Clinical and Pharmaceutical Sciences Journal

Research article

Patient Characteristics, Treatment Patterns, and Their Association with Length of Hospital Stay and Clinical Outcomes among Hospitalized COVID-19 Patients in West Kalimantan, Indonesia

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Received: 1 May 2026 | Revision: 28 May 2026 | Accepted: 30 June 2026

Abstract

The global incidence of Coronavirus Disease 2019 (COVID-19) has increased since 2020, while its risk factors and optimal treatment strategies remain incompletely understood. Advanced age and comorbidities, such as diabetes mellitus and hypertension, are known to contribute to disease severity. This study aimed to evaluate treatment patterns among hospitalized COVID-19 patients with comorbidities and to examine the association between patient characteristics, length of hospital stay, and clinical outcomes. This retrospective cross-sectional study utilized medical records of hospitalized COVID-19 patients with hypertension, diabetes mellitus, and elevated D-dimer levels from January to December 2021. Samples were selected using purposive sampling based on predefined inclusion and exclusion criteria. Associations between patient characteristics, length of hospital stay, and clinical outcomes were analyzed using the Chi-square test. The most frequently prescribed COVID-19 treatment regimen was levofloxacin combined with remdesivir, favipiravir, or oseltamivir (45.3%). Among patients with diabetes mellitus, the most commonly prescribed therapy was a combination of Levemir and Novorapid (29.7%). Patients with hypertension were predominantly treated with angiotensin receptor blockers (34.4%), whereas 50% of patients with elevated D-dimer levels received heparin. Characteristics associated with prolonged hospitalization (≥7 days) were more commonly observed among elderly patients (≥55 years), females, individuals with lower educational attainment, and those with comorbidities. Significant associations were found between age and length of hospital stay ($p = 0.001$) and between educational level and length of hospital stay ($p = 0.039$). However, no significant association was identified between patient characteristics and clinical outcomes. In conclusion, combination therapy involving levofloxacin with remdesivir, favipiravir, or oseltamivir was the most frequently prescribed treatment regimen. Age and educational level were significantly associated with length of hospital stay but not with clinical outcomes. Further studies are needed to investigate additional confounding factors influencing hospitalization outcomes.

Keywords: Clinical outcomes; COVID-19; risk factors; treatment patterns.

Introduction

At the beginning of 2020, the world faced the emergence of a novel coronavirus, which was first identified in Wuhan, China, in December 2019. The World Health Organization (WHO) subsequently designated the virus as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the associated disease as coronavirus disease 2019 (COVID-19) [1]. Early in the outbreak, the transmission dynamics of the virus, particularly human-to-human transmission, were not fully understood. Since the emergence of COVID-19 in late 2019, the disease has caused substantial morbidity and mortality worldwide, including in Indonesia and West Kalimantan, highlighting the need to better understand factors influencing disease outcomes and treatment strategies. National data reflect global trends, demonstrating a continuous increase in cases and widespread transmission across all regions. West Kalimantan was the first province in Kalimantan to report confirmed COVID-19 cases on March 12, 2020. By December 27, 2020, a total

of 3,039 confirmed cases had been reported, including 381 active cases, 2,627 recoveries, and 31 deaths, resulting in a mortality rate of 1.02%.

Disease severity and hospitalization among patients with COVID-19 are influenced by several factors, including advanced age, sex, and underlying comorbidities such as hypertension, diabetes mellitus, obesity, chronic lung disease, and cardiovascular disease [2]. Clinically, COVID-19 presents with a broad spectrum of manifestations, ranging from asymptomatic or mild disease to severe pneumonia with hypoxemia requiring hospitalization. The heterogeneity of clinical presentation is influenced by patient-specific factors, including age, sex, ethnicity, comorbidities, and pregnancy status. Higher hospitalization rates have been reported among elderly patients and those with underlying conditions such as hypertension, obesity, chronic lung disease, diabetes mellitus, and cardiovascular disease [3]. Nevertheless, further investigation is needed to better understand the determinants of disease progression, particularly among high-risk population.

Various therapeutic strategies have been employed in the management of COVID-19, including antiviral agents (remdesivir, favipiravir, and oseltamivir), immunomodulators, corticosteroids, nutritional supplements (vitamin C, vitamin D, and zinc), and supportive oxygen therapy. However, no specific antiviral therapy has been universally established, largely due to the time-consuming nature of drug development. Consequently, the evaluation and optimization of existing therapeutic regimens remain critical for the ongoing management of COVID-19 [4]. Although numerous studies have investigated risk factors and treatment strategies for COVID-19, evidence regarding treatment patterns and factors associated with length of hospital stay and clinical outcomes among hospitalized patients in West Kalimantan remains limited. Understanding these factors is important for optimizing patient management and healthcare resource allocation. Therefore, this study aimed to evaluate treatment patterns and examine the association between patient characteristics, length of hospital stay, and clinical outcomes among hospitalized COVID-19 patients at RSUD dr. Soedarso Pontianak, West Kalimantan.

Materials and Methods

Materials

A sample represents a subset of the population selected to serve as research subjects [5]. In this study, the sample consisted of medical records of hospitalized patients diagnosed with COVID-19 at RSUD dr. Soedarso Pontianak, West Kalimantan. Sample selection was performed based on predefined inclusion and exclusion criteria to ensure the appropriateness of the study population. The inclusion criteria were: (1) patients diagnosed with COVID-19 who had comorbid hypertension, diabetes mellitus, and/or elevated D-dimer levels and required hospitalization; and (2) patients with complete medical records and comprehensive clinical data. The exclusion criterion was patients who were referred to or continued treatment at another healthcare facility for further management.

Methods

This study employed an observational design using a retrospective cross-sectional approach. Data were retrospectively collected from the medical records of hospitalized COVID-19 patients treated at RSUD dr. Soedarso Pontianak, West Kalimantan, from January to December 2021. This observational approach was used to identify and evaluate treatment patterns among COVID-19 patients with comorbidities and to examine the association between patient characteristics, length of hospital stay, and clinical outcomes.

Data analysis

The collected data were analyzed using Statistical Product and Service Solutions (SPSS) version 25.0. Univariate analysis was performed to summarize and describe the distribution of variables, including age, sex, treatment patterns, comorbidities, clinical outcomes, and length of hospital stay. Bivariate analysis using the Chi-square test was conducted to assess the association between patient characteristics and clinical outcomes, as well as the relationship between patient characteristics and length of hospital stay among hospitalized COVID-19 patients. A p-value of <0.05 was considered statistically significant.

Results and Discussion

This study received ethical approval from the Research Ethics Committee of RSUD dr. Soedarso Pontianak, West Kalimantan (approval No. 28/RSUD/KEPK/X/2021). Data were retrospectively collected from medical records over a two-month period. The study dataset consisted of hospitalized COVID-19 patients admitted to the isolation ward of RSUD dr. Soedarso Pontianak between January and December 2021. Following the application of the inclusion and exclusion criteria, a total of 64 patient records were included in the analysis, comprising patients with comorbid hypertension, diabetes mellitus, and elevated D-dimer levels.

Distribution of COVID-19 Patients According to Patient Characteristics

The demographic and clinical characteristics of the 64 hospitalized COVID-19 patients included in this study are summarized in Table 1.

Table 1. Demographic and clinical characteristics of hospitalized COVID-19 patients (n=64)

Characteristics	Number (n)	Percentage (%)
Age		
< 55 years	26	40.6
≥ 55 years	38	59.4
Sex		
Female	37	57.8
Male	27	42.2
Educational level		
Primary/Junior/Senior High School	50	78.1
Diploma/Bachelor's Degree	14	21.9
Length of hospital stay		
< 7 days	18	28.1
≥ 7 days	46	71.9
Comorbidities		
Diabetes mellitus	40	62.5
Hypertension	45	70.3
Laboratory findings		
Elevated D-dimer levels	14	21.9
Clinical outcomes		
Recovered	59	92.2
Deceased	5	7.8

Note: Patients may have had more than one comorbidity.

As shown in Table I, most hospitalized COVID-19 patients were aged ≥55 years (59.4%) and female (57.8%). The majority had an educational level of primary to senior high school (78.1%) and experienced a hospital stay of ≥7 days (71.9%). Hypertension was the most common comorbidity (70.3%), followed by diabetes mellitus (62.5%). Most patients recovered from COVID-19 (92.2%), whereas 7.8% died during hospitalization. The age distribution presented in Table I shows that, of the 64 respondents included in this study, 59.4% were aged ≥55 years, whereas 40.6% were aged <55 years. These findings indicate that the majority of patients admitted to the isolation ward of RSUD dr. Soedarso Pontianak between January and December 2021 were older adults (≥55 years). Increasing age has been associated with the accumulation of cellular damage and a decline in immune system function, thereby reducing the body's ability to recognize and respond effectively to pathogens and increasing susceptibility to infection and mortality [6].

Based on the sex distribution shown in Table I, 57.8% of respondents were female, while 42.2% were male. Previous studies have reported that differences in innate immunity, steroid hormone profiles, and sex chromosome-related factors may increase susceptibility to viral infections among males. However, the findings of the present study are inconsistent with those reports, which may be attributable to the relatively small sample size [7]. Similarly, a study conducted by Nia Ayuni et al. reported that females accounted for 54% of COVID-19 cases, with no significant difference in mean age between male and female patients [8].

Regarding educational level, 78.1% of respondents had completed primary to senior high school education, whereas 21.9% had attained diploma or bachelor's degrees. The findings indicate that the majority of hospitalized COVID-19 patients had relatively lower educational attainment (≤ senior high school), which may be associated with limited health literacy and reduced awareness of disease prevention measures. The analysis of length of hospital stay revealed that 28.1% of patients were hospitalized for <7 days, whereas 71.9% required hospitalization for ≥7 days, indicating a relatively prolonged duration of care among COVID-19 patients. According to the Decree of the Minister of Health of the Republic of Indonesia No. HK.01.07/MENKES/4641/2021, the average incubation period of COVID-19 is approximately 5–6 days and may extend up to 14 days; therefore, the duration of observation and isolation should be adjusted accordingly [9].

As shown in Table I, hypertension (70.3%) and diabetes mellitus (62.5%) were the most common comorbidities observed among the study participants, whereas elevated D-dimer levels were identified in 21.9% of patients. These conditions have been associated with increased disease severity and poorer outcomes in patients with COVID-19. Regarding clinical outcomes, the mortality rate among hospitalized COVID-19 patients at RSUD dr. Soedarso Pontianak was 7.8% (n = 5), while 92.2% of patients recovered. National statistics indicate that older adults are disproportionately affected by COVID-19, with approximately one in four individuals aged >60 years experiencing severe illness and nearly 40% of COVID-19-related deaths in Indonesia occurring among the elderly population [10].

Distribution of COVID-19 Patients According to Comorbidities

The distribution of hospitalized COVID-19 patients according to comorbid conditions and elevated D-dimer levels is presented in Table 2. Diabetes mellitus, hypertension, and elevated D-dimer levels were selected for analysis because these conditions have frequently been associated with increased disease severity, poorer clinical outcomes, and higher mortality among patients with COVID-19. As shown in Table 2, a higher proportion of patients with diabetes mellitus (60%) and hypertension (64.5%) were aged ≥55 years. In contrast, elevated D-dimer levels were more frequently observed among patients aged <55 years (57.1%).

With respect to sex, diabetes mellitus and hypertension were slightly more common among male patients, whereas elevated D-dimer levels were more frequently identified among females. Regarding educational level, most patients with diabetes mellitus (77%), hypertension (75.6%), and elevated D-dimer levels (92.8%) had completed primary to senior high school education. In addition, the majority of patients with diabetes mellitus (77.5%), hypertension (73.3%), and elevated D-dimer levels (57.1%) experienced a hospital stay of ≥7 days.

Table 2. Characteristics of hospitalized COVID-19 patients according to comorbidities

Characteristics	Diabetes mellitus n (%)	Hypertension n (%)	Elevated D-dimer n (%)
Age			
< 55 years	16 (40.0)	16 (35.5)	8 (57.1)
≥ 55 years	24 (60.0)	29 (64.5)	6 (42.9)
Sex			
Female	18 (45.0)	20 (44.5)	5 (35.7)
Male	22 (55.0)	25 (55.5)	9 (64.3)
Educational Level			
Primary/Junior/Senior High School	30 (75.0)*	34 (75.6)	13 (92.8)
Diploma/Bachelor's Degree	10 (25.0)*	11 (24.4)	1 (7.2)
Length of hospital stay			
< 7 days	9 (22.5)	12 (26.7)	6 (42.9)
≥ 7 days	31 (77.5)	33 (73.3)	8 (57.1)

*Percentages were calculated within each comorbidity category.

Table 2 presents the distribution of hospitalized COVID-19 patients according to comorbidities and elevated D-dimer levels. A higher proportion of patients with diabetes mellitus (60%) and hypertension (64.5%) were aged ≥55 years, whereas elevated D-dimer levels were more frequently observed among patients aged <55 years (57.1%). Male patients accounted for the majority of cases with diabetes mellitus (55%), hypertension (55.5%), and elevated D-dimer levels (64.3%). Most patients with diabetes mellitus (75%), hypertension (75.6%), and elevated D-dimer levels (92.8%) had completed primary to senior high school education. In addition, the majority of patients with diabetes mellitus (77.5%), hypertension (73.3%), and elevated D-dimer levels (57.1%) experienced a hospital stay of ≥7 days.

COVID-19 patients aged ≥55 years showed a higher proportion of comorbid diabetes mellitus (60%; n = 24) and hypertension (64.5%; n = 29). In contrast, elevated D-dimer levels were more frequently observed among patients aged <55 years (57.1%; n = 8), although this difference was relatively small and may reflect the limited number of cases. Overall, older adults (≥55 years) constituted the majority of hospitalized COVID-19 patients and commonly presented with comorbid diabetes mellitus and hypertension. Regarding sex distribution, male patients accounted for a slightly higher proportion of cases with diabetes mellitus (55%), hypertension (55.5%), and elevated D-dimer levels (64.3%). Biological differences in immune responses between males and females may influence susceptibility to infections, including SARS-CoV-2 [11]. Sex-based differences in immune regulation are influenced by hormonal, genetic, environmental, and behavioral factors [12].

Most COVID-19 patients with diabetes mellitus (77%), hypertension (75.6%), and elevated D-dimer levels (92.8%) had an educational level of senior high school or below. Educational attainment may be associated with health knowledge and health-related behaviors, which could influence disease prevention and management [13]. COVID-19 patients with comorbid diabetes mellitus, hypertension, and elevated D-dimer levels tended to experience longer hospital stays (≥7 days), accounting for 77.5%, 73.3%, and 57.1% of cases, respectively. Overall, patients with these comorbidities are more likely to experience severe disease, prolonged hospitalization, and poorer clinical outcomes. Hypertension, diabetes mellitus, and cardiovascular disease have consistently been reported as the most common comorbidities associated with adverse outcomes in patients with COVID-19 [14]. The treatment regimens administered to hospitalized COVID-19 patients with comorbidities and elevated D-dimer levels varied according to the patients' clinical conditions and therapeutic needs. These treatments included both specific therapies for COVID-19 and supportive medications used to manage comorbid conditions and complications during hospitalization. The distribution of treatment patterns received by the patients is presented in Table 3.

Table 3. Treatment patterns among hospitalized COVID-19 patients with comorbidities and elevated D-dimer levels

Treatment regimens	Number (n)	Percentage (%)
COVID-19 treatment	2	3.1
Azithromycin	3	4.7
Azithromycin + remdesivir/ favipiravir/ oseltamivir	2	3.1
Azithromycin + levofloxacin + remdesivir/ favirapir/ oseltamivir	10	15.6
Remdesivir	2	3.1
Remdesivir + favipiravir/ oseltamivir	12	18.8
Favipiravir	3	4.7
Oseltamivir	3	4.7
Levofloxacin	1	1.6
Levofloxacin + remdesivir/ favipiravir/ oseltamivir	29	45.3
Antidiabetic treatment	19	29.7
Levemir/ Lantus + NovoRapid	11	17.2
Levemir/ Lantus	6	9.4
Levemir/Lantus + NovoRapid + metformin	2	3.1
Metformin	2	3.1
Novorapid	19	29.7
Antihypertensive treatment		
Candesartan/ valsartan	22	34.4
Amlodipine + candesartan/valsartan	12	18.8
Amlodipine	11	17.2
Anticoagulant treatment for elevated D-dimer		
Heparin	32	50

Table 3 presents the treatment patterns among hospitalized COVID-19 patients with comorbidities and elevated D-dimer levels. The most frequently prescribed COVID-19 treatment regimen was a combination of levofloxacin with remdesivir, favipiravir, or oseltamivir (45.3%), followed by favipiravir monotherapy (18.8%) and remdesivir monotherapy (15.6%). Among patients with diabetes mellitus, the most commonly prescribed antidiabetic regimen was a combination of Levemir/ Lantus and NovoRapid (29.7%). In patients with hypertension, candesartan or valsartan was the most frequently used antihypertensive therapy (34.4%). Furthermore, heparin was administered to 50% of patients with elevated D-dimer levels.

Pharmacological management of COVID-19 patients in this study was generally based on the guideline issued by the Indonesian Ministry of Health in 2021. As shown in Table III, the three most commonly prescribed treatment regimens were a combination of levofloxacin with antiviral agents (remdesivir, favipiravir, or oseltamivir) (45.3%), favipiravir monotherapy (18.8%), and remdesivir monotherapy (15.6%). These findings indicate that the treatment regimens prescribed in this study were generally consistent with the COVID-19 management guidelines issued by the Indonesian Ministry of Health during the early phase of the pandemic. Azithromycin and levofloxacin are antibiotics recommended as alternative therapies when bacterial pneumonia is suspected, particularly in patients presenting with symptoms such as dyspnea, chest pain, and tachycardia. In contrast, the World Health Organization (WHO) issued a conditional recommendation against the routine use of remdesivir as standard care for COVID-19 patients, regardless of disease severity [15]. Remdesivir is metabolized within host cells into a pharmacologically active nucleoside triphosphate, which inhibits viral RNA replication [16].

Among COVID-19 patients with diabetes mellitus, the combination of long-acting insulin (Levemir/ Lantus) and rapid-acting insulin (NovoRapid) was the most frequently prescribed regimen, with Levemir/ Lantus plus NovoRapid accounting for 29.7% of cases. The primary goal of insulin therapy is to achieve short-term glycemic control while preventing long-term complications [17]. For patients with hypertension, angiotensin receptor blockers (ARBs), particularly candesartan or valsartan, were the most commonly prescribed antihypertensive agents (34.4%). Subcutaneous insulin is generally recommended for hospitalized patients with moderate symptoms and uncontrolled blood glucose levels.

Heparin was administered in 50% of patients with elevated D-dimer levels. Heparin is widely used as an anticoagulant because it inhibits coagulation pathways by blocking proteins involved in blood clot formation, thereby reducing the risk of thrombotic complications. Previous studies have also reported that the use of ARBs among hospitalized COVID-19 patients with hypertension was associated with a reduced risk of adverse clinical outcomes compared with non-use [18].

Therapeutic Outcomes

Laboratory findings related to diabetes mellitus, hypertension, and D-dimer levels at hospital admission and during the first day of treatment at the Emergency Department of RSUD dr. Soedarso Pontianak, West Kalimantan, are presented in Table 4.

Table 4. Clinical and laboratory outcomes among hospitalized COVID-19 patients

Characteristics	Category	Number (n)	Percentage (%)
Diabetes Mellitus (random blood glucose)	Controlled	41	64.1
	Uncontrolled	23	35.9
Hypertension (blood pressure)	Controlled	38	59.4
	Uncontrolled	26	40.6
Elevated D-dimer	Controlled	50	78.1
	Uncontrolled	14	21.9

Based on Table 4, 35.9% of hospitalized COVID-19 patients presented with uncontrolled blood glucose levels (>200 mg/dL) at admission [19]. Uncontrolled blood pressure, defined according to guideline recommendations (≥140/80 mmHg), was observed in 40.6% of patients, while elevated D-dimer levels (>500 ng/mL, based on the Ministry of Health criteria) were identified in 21.9% of cases [9]. Overall, more than 20% of patients exhibited uncontrolled random blood glucose (RBG), elevated blood pressure, and increased D-dimer levels. These abnormalities have been associated with an increased risk of mortality and prolonged length of hospital stay among patients with COVID-19.

Association Between Patient Characteristics and Length of Hospital Stay Among COVID-19 Patients

To identify factors associated with the length of hospital stay among COVID-19 patients, a bivariate analysis was performed using the Chi-square test. The analysis examined the associations between patient characteristics, including age, gender, educational level, and comorbidities (diabetes mellitus, hypertension, and D-dimer status), and the duration of hospitalization. The results of the analysis are presented in Table 5.

Table 5. Association between patient characteristics and length of hospital stay among COVID-19 patients

Characteristics	Category	Length of hospital stay <7 days n (%)	Length of hospital stay ≥7 days n (%)	Total n (%)	p-value
Age	< 55 years	13 (50.0)	13 (50.0)	26 (40.6)	0.001*
	≥ 55 years	5 (13.2)	33 (86.8)	38 (59.4)	
Sex	Male	6 (22.2)	21 (77.8)	27 (42.2)	0.370
	Female	12 (32.4)	25 (67.6)	37 (57.8)	
Education	Elementary/ middle /high school	11 (22%)	39 (78%)	50 (78.1)	0.039*
	Diploma/ bachelor's degree	7 (50%)	7 (50%)	14 (21.9)	
Comorbidities					
Diabetes Mellitus	Yes	9 (22.5%)	31 (77.5%)	40 (62.5)	0.196
	No	9 (37.5%)	15 (62.5%)	24 (37.5)	
Hypertension	Yes	12 (26.7)	33 (73.3%)	45 (70.3)	0.690
	No	6 (31.6)	13 (68.4)	19 (29.7)	
Elevated D-dimer	Yes	6 (42.9%)	8 (57.1%)	14 (21.9)	0.165
	No	12 (24%)	38 (76%)	50 (78.1)	

*Note: Bivariate analysis was performed using the Chi-square test in SPSS version 25. Statistical significance was defined as $p < 0.05$.

Bivariate analysis using the Chi-square test yielded a p-value of 0.001 (<0.05), indicating rejection of H_0 and demonstrating a statistically significant association between age and length of hospital stay among patients with COVID-19. These findings are consistent with previous studies demonstrating that older age is associated with increased COVID-19 severity and prolonged recovery among elderly patients [20]. In contrast, no significant association was observed between gender and length of hospital stay (p=0.370), indicating acceptance of H_0. However, a statistically significant association was found between educational level and length of hospital stay among COVID-19 patients (p=0.039), leading to rejection of H_0. Lower educational attainment may be associated with limited knowledge and

awareness regarding COVID-19 prevention and management, potentially increasing disease severity and prolonging hospitalization.

The Chi-square analysis further showed no significant association between comorbidities and length of hospital stay, as all p-values were greater than 0.05, indicating acceptance of H_0. Specifically, the p-values for diabetes mellitus, hypertension, and D-dimer levels were 0.196, 0.690, and 0.165, respectively. These findings are consistent with previous studies reporting no significant association between diabetes ($p = 0.63$), hypertension ($p = 0.64$), and the duration of hospitalization [21]. However, the present findings differ from previous studies that demonstrated a statistically significant association between diabetes and length of hospital stay ($p = 0.001$). Diabetes mellitus may impair macrophage and lymphocyte function, thereby weakening the immune response and potentially leading to more severe disease outcomes [22].

Similarly, previous studies have reported that hypertension is significantly associated with prolonged hospitalization among patients with COVID-19 [23]. This relationship may be explained by the pathophysiological mechanism whereby SARS-CoV-2 infection induces dysregulation and overactivation of the renin–angiotensin system (RAS), resulting in an exaggerated inflammatory response and cytokine storm that can exacerbate lung injury in COVID-19 patients [24].

The discrepancies between the findings of the present study and those of previous studies may be attributable to the relatively small sample size. The study population consisted of hospitalized patients treated in the isolation ward of Dr. Soedarso Regional General Hospital, Pontianak, West Kalimantan, between January and December 2021, with the majority of participants aged ≥55 years. This observation is in line with previous findings identifying older age as a significant risk factor for severe COVID-19 and prolonged recovery [20].

Association Between Patient Characteristics and Clinical Outcomes among COVID-19 Patients

To evaluate factors associated with clinical outcomes among COVID-19 patients, a bivariate analysis was performed using the Chi-square test. The analysis assessed the associations between demographic and clinical characteristics, including age, gender, length of hospital stay, diabetes mellitus, hypertension, and D-dimer status, and patient outcomes (recovered or deceased). The results of the analysis are presented in Table 6.

Table 6. Association between patient characteristics and clinical outcomes among COVID-19 patients

Characteristics	Category	Recovered, n (%)	Deceased, n (%)	p-value
Age	< 55 years	25 (96.2)	1 (3.8)	0.328
	≥ 55 years	34 (89.5)	4 (10.5)	
Sex	Male	33 (89.2)	4 (10.8)	0.295
	Female	26 (96.3)	1 (3.7)	
Length of stay	< 7 days	17 (94.4)	1 (5.6)	0.674
	≥ 7 days	42 (91.3)	4 (8.7)	
Diabetes mellitus	Yes	36 (90.0)	4 (10.0)	0.400
	No	23 (95.8)	1 (4.2)	
Hypertension	Yes	43 (95.6)	2 (4.4)	0.122
	No	16 (84.2)	3 (15.8)	
Elevated D-dimer	Yes	12 (85.7)	2 (14.3)	0.307
	No	47 (94.0)	3 (6.0)	

Note: Bivariate analysis was performed using the Chi-square test in SPSS version 25. Statistical significance was defined as $p < 0.05$.

Bivariate analysis using the Chi-square test was conducted to assess the associations between patient characteristics, comorbidities, and clinical outcomes among COVID-19 patients. The variables analyzed included age, gender, length of hospital stay, diabetes mellitus, hypertension, and D-dimer levels. The results presented in Table 6 showed that age was not significantly associated with clinical outcomes among COVID-19 patients ($p=0.328$; $p>0.05$), indicating acceptance of H_0. Nevertheless, age remains a critical determinant of COVID-19 outcomes, with approximately 80% of COVID-19-related deaths occurring among individuals aged ≥65 years, suggesting that advanced age is an important risk factor for adverse clinical outcomes [25]. The discrepancy between the present findings and previous studies may be attributable to differences in age classification. In this study, older age was defined as ≥55 years based on WHO criteria, whereas previous studies commonly used a threshold of ≥65 years. Advanced age is associated with increased mortality due to age-related immune decline, including dysfunction of T and B lymphocytes and impaired control of SARS-CoV-2 replication [26].

The Chi-square analysis examining the association between gender and clinical outcomes yielded a p-value of 0.295 ($p>0.05$), indicating no statistically significant association. These findings are consistent with studies showing no

significant relationship between gender and clinical outcomes among COVID-19 patients (p=0.761) [27]. However, these findings differ from several studies conducted in China, which reported a significant association between gender and COVID-19 outcomes. Overall, COVID-19 affects both sexes, and the mechanisms underlying sex-related differences in clinical outcomes remain incompletely understood [28].

The association between length of hospital stay and clinical outcomes showed a p-value of 0.674 (p>0.05), indicating no statistically significant association. Patients with prolonged hospitalization (≥7 days) may have additional risk factors, such as advanced age and multiple comorbidities. Although four patients with a hospital stay of ≥7 days died, prolonged hospitalization does not necessarily lead to mortality, as some patients require extended periods of treatment to recover and achieve clinical improvement.

Similarly, no significant associations were observed between comorbidities and clinical outcomes (all p>0.05), including diabetes mellitus (p=0.400), hypertension (p=0.122), and D-dimer levels (p=0.307). Previous studies have reported that hypertension is a common comorbidity among patients with severe COVID-19 and has been associated with increased mortality, accounting for approximately 58.9% of COVID-19-related deaths in Africa and the Americas [4]. However, increased mortality among hypertensive patients may also be influenced by the presence of concomitant infections and other underlying conditions [29]. Nevertheless, uncontrolled diabetes in COVID-19 patients may increase the risk of renal dysfunction and cytokine-mediated inflammation, thereby contributing to multi-organ damage [30].

The association between laboratory parameters, including D-dimer, C-reactive protein (CRP), and glomerular filtration rate, and mortality yielded p-values >0.05, indicating no statistically significant associations between these variables and clinical outcomes. The relatively small number of patients with elevated D-dimer levels in this study may have limited the ability to detect a significant association with mortality. Despite the absence of statistical significance, elevated D-dimer levels in COVID-19 patients require careful monitoring and intensive management because they have been associated with thrombotic complications and poor prognosis.

Conclusion

This study found that combination therapy involving levofloxacin with remdesivir, favipiravir, or oseltamivir was the most commonly prescribed treatment regimen among hospitalized COVID-19 patients. In addition, age and educational level were identified as significant factors associated with the length of hospital stay, whereas other patient characteristics and clinical outcomes showed no significant associations. Further studies with larger sample sizes are needed to investigate additional confounding factors that may influence the length of hospital stay, such as comorbidities, disease severity, and other clinical characteristics.

Acknowledgment

The authors would like to express their sincere gratitude to the Institute for Research and Community Service, Universitas Ahmad Dahlan (LPPM UAD), for its support of this research. The authors also thank Dr. Soedarso Regional General Hospital, Pontianak, West Kalimantan, for facilitating data collection and supporting the implementation of this study.

Declarations

Author contribution	:	Conceptualization, A.S.; Methodology, I.N.F.; Data curation, K.N. and D.C.W.A.P.; Writing—original draft preparation, A.S.; Writing—review and editing, H.D. and P.A.K.S. All authors have read and approved the final version of the manuscript.
Funding statement	:	This study was supported by the Institute for Research and Community Service, Universitas Ahmad Dahlan (LPPM UAD).
Conflict of interest	:	The authors declare that they have no conflicts of interest and have fully disclosed all relevant relationships and affiliations.
Ethics Declaration	:	This study was conducted in accordance with all relevant ethical guidelines and was approved by the Research Ethics Committee of Dr. Soedarso Regional General Hospital, Pontianak, West Kalimantan (Approval No. 28/RSUD/KEPK/X/2021). The study utilized retrospective medical record data. Patient confidentiality and privacy were strictly maintained by anonymizing all Ethics Committee due to the retrospective nature of the study.
Additional information	:	Supplementary data supporting the findings of this study are available from the corresponding author upon reasonable request.

Informed Consent Statement

Patient informed consent was waived by the Ethics Committee due to the retrospective nature of the study and the use of anonymized medical record data.

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical restrictions and the need to protect patient confidentiality.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used generative artificial intelligence (AI)-assisted technology solely to improve the readability, grammar, and language of the manuscript. After using this technology, the authors carefully reviewed and edited the content as necessary and take full responsibility for the accuracy, integrity, and originality of the published work. No AI tools were used for study design, data collection, data analysis, interpretation of results, or the generation of scientific conclusions.

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