.

## Conflict of Interest

All authors declare there is no conflict of interest in this study

## Eligibility of Research Ethics

This research has received ethical approval from the ethics commission of Udayana University with the number: 1839/UN 14.2.2.VII/LT/2020

## Author Contribution

PS (Concept and design of study, analysis, and interpretation of data), INW (data collection method, data collection, interpretation of data), KSN (research results, research discussion, final approval of the version to be published), LPN (research discussion, important intellectual content), MAM (drafting the article or revising it critically for important intellectual content), IWS (data analysis techniques and data presentation, final approval of the version to be published).

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