Mortality Prediction in ICU Patients on Mechanical Ventilation at RSUD Pasar Minggu

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Abstract.

Intensive Care Unit (ICU) is a vital unit for critically ill patients. The ICU is known as an area with the highest mortality rates. One of the primary interventions in the ICU is the use of invasive mechanical ventilation, an essential therapy to support respiratory function. Although effective in saving lives, mechanical ventilation also carries the risks of serious complications. This study aimed to identify predictor factors for mortality in patients on mechanical ventilators in the ICU. This retrospective cohort study analyzed medical records from 424 patients, were obtained through simple random sampling from 614 patients meeting the inclusion and exclusion criteria. Data analysis was conducted using IBM SPSS Statistics version 22. Bivariate analysis was conducted using the chi-square test to identify associations between independent variables and mortality, followed by multivariate analysis using logistic regression to determine significant predictors of mortality. The mortality rate was 51%. Multivariate analysis identified nine mortality factors. ICU admission from inpatient ward (RR=2.688), GCS (RR=2.674), respiratory failure (RR=18.187), ROSC (RR=6.754), septic shock (RR=3.885), renal failure (RR=2.024), and reintubation (RR=2.257) were found to increase the risk of mortality, while length of ICU stay (RR=0.323) and length of ventilator use (RR=0.313) were identified as protective factor. On the other hand, variables such as age, gender, pneumonia, stroke, and tracheostomy did not have a real influence on mortality in this study. ICU admission from inpatient ward, GCS, respiratory failure, ROSC, septic shock, renal failure, and reintubation were found to be predictors of mortality in patients with mechanical ventilator in ICU.

Keywords: *Mortality; Predictor; Risk factor; Mechanical ventilator and ICU.*

I. INTRODUCTION

The Intensive Care Unit (ICU) is a vital unit within the healthcare system that provides intensive care for critically ill patients at risk of organ failure (Marshall et al., 2017). Globally, the ICU is known as an area with the highest mortality rates, and patient death rates vary significantly, ranging from 8% to 26.2%, depending on patient condition, infrastructure, and the availability of medical personnel in a region (Melaku et al., 2024). Research at RSUD Pasar Minggu is essential because the mortality rate in its Intensive Care Unit (ICU) reached 49.8% in 2024. Compared to other hospitals, the ICU mortality rate at RSUD Pasar Minggu is considered high. Several major hospitals have recorded varying ICU mortality rates, such as Dr. Kariadi General Hospital with the highest ICU mortality rate at 49.5%, a regional hospital in West Java with an ICU mortality rate of 29.9%, Sanglah General Hospital in Denpasar at 24.8%, and Wajo Regency General Hospital in South Sulawesi with the lowest ICU mortality rate at 2.4% (Silaban & Tarigan, 2024). One of the primary interventions in the ICU is the use of invasive mechanical ventilation, an essential therapy to support respiratory function in patients with severe respiratory failure (Mora Carpio & Mora, 2023). Although effective in saving lives, the use of mechanical ventilators also carries the risk of serious complications, such as nosocomial infections and lung injury, which can increase morbidity and mortality rates (Chiwhane & Diwan, 2016). Previous studies have identified several factors that influence mortality in patients using mechanical ventilators, including demographic characteristics such as advanced age (Parpucu et al., 2024) and gender (Maisa et al., 2021).

Furthermore, clinical factors such as level of consciousness (Glasgow Coma Scale/GCS < 8), comorbid medical conditions (such as septic shock, pneumonia, stroke, and acute kidney failure), as well as the duration of ICU and ventilator care, have also been proven to correlate strongly with poor clinical outcomes (Viarasilpa et al., 2024; Higgins et al., 2019).Although many global studies have discussed ICU mortality risk factors, specific data regarding the situation in Indonesian hospitals, especially in regional hospitals, remain limited. Based on internal data from RSUD Pasar Minggu, the total number of ICU patients

treated from January to December 2024 was 837, with 417 of them dying, resulting in an average mortality rate of 49.8%. This high mortality rate indicates a critical issue that needs further analysis. Given that most of the patients who died (233 out of 379) in the ICU at Sanglah General Hospital in Denpasar were mechanical ventilator users (Brahmani & Hartawan, 2019), there is an urgency to specifically investigate the factors influencing mortality rates in patients with this intervention.

Although factors such as age, GCS, and comorbidities have been identified as general predictors of mortality, no comprehensive study has specifically examined and validated these risk factors in the ICU patient population at RSUD Pasar Minggu. This gap creates a need for focused research to identify the determinant factors contributing to the high mortality rate of ICU patients, particularly those undergoing mechanical ventilation.Therefore, the purpose of this study is to comprehensively identify and analyze the mortality risk factors in ICU patients using mechanical ventilators at RSUD Pasar Minggu. The results of this study are expected to provide a deeper understanding of the characteristics of high-risk patients. This information is crucial for developing strategic recommendations, which include improving care protocols, resource allocation, and healthcare personnel training. Ultimately, the implementation of these recommendations is expected to enhance the quality of care, improve patient clinical outcomes, and significantly reduce the mortality rate in the ICU at RSUD Pasar Minggu.

II. METHODS

This study utilized a retrospective cohort design to predict the factors influencing mortality in patients using mechanical ventilators. This design was chosen as it allows for tracing the temporal relationship between exposure to predictor factors and clinical outcomes. The study was conducted in the ICU of RSUD Pasar Minggu by analyzing patient medical record data from January to December 2024. The target population for this study was all patients treated in the ICU of RSUD Pasar Minggu throughout 2024, totaling 837 patients. The study population, or accessible population, consisted of patients who used mechanical ventilators, had complete medical records, and were admitted to the ICU from the Operating Room (OR), Emergency Department (ED), or inpatient wards. From the total target population, 614 patients met the criteria for the study population after excluding 30 patients who were re-admissions, were already on a ventilator before ICU admission, or were referred/discharged before their treatment was complete.The sample size was determined using the Lemeshow formula, with a minimum sample size of 385. An additional 10% was added, bringing the total required sample to 424 patients. The sampling technique used was probability sampling with a simple random sampling method from the study population of 614 patients.

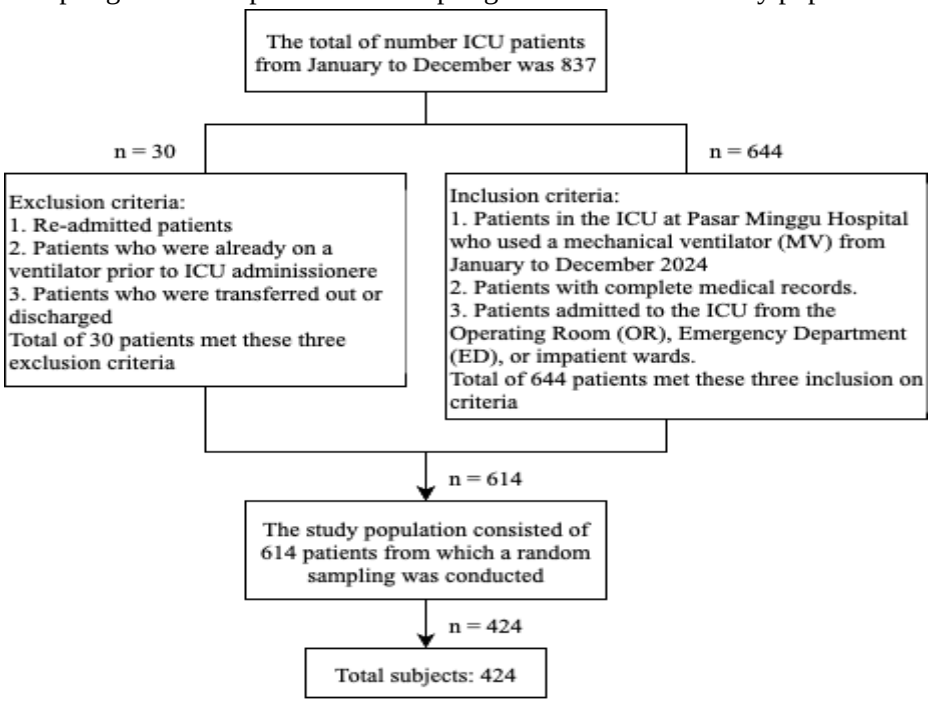

Fig 1. Subject selection flowchart

This study examined the relationship between several independent variable and the dependent variable, which was patient mortality (Survived or deceased). The independent variables analyzed included demographic data such as age and gender, as well as clinical and treatment factors like ICU admission source, Glasgow Coma Scale (GCS), pneumonia, septic shock, stroke, renal failure, duration of ventilator use, length of ICU stay, Return of Spontaneous Circulation (ROSC), respiratory failure, reintubation, and tracheostomy.The selection criteria for the research subjects included inclusion criteria namely, ICU patients who used mechanical ventilators between January and December 2024, had complete medical records, and were admitted to the ICU from the OR, ED, or inpatient wards. Conversely, the exclusion criteria included patients who were discharged before completing treatment, patients who were already on a ventilator before ICU admission, and patients with a history of readmission, to ensure the analyzed data was valid and relevant. Data analysis was conducted using IBM SPSS Statistics version 22 and was divided into three stages: univariate, bivariate, and multivariate analysis.This research obtained ethical approval from the Respati University Research Ethics Committee (Number: 223/SK.KEPK/UNR/IV/2025) and the RSUD Pasar Minggu Ethics Committee (Number: 59/KOMETHUK/VI/2025). The confidentiality of patient medical records will be fully maintained by the researchers.

III. RESULT AND DISCUSSION

In this study, out of a total of 424 patients using ventilators, 215 patients (51%) deceased and 209 patients (49%) survived, as written in table 1.

Table 1. Frequency Distribution of Mortality in Ventilator-Dependent Patients

Variabel		%
Survived	209	49
Deceased	215	51
Total	424	100

Bivariate Analysis

In this study, a bivariate analysis was first performed to assess the relationship between each variable and patient mortality in the ICU. Chi-square tests were used for categorical data to determine the p-value. In the ICU, the majority of deceased patients were elderly individuals (> 60 years old), accounting for 47% of the total deaths. The results of the bivariate analysis showed that elderly patients (> 60 years old) had an RR of 1.758 (95% CI: 1.051-2.941) with a p-value of 0.032. This indicates that elderly patients had a 1.758 times higher risk of death compared to young adults (17-44 years). The late adulthood age group (45-59 years) also showed an increased risk of death (RR = 1.523) compared to young adults; however, this relationship was not significant (p-value = 0.121).Male patients comprised 117 deaths (54%). Male patients had an RR of 1.276 (95% CI: 1.061-1.535; p=0.014), demonstrating a 1.276 times higher risk of death compared to females, and this was significant.Most deaths (108 patients, or 50%) originated from the Emergency Department (ED). Patients from the Emergency Department (ED) showed a 3.323 times higher risk of death (RR = 3.323; 95% CI: 1.885-5.548; p=0.000) compared to the operating room. Similarly, patients admitted from inpatient wards had an almost 8.887 times higher risk of death (RR = 8.887; 95% CI: 4.476-16.640; p=0.000) than those admitted from the operating room.

Both findings were statistically significant. Furthermore, the majority of patients who died had a Glasgow Coma Scale (GCS) score of less than 8, reaching 160 patients (74%). Glasgow Coma Scale (GCS) of ≤8 had an RR of 0.484 (95% CI: 0.382-0.614) with a p-value of 0.000. This indicates that patients with a GCS of ≤8 had a death risk approximately 0.484 times that of patients with a GCS of >8, and this was statistically significant. The majority of deaths also occurred within a short ICU stay, with 148 patients (69%) having a length of stay of 7 days or less. Patients with an ICU length of stay of ≤7 days had a 1.352 times higher risk of death (RR = 1.352; 95% CI: 1.094-1.671; p=0.005) compared to patients with an ICU stay of >7 days, and this was statistically significant. Most of the patients who died were diagnosed with pneumonia (153 patients or 71%). Patients with pneumonia had a mortality risk of RR = 0.655 (95% CI 0.526-0.817) compared to those without pneumonia, which was statistically significant (p = 0.000).Most of the patients who died were also diagnosed with septic shock (156 patients or 73%).

Patients with septic shock showed a mortality risk of RR = 0.470 (95% CI 0.374-0.592) compared to those without septic shock, which was also statistically significant (p = 0.000). Similarly, most of deceased patients had renal failure (111 patients or 52%). Patients with renal failure had a mortality risk of RR = 0.603 (95% CI 0.502-0.704) compared to those without renal failure, and this was statistically significant.Most of deceased patients had respiratory failure (213 patients or 99%). Patients with respiratory failure had a mortality risk of 0.067 (95% CI 0.017-0.262) compared to those who did not, which was statistically significant.Additionally, patients with a return of spontaneous circulation (ROSC) had a lower mortality risk, with an RR of 0.554 (95% CI 0.462-0.665) compared to those who did not have ROSC (194 patients or 90%), and this was statistically significant. The majority of deaths occurred in patients with ventilator use longer than 48 hours (140 patients, 65%), those without reintubation (177 patients, 82%), and those without tracheostomy (189 patients, 88%). Bivariate analysis showed that the duration of ventilator use (RR = 1.172, CI: 0.968–1.419, p = 0.139), reintubation (RR = 0.905, CI: 0.714–1.418, p = 0.509), and tracheostomy (RR = 1.016, CI: 0.761–1.357, p = 1.000) did not demonstrate a statistically significant association with mortality.

Table 2. Distribution of Mortality in Ventilator-Dependent Patients

Variabel	Mortalitas				Total		RR	(95% CI)	P value
	Survived		Deceased						
	n	%	n	%	n	%			
Age (years)									
Young adults:17-44	52	25	36	17	88	21			
Middle-aged: 45-59	74	35	78	36	152	36	1.523	0.895-2.589	0.121
Elderly > 60	83	40	101	47	184	43	1.758	1.051-2.941	0.032
Total	209	100	215	100	424	100			
Gender									
Female	70	33.5	98	46	168	40			
Male	139	66,5	117	54	256	60	1.276	1.061-1.535	0.014
Total	209	100	215	100	424	100			
Patient Admission Source									
Operating Room	73	35	23	11	96	23			
Inpatient Ward	30	14	84	39	114	27	8.887	4.476-16.640	0.000
ED	106	51	108	50	214	50	3.323	1.885-5.548	0.000
Total	209	100	215	100	424	100			
GCS									
GCS > 8	121	58	55	26	176	41.5			
GCS ≤ 8	88	42	160	74	248	58,5	0.484	0.382-0.614	0.000
Total	209	100	215	100	424	100			
Length of Stay in ICU									
1) ≤ 7 hari	115	55	148	69	263	62			
2) > 7 hari	94	45	67	31	161	38	1.352	1.094-1.671	0.005
Total	209	100	215	100	424	100			
Pneumonia									
No	100	48	62	29	162	38			
Yes	109	52	153	71	262	62	0.655	0.526-0.817	0.000
Total	209	100	215	100	424	100			
Septic shock									
Without septic shock	130	62	59	27	189	45			
with septic shock	79	38	156	73	235	55	0.470	0.374-0.592	0.000
Total	209	100	215	100	424	100			
Renal failure									
No	154	74	104	49	258	61	0.603	0.502-0.704	0.000
Yes	55	26	111	52	166	39			

Total	209	100	215	100	424	100			
Respiratory failure									
No	50	24	2	1	52	12			
Yes	159	76	213	99	372	88	0.067	0.017-0.262	0.000
Total	209	100	215	100	424	100			
ROSC									
No	206	99	194	90	400	94			
Yes	3	1	21	10	24	6	0.554	0.462-0.665	0.000
Total	209	100	215	100	424	100			
Stroke									
No	154	74	172	80	326	77			
Yes	55	26	43	20	98	23	1.202	0.940-1.538	0.154
Total	209	100	215	100	424	100			
Duration of Ventilator Use									
1) ≤ 48 hours	58	28	75	35	133	31			
2) > 48 hours	151	72	140	65	291	69	1.172	0.968-1.419	0.139
Total	209	100	215	100	424	100			
Reintubasi									
No	178	85	177	82	355	84			
Yes	31	15	38	18	69	16	0.905	0.714-1.148	0.509
Total	209	100	215	100	424	100			
Trakestomi									
No	183	88	189	88	372	88			
Yes	26	12	26	12	52	12	1.016	0.761-1.357	1.000
Total	209	100	215	100	424	100			

ICU = Intensive Care Unit, GCS = Glasgow Coma Scale, CI = Confidence Interval, ED = Emergency Department, ROSC = Return of Spontaneous Circulation

Multivariate Analysis

After performing bivariate analysis using Chi-square tests, variables with a p-value of ≤ 0.25 in the bivariate analysis were then selected for inclusion in the multivariate model to find relationships between multiple variables simultaneously.

Table 3. Final Model of Multivariate Logistic Regression Analysis of Factors Associated with Mortality in Patients Requiring Ventilator Support

Variabel	p-Value	RR	95% CI		Δ R %
			Lower	Upper	
GCS	0,000	2.674	1.604	4.457	0.15
ICU Admission Source: Inpatient Ward	0.023	2.688	1.149	6.291	6.37
Length of Stay in ICU	0,000	0.323	0.171	0.610	5.28
Septic shock	0,000	3.885	2.318	6.510	1.17
Renal failure	0.006	2.024	1.224	3.347	5.14
Respiratory failure	0,001	18.187	3.537	93.513	7.31
ROSC	0.017	6.754	1.403	32.508	0.82
Duration of Ventilator Use	0.001	0.313	0.159	0.619	2.96
Reintubasi	0.029	2.257	1.088	4.684	3.01

GCS = Glasgow Coma Scale, ROSC = Return of Spontaneous Circulation, ICU= Intensive Care Unit, CI = Confidence Interval

This section presents the results of the logistic regression analysis. The findings showed that several factors were significantly associated with mortality, including GCS (RR = 2.674; 95% CI: 1.604-4.457; p = 0.000), ICU admission source from an inpatient ward (RR = 2.688; 95% CI: 1.149-6.291; p = 0.023), ICU length of stay (RR = 0.323; 95% CI: 0.171-0.610; p = 0.000), septic shock (RR = 3.885; 95% CI: 2.318-6.510; p = 0.000), renal failure (RR = 2.024; 95% CI: 1.224-3.347; p = 0.006), respiratory failure (RR = 18.187; 95% CI: 3.537-93.51; p = 0.001), ROSC (RR = 6.754; 95% CI: 1.403-32.508; p = 0.017), duration of

ventilator use (RR = 0.313; 95% CI: 0.159-0.619; p = 0.001), and reintubation (RR = 2.257; 95% CI: 1.088-4.684; p = 0.029).

Discussion

Age

The age variable showed that the majority of ICU patients on mechanical ventilators were in the elderly age group (> 60 years), comprising 184 patients (43%). The highest mortality rate also occurred in this group, accounting for 101 deaths (47%). The bivariate analysis found that elderly patients had a 1.758 times higher risk of death (95% CI: 1.051-2.941; p-value=0.032), and this relationship was statistically significant. However, after conducting a multivariate analysis, age no longer showed a statistically significant relationship with mortality. This finding contrasts with a meta-analysis by Dane (2019) which involved elderly patients (> 65 years) on mechanical ventilators and found an increased risk of death with an odds ratio of 1.80 (95% CI 1.56–2.08). Therefore, the results of this study indicate that age does not have a statistically significant effect on patient mortality.

Gender

In this study, it was found that the 424 patients admitted to the ICU at RSUD Pasar Minggu were predominantly male, with 256 patients (60%), while there were 168 female patients (40%). Bivariate analysis showed a significant relationship between gender and patient mortality. Male patients had a 1.276 times higher risk of death (95%CI: 1.061-1.535; p=0.014) compared to female patients. However, when a multivariate analysis was performed, the results showed that the gender variable had a p-value of 0.069, indicating it was no longer statistically significant. A similar finding was reported in a meta-analysis by Antequera et al. (2021), which concluded that gender is not an independent predictor of ICU mortality after adjusting for disease severity and comorbidities.

ICU Admission Source

In this study, patient ICU admission sources were categorized into three groups: the Operating Room (OR), inpatient ward, and Emergency Department (ED). The highest number of admissions came from the ED, accounting for 214 patients (50.5%). Bivariate analysis revealed that patients admitted from the inpatient ward had an 8.887 times higher risk of death compared to those from the OR. Patients from the ED also showed a 3.232 times higher risk of death compared to those from the OR, and both relationships were statistically significant. However, after performing a multivariate analysis and controlling for other clinical variables, the results showed that only patients from the inpatient ward remained significantly associated with mortality (p=0.023). This finding is consistent with a previous study by Motzkus et al. (2020), which also found that septic patients admitted to the ICU from inpatient wards had a 1.35 times higher mortality risk than patients admitted from the ED (HRR 1.35; 95% CI 1.09–1.68; p < 0.01). Motzkus et al. suggested that delays in detecting clinical deterioration and delayed treatment in the wards may be key factors contributing to this high mortality rate.

Glasgow Coma Scale (GCS)

In this study, a significant relationship was found between a decrease in the Glasgow Coma Scale (GCS) score and patient mortality. Of the 215 patients who died, the majority (160, or 74%) had a GCS of ≤ 8. The bivariate analysis showed that patients with a GCS of ≤ 8 had a mortality risk of approximately RR = 0.484 compared to those with a GCS of > 8. However, in the multivariate analysis, these patients had a mortality risk 2.674 times higher than those with a GCS of > 8. Despite this difference in the risk ratio, both analyses found GCS to be significantly associated with mortality. Epidemiologically, these findings are consistent with various previous studies. In Indonesia, a study by Taneo et al. (2023) at Dr. Sardjito General Hospital in Yogyakarta showed that patients with a GCS of < 8 had an 18.3 times greater risk of death compared to patients with a GCS of 13–15 (p < 0.001).

Length of Stay in ICU

Based on the results of this study, of the 215 patients who died, 148 (69%) were treated in the ICU for 7 days or less, while 67 patients (31%) were treated for more than 7 days. This proportion indicates that the majority of deaths occurred within the first week of ICU care. Bivariate analysis confirmed this finding, showing that patients with an ICU stay of 7 days or less had a 1.352 times higher risk of death (95% CI:

1.094-1.671; p=0.005) compared to patients treated for more than 7 days. In the multivariate analysis, after adjusting for other variables, it was found that patients with an ICU stay of more than 7 days had an RR of 0.323 (95% CI: 0.171–0.610, p=0.000). This means that the risk of death for patients with a length of stay of more than 7 days was 0.323 times lower compared to patients treated for 7 days or less, after accounting for other factors. This indicates that a length of stay of more than 7 days is actually a protective factor.

While deaths proportionally occur more frequently in patients with an ICU stay of 7 days or less, the explanation behind this multivariate phenomenon is as follows: Most patients admitted to the ICU are in a very critical clinical condition from the outset, which leads to a higher likelihood of faster death, often within the first 3 to 7 days of ICU care. In line with the Chronic Illness Trajectory Framework developed by Strauss and Corbin (1988), a critically ill patient's clinical journey involves stages of crisis, turning points, and either stabilization or deterioration. The turning point often occurs within the first 5 to 7 days. During this phase, unstable hemodynamic conditions, multiple organ failure, and the response to initial resuscitation are the main determining factors for patient outcomes. The more severe a patient's condition is upon ICU admission, the greater the chance they will not survive the first week of care due to progressive and rapidly worsening vital system dysfunction (Vincent et al., 2018; Moitra et al., 2016).

Pneumonia

Based on this study, of the total 215 patients who died, 153 patients (71%) had pneumonia, while 62 patients (29%) did not. The bivariate analysis found that patients with pneumonia had a mortality risk 0.655 times that of patients without pneumonia (95% CI: 0.526-0.817; p-value 0.000), and this was associated with mortality. However, in the multivariate analysis, pneumonia no longer showed a significant effect on patient mortality (RR = 1.129; 95% CI: 0.630–2.026; p = 0.683). Similar findings were reported by Torres et al. (2021) and Zhang et al. (2024), who stated that ICU mortality is generally more influenced by severe systemic diseases such as acute respiratory distress syndrome (ARDS), advanced age, and severe comorbidities, while pneumonia is rarely the sole cause of death. A study in Indonesia by Indriasari et al. (2024) also showed that mortality in patients with Ventilator-Associated Pneumonia (VAP) is more influenced by other factors like a high Sequential Organ Failure Assessment (SOFA) score, multidrug-resistant (MDR) pathogen infections, and the presence of severe sepsis, rather than by pneumonia itself.

Septic Shock

This study found a significant association between the occurrence of septic shock and patient mortality in the ICU at RSUD Pasar Minggu. Of the 215 deceased patients, 156 individuals (73%) were from the septic shock group. Bivariate analysis showed that patients with septic shock had a mortality risk of 0.470 times (95% CI: 0.374–0.592, p = 0.000) compared to those without septic shock. This finding was strengthened by the results of the multivariate analysis, where septic shock remained a significant independent predictor of mortality with an RR of 3.885 (95% CI: 2.318–6.510; p = 0.000). This means that ICU patients with septic shock had an almost 4 times higher risk of death than patients without the condition. A multicenter study by Zhou et al. (2022) also reported that patients with septic shock had an adjusted OR of 3.57 (95% CI: 2.81–4.54) for mortality risk compared to patients without shock.

Renal Failure

Of the 215 deceased patients, 111 (52%) had renal failure, while 104 (49%) did not. Bivariate analysis showed that patients with renal failure had a mortality risk of 0.603 times (95% CI 0.502-0.704) compared to patients without renal failure. However, in the multivariate analysis, the renal failure variable continued to show a significant effect on ICU patient mortality, with a value of 2.024 (95% CI: 1.224–3.347; p = 0.006). This means that ICU patients with renal failure had an almost two-fold higher risk of death compared to patients without the condition. A study in Padang by Kahar et al. (2024) also showed that of 352 ICU patients, 36.4% had acute renal failure, and the major predictors of mortality were chronic renal failure, sepsis, and the use of vasopressors.

Respiratory Failure

It was found that ICU patients with respiratory failure had a very high mortality rate. Of the 215 deceased patients, 213 (99%) experienced respiratory failure. Bivariate analysis showed that patients with respiratory failure had a much higher risk of death compared to patients without it, with a mortality risk of

0.067 (95% CI 0.017-0.262). In the multivariate analysis, the respiratory failure variable remained the strongest predictor of mortality, with a risk of 19.622 times (95% CI: 3.769–102.147; p = 0.000). This indicates that ICU patients who experience respiratory failure have a nearly 20-fold higher chance of death compared to patients without it. A national study by Ardiansyah et al. (2022) at Dr. Sardjito General Hospital in Yogyakarta reinforces this finding, stating that respiratory failure is the most common cause of death in the ICU.

Return of Spontaneous Circulation (ROSC)

Based on the findings of this study, out of the total 424 patients, 24 (5.7%) experienced Return of Spontaneous Circulation (ROSC), while 400 patients (94.3%) did not. Of the 215 patients who died, 21 (10%) were from the ROSC group, while 194 (90%) were from the group without ROSC. Bivariate analysis showed that patients who experienced ROSC had a significantly lower mortality risk compared to patients who did not (RR = 0.554; 95% CI: 0.462–0.665). This might initially suggest that ROSC is a protective factor against mortality, as the goal of resuscitation in cardiac arrest patients is to achieve ROSC (Safitri et al., 2022). However, this finding is in the opposite direction of the multivariate analysis results. In the multivariate model, after controlling for the influence of various other clinical variables such as gender, admission source, and length of stay, the ROSC variable showed a statistically significant association with patient mortality. Patients who successfully achieved ROSC had an almost 7 times higher risk of death (RR = 6.754; 95% CI: 1.403–32.508) compared to patients who did not. This multivariate finding is more consistent with the evolving clinical understanding of Post-Cardiac Arrest Syndrome (PCAS). ROSC, while an indicator of successful initial resuscitation, does not eliminate the high risk of mortality. These patients have previously experienced cardiac arrest, a very severe clinical condition, and often develop PCAS after ROSC. PCAS involves multi-organ damage, anoxic brain injury, and significant myocardial dysfunction (Kang, 2019). Therefore, even though patients successfully achieve ROSC, they remain vulnerable to serious complications and a high risk of death in the ICU (Sari, 2021).

Stroke

Based on the results of the bivariate analysis, out of the 215 deceased patients, 43 (20%) were stroke patients, while 172 (80%) were non-stroke patients. The bivariate analysis (p=0.154) and multivariate analysis (p=0.561) both showed that the stroke variable did not have a significant association with patient mortality in the ICU. This finding confirms that although a history of stroke is a risk factor, the presence of acute systemic complications remains the primary determinant of mortality. Furthermore, a meta-analysis by Al-Khaled et al. (2016) also concluded that neurological status at ICU admission, successful resuscitation, and acute complications have a greater influence on the outcomes of severe stroke patients in intensive care compared to a previous history of cerebrovascular disease. Therefore, in a critical condition such as in the ICU, the management of acute complications has a greater contribution to mortality.

Duration of Ventilator Use

Descriptive analysis showed that among the 215 deceased patients, the majority, 140 individuals (65%), were on a mechanical ventilator for more than 48 hours, while 75 patients (35%) used it for 48 hours or less. Bivariate analysis found no significant effect of the duration of ventilator use on mortality (RR = 1.172; 95% CI: 0.968–1.419, p = 0.139). However, a different result was observed in the multivariate analysis. After controlling for other confounding factors, a longer duration of ventilator use showed a significant and protective effect against death (RR = 0.313; 95% CI: 0.159–0.619; p = 0.001). This finding is in line with concepts from intensive care literature by researchers such as Prescott and Angus (2018). This concept argues that patients who are able to survive and overcome the initial critical phases of care, even when critically ill, are a select group who possess better physiological reserves, a more positive response to therapy, or fewer early complications compared to patients who die quickly. In other words, patients with a very poor prognosis tend to die earlier and do not have the opportunity to reach a longer duration of intervention. Therefore, a longer duration of ventilation in this group does not reflect an increased risk from the duration itself; instead, it indicates that they have successfully overcome initial challenges and demonstrated physiological resilience.

Reintubation

In this study, the bivariate analysis showed no significant association between reintubation and patient mortality (RR = 0.905; 95% CI: 0.714–1.148; p = 0.509). Of the deceased patients, 38 (18%) had been reintubated while 177 (82%) had not, but statistically, this relationship was not significant. However, in the multivariate analysis, reintubation became a statistically significant factor for ICU patient mortality (RR = 2.257; 95% CI: 1.088–4.684; p = 0.029). This indicates that after controlling for other clinical variables, ICU patients who underwent reintubation had an approximately 2.25 times higher risk of death compared to patients who were not reintubated. This finding is consistent with several previous studies that state reintubation is an independent predictor of mortality in the ICU because it is associated with ventilator complications, pneumonia, and multi-organ dysfunction (Villar et al., 2025; Esteban et al., 2012).

Tracheostomy

Based on the results of the bivariate analysis, it was found that of the 215 deceased patients, 26 (12%) had a tracheostomy, while 189 (88%) did not. The analysis showed that the tracheostomy variable did not have a significant association with patient mortality (RR = 1.016; 95% CI: 0.761–1.357; p = 1.000). Since no significant relationship was found in the bivariate test, the tracheostomy variable was not included in the multivariate analysis. Therefore, this variable was excluded from the model as it did not show a strong statistical or clinical association with patient mortality in the ICU for this study. Meanwhile, Villar et al. (2025) also mentions that the decision to perform a tracheostomy is more influenced by the patient's clinical condition, the duration of ventilation, and the likelihood of extubation, rather than by the mortality rate itself.

IV. CONCLUSION

In ICU patients on mechanical ventilators, several factors were found to significantly influence mortality, while others showed no meaningful association. Age, gender, pneumonia, stroke, and tracheostomy were not significantly associated with mortality. However, ICU admission from an inpatient ward, lower Glasgow Coma Scale (GCS) scores, septic shock, renal failure, respiratory failure, and reintubation were all significantly associated with increased mortality. Additionally, return of spontaneous circulation (ROSC) also had a significant impact on mortality outcomes. Interestingly, a longer ICU length of stay and extended duration of ventilator use were found to have protective effects on mortality in this patient population.

V. CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

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