Correlations Between Age, Gender and Comorbidity to the Duration of Ventilator Usage on COVID-19 Patients in Kupang

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KEYWORD	ABSTRACT
Risk Factors, Corona Virus Infection, Mechanical Ventilator	Coronaviruses are known to cause respiratory tract infections. COVID-19 emerged in early March 2020, and cases have continued to rise. Confirmed patients may experience mild, moderate, or severe/critical symptoms, influenced by individual risk factors such as age, gender, genetics, ethnicity, nutritional status, and comorbidities. Patients with severe/critical symptoms receive oxygen therapy and mechanical ventilation. The duration of ventilator use depends on the patient's physical condition and disease severity and may be discontinued once normal breathing is restored. This research aims to identify the correlation between age, gender, and comorbidity with the duration of ventilator usage in COVID-19 patients in Kupang. This research is an observational analytic study with a cross-sectional design. The samples comprised 23 COVID-19 patients with comorbidities who used ventilators in RSUD Prof. Dr. W. Z. Johannes and RSUD S. K. Lerik Kupang, obtained by a non-probability sampling technique—specifically, accidental sampling. In the bivariate test using the contingency coefficient, it was found that there was no correlation between age and the duration of ventilator usage in COVID-19 patients in Kupang (P=0.40, r=0.46). There was no correlation between gender and the duration of ventilator usage in COVID-19 patients in Kupang (P=0.58, r=0.21). There was no correlation between comorbidity and the duration of ventilator usage in COVID-19 patients in Kupang (P=0.69, r=-0.37). However, there was a correlation between age, gender, and comorbidity and the duration of ventilator usage in COVID-19 patients in Kupang.

INTRODUCTION

Coronavirus is a virus that can cause disease in humans and animals. In humans, it usually causes respiratory tract infections, ranging from the common cold to serious illnesses such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). A new type of coronavirus was discovered in humans following an outbreak in Wuhan, China, in December 2019. It was named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and causes Coronavirus Disease-2019 (COVID-19) (Wardiana, 2020; NTT GTPPC-19, 2021). In March 2020, the number of Covid-19 cases outside China had increased 13-fold and the number

of infected countries had tripled, with more than 118,000 cases in 114 countries and more than 4,000 deaths. The WHO declared Covid-19 a pandemic (Wardiana, 2020).

Covid-19 in Indonesia began in early March 2020 with the number of cases increasing to date. The Task Force for the Acceleration of Covid-19 Handling reported a total of 4,043,736 confirmed Covid-19 cases as of August 26, 2021, with a total of approximately 130,182 deaths due to COVID-19. In East Nusa Tenggara, according to data from the Task Force for the Acceleration of Covid-19 Handling as of August 26, 2021, there were 56,686 confirmed positive cases, In Kupang City alone, as of August 26, 2021, there were approximately 14,159 confirmed COVID-19 cases, with a total of 313 deaths and 9,928 people who had recovered from COVID-19 infection (NTT GTPPC-19, 2021).

People confirmed to have COVID-19 may have mild, moderate, or severe/critical symptoms. Patients with mild symptoms may experience fever, cough, runny nose, fatigue, and myalgia, or may be asymptomatic (Celik & Öztürk, 2021; Kim et al., 2020; O'Malley, 2025). Patients with moderate symptoms may experience clinical signs such as fever, cough, runny nose, and shortness of breath (Çalıca Utku et al., 2020; Kim et al., 2020; Kuchar et al., 2015). Meanwhile, patients with severe/critical symptoms may experience signs such as fever, cough, shortness of breath, respiratory rate >30 breaths per minute with oxygen saturation <93%, as well as Acute Respiratory Distress Syndrome (ARDS), sepsis, and septic shock. The severity of Covid-19 symptoms can be influenced by several risk factors (Luo et al., 2024; Tsampasian et al., 2023; Zsichla & Müller, 2023). These risk factors include age, gender, genetics, ethnicity, nutritional status, and comorbidities. Patients with comorbidities and advanced age are at greater risk of experiencing more severe Covid-19 symptoms because comorbidities can cause multi-organ damage and decreased immunity. Additionally, females have chromosomal and hormonal factors that can protect the immune system compared to males, making males more at risk of developing severe symptoms than females (Hairunisa & Amalia, 2020; Ratna Hidayani et al., 2020).

Treatment for Covid-19 patients is divided according to the severity of the patient's condition. Patients with mild symptoms are advised to self-isolate at home and are given symptomatic therapy according to their symptoms. Patients with moderate severity are given symptomatic therapy, vitamins, antiviral drugs, azithromycin, and treatment for comorbidities if present. For patients with severe/critical severity, oxygen therapy is administered until oxygen saturation reaches >93%, along with treatments such as fluid therapy, antibiotics, and corticosteroids. Patients who are severely ill are given mechanical ventilator therapy (Hairunisa & Amalia, 2020; Burhan et al., 2020).

A mechanical ventilator is a positive or negative pressure breathing aid that can produce a controlled flow of air into the patient's airway, thereby maintaining ventilation and oxygen delivery over a long period of time. Ventilators are generally used when the patient's lungs are unable to inhale the oxygen needed by the body. Additionally, ventilators are used to help remove carbon dioxide and assist unconscious patients in breathing due to severe infections, toxin buildup, drug overdoses, or injuries to the nervous system. Therefore, ventilators are very useful in helping patients breathe. The duration of ventilator use depends on the patient's physical condition and the

severity of the illness. New patients may stop using ventilators once they are able to breathe normally. The use of ventilators for Covid-19 patients is not without the risk of side effects. Side effects experienced include infection, lung damage, drug side effects, and the inability to stop ventilator support. However, ventilators still play an important role, especially for medical personnel dealing with critical Covid-19 patients (Sinarti et al., 2021; American Thoracic Society, 2017; Morgan et al., 2013). In line with the title, as Covid-19 cases in NTT continue to increase, especially in Kupang City, and one of the treatments for critical Covid-19 cases involves the use of ventilators, and considering the factors that influence Covid-19, namely age, gender, and comorbidities, the researchers wanted to determine whether there is a relationship between these factors and the duration of ventilator use. This study aims to identify the correlation between age, gender, and comorbidities with the duration of ventilator use in COVID-19 patients in Kupang City. By understanding these relationships, the findings are expected to provide useful clinical insights for healthcare professionals in estimating ventilator needs and usage duration, as well as supporting more effective policy-making and resource allocation in COVID-19 referral hospitals.

METHOD

The location was Prof. Dr. W Z Johannes Regional General Hospital and S.K. Lerik Regional General Hospital in Kupang, East Nusa Tenggara, Indonesia, in October-November 2021. This study was an observational analytical study using a cross-sectional research design. Data collection will be conducted from the medical records of patients diagnosed with COVID-19 who used ventilators and were diagnosed by specialist doctors at Prof. Dr. W Z Johannes Regional General Hospital and S.K. Lerik Kupang Regional General Hospital between March 2020 and September 2021. The sampling technique used non-probability sampling, specifically accidental sampling, with a sample size of 23 patients, where 12 patients were from Prof. Dr. W. Z. Johannes Regional General Hospital and 11 patients were from S. K. Lerik Regional General Hospital in Kupang City, who met the inclusion and exclusion criteria.

This study was conducted by collecting data through the medical records of Covid-19 patients as required for the research objectives. The medical records used were those of Covid-19 patients who used ventilators and were treated at Prof. Dr. WZ Johannes Regional General Hospital and S.K. Lerik Kupang Regional General Hospital from March 2020 to September 2021. The analyses used in this study were univariate and bivariate analyses. Univariate analysis was used to describe each variable, both independent and dependent variables, while bivariate analysis in this study was used to determine the relationship between the dependent variable and the independent variable using the contingency coefficient statistical test.

RESULTS AND DISCUSSION

Normality Test

Based on the results of the Shapiro-Wilk Test for data normality, the results were found to be non-normally distributed with p=0.002 for age, p=0.000 for gender, p=0.002 for comorbidity, and p=0.001 for duration of ventilator use. Therefore, the statistical test used was the contingency coefficient test.

Univariate Analysis

The following are the results of univariate analysis to determine the distribution of age, gender, and comorbidities in relation to the duration of ventilator use in Covid-19 patients in Kupang City.

a. Age Distribution of Covid-19 Patients Using Ventilators in Kupang City

Table 1. Patient Age

No	Age	Frekuensi (n)	Persentase (%)
1	Adulthood Late (36-45)	1	4,3
2	Early old age (46-55)	11	47,8
3	Late old age (56-65)	7	30,4
4	Period Manual (>65)	4	17,4
	Total	23	100

Source: Primary Data Processed, 2021

Based on Table 1, the results show that the number of respondents in this study were 23 Covid-19 patients who used ventilators in Kupang City, with a total of 11 patients (47.8%) in the 46-55 age group and 1 respondent (4.3%) in the 36-45 age group. The most common disease in the ICU among early elderly patients (46-55 years old) is respiratory tract infection associated with respiratory tract disorders, which often requires mechanical ventilator support (Susanti, 2015).

b. Gender Distribution of Covid-19 Patients Using Ventilators in Kupang City

Table 2. Patient gender

Gender	Frequency (n)	Percentage (%)
Male	11	47.8
Female	12	52.2
Total	23	100

Source: Primary Data Processed, 2021

Based on Table 2, the results show that there were 23 female patients, which is more than the number of male patients, namely 12 female patients (52.2%) and 11 male patients (47.8%). The difference in the function of testosterone in males and estrogen in females can determine the number of immune cells in the body (Frischa et al., 2019).

c. Distribution of Covid-19 Comorbid Patients Using Ventilators in Kupang City

Table 3. Patient comorbidities

No	Comorbidity	Frequency (n)	Percentage (%)
1	No comorbidity	1	4,3
2	1 type of comorbidity	11	47,8
3	2 types of comorbidity	8	34,8
4	>2 types of comorbidity	3	13,0
	Total	23	100

Source: Primary Data Processed, 2021

Based on Table 3, it was found that the total number of patients in the study was 23, with the highest number being 11 patients (47.8%) who had 1 type of comorbidity and 1 patient (4.3%) who had no comorbidity. DM and hypertension were the most commonly found diseases in this study. COVID-19 patients with comorbidities of DM and hypertension are associated with poor prognosis, such as intensive care in the ICU and even death, with a higher mortality rate in patients with comorbidities compared to patients without comorbidities (Drew & Adisasmita, 2021).

d. Distribution of Ventilator Use Duration in Covid-19 Patients in Kupang City

Table 4. Length of ventilator use for patients

No	Duration of Use Ventilator	Frequency (n)	Percentage (%)
1	< 2 days	8	34,8
2	2-6 days	10	43,5
3	>7 days	5	21,7
	Total	23	100

Source: Primary Data Processed, 2021

Based on Table 4, it was found that the number of patients who used ventilators for 2-6 days was 10 patients (43.5%) and the number of patients who used ventilators for > 7 days was 5 patients (21.7%). Ventilator use for more than 5 days can cause nosocomial infections due to decreased patient immunity, and improper ventilator use can cause oropharyngeal colonization in these patients (Miranda, 2019).

Bivariate Analysis

a. The Relationship Between Age and Length of Ventilator Use in Covid-19 Patients in Kupang City

Table 5. Relationship between age and duration of ventilator use

		Duration of Use					
No	Age	< 2 day	2-6 day	>7 day	n	r	p

No		n	%	n	%	n	%	n	%	r	p
1	Late adulthood (36-45)	1	4,3	0	0	0	0	1	100		
2	Early old age (46-55)	5	21,7	5	21,7	1	4,3	1 1	100	0,46	0,40
3	Late old age (56-65)	2	8,7	3	13	2	8,7	7	100		
4	Manual period (>65)	0	0	2	8,7	2	8,7	4	100		
	Total	8	34,8	10	43,5	5	21,7	23			

Source: Primary Data Processed, 2021

Based on Table 5, which has been statistically tested using the SPSS Statistics 25 program, it was found that it meets the contingency coefficient test requirements, so that the p-value shows a significance value of $p = 0.40$ or $p > 0.05$, while the value shows that there is no significant relationship between age and the duration of ventilator use in Covid-19 patients in Kupang City. The value of $r = 0.46$, thus the correlation between the two variables is moderate (0.40-0.59) and the calculated r value has a positive sign (+), indicating a unidirectional relationship.

b. The Relationship Between Gender and Length of Ventilator Use in Covid-19 Patients in Kupang City

Table 6. Relationship between gender and duration of ventilator use

No	Gender	Duration of Use						n	r	p
		< 2 day		2-6 day		>7 day				
		n	%	n	%	n	%	(%)		
1	Male	5	21,7	4	17,4	2	8,7	11 (100)		
2	Women	3	13,0	6	26,1	3	13,0	12 (100)	0,21	0,58
	Total	8	34,8	10	43,5	5	21,7	23		

Source: Primary Data Processed, 2021

Based on Table 6, which has been statistically tested using the SPSS Statistics 25 program, it was found that it meets the contingency coefficient test requirements, so that the p-value shows a significance value of $p = 0.58$ or $p > 0.05$, indicating that there is no significant

relationship between gender and the duration of ventilator use in Covid-19 patients in Kupang City. The value of r = 0.21, thus the correlation between the two variables is weak (0.20-0.39), and the calculated r value has a positive sign (+), indicating a unidirectional relationship.

c. The Relationship Between Comorbidities and the Duration of Ventilator Use in Covid-19 Patients in Kupang City

Table 7. Relationship between comorbidities and duration of ventilator use

No	Comorbidities	Duration of Use						n		r	p
		< 2 day		2-6 day		>7 day		n			
		n	%	n	%	n	%	n	%		
1	No comorbidities	0	0	1	4,3	0	0	1	100		
2	1 type of comorbidity	3	13,0	5	21,73	3	13,0	11	100	0,37	0,69
3	2 types	4	17,4	2	8,7	2	8,7	8	100		
4	of comorbidities	1	4,3	2	8,7	0	0	3	100		
	Total	8	34,8	10	43,5	5	21,7	23			

Source: Primary Data Processed, 2021

Based on Table 7, which has been statistically tested using the SPSS Statistics 25 program, it was found that it meets the contingency coefficient test requirements, so that the p-value shows a significance value of p = 0.69 or p > 0.05, indicating that there is no significant relationship between comorbidity and the duration of ventilator use in Covid-19 patients in Kupang City. The value of r = -0.18, indicating that the correlation between the two variables is very low (0.00-0.19), and the calculated r value has a positive sign (+), indicating a unidirectional relationship.

Discussion

Table 5 shows the relationship between age and duration of ventilator use using a contingency coefficient test, yielding a p-value of 0.40, indicating no relationship between age and duration of ventilator use. As age increases, a person's immune function declines, putting them at risk and making them susceptible to infectious diseases, especially in the respiratory system, with ventilator use. The duration of ventilator use is related to a person's acute physiological disorders, comorbidities, and treatment in the ICU of each hospital (Frischa et al., 2019; Drew & Adisasmita, 2021). Increasing patient age increases the risk of several diseases such as metabolic syndrome, shock, acute renal failure, worsening neurological conditions, and respiratory system infections such as Covid-19, one of the treatments for which requires the use of a ventilator (Drew & Adisasmita, 2021; Wibowo et al., 2021). One factor influencing age on the duration of ventilator use is immune function, where patients aged 46–55 years using ventilators with comorbidities experience a decline in immune function similar to patients over 60 without comorbidities, so age alone does not determine the duration of ventilator use (Yufuf, 2019).

Table 6 shows the relationship between gender and duration of ventilator use using a

contingency coefficient test, which yielded a p-value of 0.58, indicating that there is no relationship between the two variables. Differences in the hormonal systems of men and women can affect a person's susceptibility to diseases such as respiratory tract infections requiring ventilator support. Estrogen hormones present in women's bodies can increase the number of immune cells in the body, while testosterone hormones suppress the immune response, making men more susceptible to infection than women (Miranda, 2019). The results of the study found that women used ventilators the most because the average age of female patients was over 50 years, which is followed by menopause and a decrease in estrogen production (Yufuf, 2019).

Table 7 on the relationship between comorbidities and ventilator use duration shows a p-value of 0.69 with a contingency coefficient test, indicating no relationship between comorbidities and ventilator use duration. Patients with a history of DM with chronic hyperglycemia and immune modulation disorders can inhibit the immune system, thereby increasing the risk of mortality in Covid-19 patients with a history of DM (Bakta et al., 2016). Covid-19 patients with cardiovascular disease, such as organ dysfunction and acute inflammation experienced at the beginning of treatment, will increase the risk of death from Covid-19 infection (Satria et al., 2020). The management of DM and hypertension in Covid-19 patients is not associated with the duration of ventilator use but rather with general therapy such as insulin administration in DM patients and antihypertensive medication in patients with hypertension. Ventilator use is directly administered to Covid-19 patients with severe respiratory comorbidities such as chronic obstructive pulmonary disease (COPD) (Burhan et al., 2020).

Respiratory dysfunction includes disorders of the respiratory center, chest wall, and neuromuscular system that cause respiratory failure requiring a mechanical ventilator. Ventilators are designed to assist or replace human respiratory muscles. Respiratory distress in humans causes the respiratory muscles to work harder to meet metabolic needs, which can lead to worsening conditions such as fatigue and even respiratory failure. Ventilators use positive pressure to create a pressure difference so that air can flow into the human lungs (Bakta et al., 2016). The use of mechanical ventilators in Covid-19 patients is divided into two types, namely Covid-19 type L, which requires conventional oxygen therapy, and Covid-19 type H, which requires oxygen therapy with higher pressure. The target oxygen saturation in Covid-19 patients with ventilators is $\geq 96\%$ (Burhan et al., 2020).

The study was conducted to determine and analyze the relationship between age, gender, and comorbidities with the duration of ventilator use in Covid-19 patients in Kupang City. The results of the bivariate analysis showed that there was a significant relationship between age and the duration of ventilator use, but there was no relationship between gender and comorbidities with the duration of ventilator use in Covid-19 patients in Kupang City. These results are supported by research conducted by Miranda et al. (2019), which found no relationship between risk factors and the incidence of ventilator-associated pneumonia in the intensive care unit at H. Adam Malik General Hospital in Medan (Wibowo et al., 2021). These results are also in line with research conducted by Evira (2019), which found no relationship between patient risk factors and

ventilator-associated pneumonia caused by carbapenem resistance in the Intensive Care Unit of Dr. Saiful Anwar Malang Regional General Hospital (Bakta et al., 2016).

CONCLUSION

This study of 23 COVID-19 patients requiring ventilators in Kupang hospitals revealed that most were in the early elderly age group (46-55 years; 47.8%), slightly more were female (52.2%), and nearly half had one comorbidity (47.8%), with the shortest ventilator duration (2-6 days) being most common (43.5%). However, bivariate analyses showed no significant correlations between age, gender, or comorbidity and ventilator use duration. For future research, studies should increase sample sizes and include additional variables like disease severity, inflammatory markers, and treatment regimens to better identify determinants of ventilator dependency.

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