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Analysis of Length of Stay (LOS) of Diabetes Mellitus Patients with COVID-19 Confirmed at One of Bantul Private Hospitals

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ABSTRACT

Diabetes mellitus (DM) is one of the most common health problems affecting millions of people in the world. Based on data from the Indonesian COVID-19 Handling Task Force, as of May 2021, it is known that the prevalence of DM as a comorbid COVID-19 is 33.6%. The variety of clinical conditions that accompany DM cases makes the complexity of patient care increase, which results in variations in patient LOS as one of the quality indicators to support better management and to improve the quality of service for DM patients confirmed with COVID-19 and not confirmed COVID-19. The purpose of this study was to determine whether or not there is a difference in the *Length of Stay* (LOS) of DM patients confirmed with COVID-19 and not confirmed with COVID-19 with the type of *observational analytic* cross-sectional design. Result Research shows that based on the *Mann-Whitney* test used to determine the *difference in length of stay* between DM patients confirmed with COVID-19 and not confirmed COVID-19, they get significant results, namely *p-value* = 0.000 (p<0.050). It can be concluded that there is a difference between the *Length Of Stay* (LOS) of Diabetes Miletus patients confirmed with COVID-19 and diabetes mellitus patients who are not confirmed with COVID-19.

Keywords: COVID-19; Diabetes mellitus; Hospital; Length of stay

INTRODUCTION

Diabetes mellitus (DM) is one of the most common health problems affecting millions of people in the world. [1,2] *World Health Organization* (WHO) reported that people with diabetes mellitus (DM) worldwide reached 422 million people in 2016 and in 2019 increased to 463 million people and is even expected to continue to increase by around 600 million people in 2035.[1,3,4]

Increased blood glucose can cause various types of complications in organs and body systems even death if DM management is not optimal.[5] One disease that can affect glycemic control is *Coronavirus Disease 2019* (COVID-19).[6] Based on the results of Dionita and Anggi's research on COVID-19 cases in Indonesia, it is known that DM is ranked second as the most comorbid with a percentage of 33.6%.[7] The data illustrates that during the COVID-19 pandemic, many DM sufferers must receive attention because DM is considered to have a close relationship with morbidity and mortality in COVID-19 patients.[8]

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The relationship between COVID-19 and DM has been described as two pandemics, as DM is the most common chronic noncommunicable disease globally and in parallel is one of the major comorbidities in patients with COVID-19.[6] This situation is caused by the immune system in COVID-19 patients with DM not functioning normally, especially in the uncontrolled group. In patients with uncontrolled DM, there is also impaired T-lymphocyte function which causes damage to the adaptive immune system.[9]

Management of DM patients in the era of the COVID-19 pandemic can be a challenge for health workers. [6] *Length of stay* (LOS) is an important indicator in ensuring successful patient treatment. LOS is also related to the cost of treatment incurred by patients. DM patients who undergo inpatient services at hospitals have various LOS. [10,11]

The quality of hospital services is determined by several factors, including *the length of stay*. While the *length of stay of* DM patients is influenced by the type of complications experienced.[10,11] Therefore, considering that there is still little research in Indonesia related to the length of stay of COVID-19 patients with comorbid DM, this study is important to determine whether or not there is a difference in the LOS and to support better management and to improve the quality of service for type II DM patients confirmed with COVID-19 and not confirmed with COVID-19 in one of the private hospitals assisted by COVID-19.

However, this study is not the only one about LOS diabetes mellitus. A number of studies by Gayatri mention that there is a hospital cluster effect on patient LOS variations. The difference between this study and Gayatri is the variables used. Gayatri used the dependent variable LOS of COVID-19 patients with comorbid DM, while the author used independent variables, namely confirmed and unconfirmed type II DM patients.[12]

In addition, Marko's research and Ismil Khairi Lubis research also have linearity because they research LOS. However, both have significant differences with this study from the independent variables used. The independent variables of previous studies were hypertension, nephropaty, neuropathy, obesity, CHD, stroke, and pulmonary TB while the authors used independent variables, namely type II DM patients who were confirmed with COVID-19 and those who were not confirmed with COVID-19.[11] Although the types of research were both analytic observational, the conclusions differed because of the difference in variables made this study find its own novelty.

METHODS

Type and design of research

The type of research used is *observational analysis* with *a cross-sectional* design. The study was conducted in September 2021-June 2022. Data collection was carried out by observing the medical records of DM patients confirmed with COVID-19 and not confirmed with COVID-19 who were treated at one of the auxiliary private hospitals from June to December 2021 using *simple random sampling* techniques until the required number of samples was met. In determining the sample size in this *cross-sectional* study using the Lemeshow formula method. The sample size in this study based on the formula obtained the minimum sample results for each group is 36 people. This research was carried out after obtaining a letter of ethics from the ethics commission of Alma Ata University no. KE//AA/III/10730/EC/2022.

Inclusion and exclusion criteria

The criteria for sample inclusion are patients who are mainly diagnosed with type II DM confirmed with COVID-19 and unconfirmed COVID-19 without complications, type II DM confirmed with COVID-19 based on moderate and severe RT-PCR, and patients aged ≥ 18 years. The criteria for sample exclusion are deceased patients, inpatients in the ICU, and referred patients.

Data Processing and Analysis

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Data obtained from patient medical records are collected and then observations are made using statistical descriptive analysis. Univariate analysis was carried out to describe the variables of the study by creating a frequency distribution table, while bivariate analysis used the *Mann-Whitney* test to analyze the presence or absence of differences in *the length of stay* (LOS) of DM patients confirmed with COVID-19 and those who were not confirmed with COVID-19. The interpretation of the data can be seen from the significance value obtained, that is, if the significance value <0.05 means that the hypothesis is accepted (there is a difference between two different independent variables). Meanwhile, if the significance value > 0.05, it means that the hypothesis is rejected (there is no difference between two different independent variables).

RESULTS AND DISCUSSION

Distribution of characteristics of the subject of study

The distribution of characteristics of research subjects by sex in Table 1 shows that research subjects with type II DM diagnosis are more dominated by women with 21 results (58.3%).

This result is in line with research by Dewi and Arulita, (2021) which shows that the majority of DM patients are female, namely 49 patients (73.1%).[13] Factors that cause women to be more susceptible to DM are unstable estrogen hormones (up or down) which can affect glucose levels in the blood. The female hormone estrogen regulates insulin sensitivity and increases glucose uptake in the blood. When levels of the hormone estrogen increase, the body becomes resistant to insulin.[14] The characteristics of the research subject can be seen in Table 1.

In contrast, the distribution of characteristics of research subjects based on sex with a confirmed diagnosis of type II DM COVID-19,

Table 1. Distribution of characteristics of the subject of study

Characteristic	DM type II confirmed with COVID-19		DM type II is not confirmed with COVID-19	
	n	%	n	%
Gender				
Man	19	52.8	15	41.7
Woman	17	47.2	21	58.3
Age				
18 - 25 years	0	0	0	0
26 - 34 years	2	5.6	1	2.8
35 - 44 years	4	11.1	1	2.8
45 - 54 years	13	36.1	9	25.0
55 - 64 years	8	22.2	18	50.0
65 - 74 years	9	25.0	5	13.9
≥75 years old	0	0	2	5.6
Total	36	100	36	100

showed that the study subjects were more dominated by men with a total of 19 people with results (52.8%). The results of this study are in line with several research results such as Sticchi *et al*. (2021) which has a much larger male population than females.[15] This is because men are more sensitive to SARS-CoV-2, so male sex is one of the risk factors for COVID-19.[16] The variability of innate immunity, steroid hormones, and factors related to sex chromosomes makes males more susceptible to viral infections.[17]

Prevalence of DM patients from June to December 2021

The total prevalence of type II DM patients in one of Bantul's private hospitals from June to December 2021 with the highest known prevalence found in DM patients confirmed with COVID-19, which is 185 (50.3%). Of the total number of 368 type II DM patients, 142 patients are known to meet the inclusion criteria and 50 patients are known to meet the exclusion criteria with details of 49 patients died and 1 patient was referred to another hospital.

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Table 2. The prevalence of type II DM patients in one of the private hospitals from June to December 2021

Diagnosis	Frequency (n)	Percentage (%)
DM confirmed COVID-19	185	50.3
DM not confirmed COVID-19	183	49.7
Total	368	100

The results of the prevalence of DM confirmed by COVID-19 in several studies vary, such as the results of research by Nurida *et al* (2022) obtained data on 45 COVID-19-positive patients with DM disease in Surabaya Hospital as much as 29.8%.[18] Sheshah *et al* (2021) stated that type II DM is the most common comorbidity in COVID-19 patients in Riyadh Hospital (45.7%).[19] Pavan *et al* (2020) stated that the prevalence of diabetes in patients infected with COVID-19 in the settle region was found to be 58%.[20] And research by Wang *et al* (2020) states that the prevalence of diabetes is 16.7%.[21]

Furthermore, based on Table 2, it is known that the prevalence of DM patients with not confirmed COVID-19 is 183 (49.7%). Of the 183 patients with type II diabetes, 53 patients were found to meet the inclusion criteria, and 11 patients were known to be included in the exclusion criteria with details of 11 patients who died. The results of several studies on the prevalence of COVID-19 unconfirmed DM vary, such as research by Trusda *et al* (2021) stating that West Java is the most populous province in Indonesia with a DM prevalence of 1.28%.[22] IDF explained that the global prevalence of diabetes among 20-79 years old in 2021 was 10.5%, namely a number (536.6 million people), increasing to 12.2% (783.2 million) in 2045.[23] Of the 18.9 million National Health Insurance members who accessed secondary and tertiary health services, 812,204 (4%) identified patients with DM which of 57% had complications.[24]

Overview of Results and Comparison of *Lenght of Stay of* DM type II patients confirmed with COVID-19 and not confirmed with COVID-19

LOS type II DM patients confirmed with COVID-19 are in the range of 3-26 days with an average of 9.8 days. The highest proportion was in the duration of treatment of 1-7 days with study subjects amounting to 16 (44.4%). Based on these data, it is explained that the longest LOS in type II DM patients confirmed with COVID-19 is 26 days. This is due to worsening clinical symptoms in patients, causing hospital stays to be longer and patients require intensive care.[25] Furthermore, for patients with type II DM not confirmed with COVID-19 is in the range of 2-8 days with an average of 4.3 days. The highest proportion was in the length of treatment of 1-7 days with 35 study subjects (97.2%).

Table 3. The length of stay of type II DM patients from June to December 2021

LOS (day)	DM type II confirmed with COVID-19		DM type II is not confirmed with COVID-19		*p-value*
	n	%	n	%	
1 – 7	16	44.4	35	97.2	
8 - 14	15	41.7	1	2.8	
15 - 21	2	5.6	0	0	0.000
22 - 28	3	8.3	0	0	
Total	36	100	36	100	
Average LOS	9.8 days		4.3 days		
LOS Range	3-26 days		2-8 days		

The results of the *Mann-Whitney* test used to see the difference between LOS type II DM patients confirmed with COVID-19 and not confirmed with COVID-19 obtained significant results, namely *p-value* = 0.000 (<0.050). From these results, it can be concluded that there is a significant difference between the LOS of type II DM patients confirmed with COVID-19 and not confirmed with COVID-19, namely in type II DM patients confirmed with COVID-19 have longer

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LOS than type II DM not confirmed with COVID-19.

The results of this study are in line with research conducted by Bode *et al* (2020) where among 1,122 patients in 88 hospitals in the United States, 451 patients with comorbid DM with uncontrolled hyperglycemia, 37.8% of them had longer LOS. Among the 493 people who lived, 184 patients with uncontrolled diabetes had longer LOS compared with 386 patients without diabetes.[26]

Research conducted by Kalista and Anisa, (2022) states that the average LOS of COVID-19 patients with comorbid DM is 15 days and without comorbidities is 13 days.[27] Alkundi *et al* (2020) said that COVID-19 patients with uncontrolled DM had longer LOS and much higher mortality with an average value of 14.3 days compared to patients without DM with a mean value of 9.8 days. Patients with uncontrolled DM have a very high mortality rate.[28] In line with research conducted by Wu *et al* (2020) that DM increased the severity of COVID-19 by 2.58 times compared to no comorbidities, and also increased COVID-19 deaths by 2.95 times. Wu *et al* (2020) mentioned that the underlying relationship between DM and COVID-19 is chronic inflammation, increased coagulation activity and impaired immune response.[29]

This is because DM is considered one of the risk factors for severity and death of COVID-19 patients.[30] COVID-19 patients with comorbid DM with uncontrolled hyperglycemia increased the risk of death higher than DM with controlled sugar levels.[8] The cause of severity due to comorbid DM is thought to be because DM patients are more susceptible to infection. The susceptibility of DM patients to COVID-19 infection is due to; 1. increased ACE2 in DM patients so that the virus attaches and replicates more, 2. Impaired immunological function in DM causes cytokine storms that cause COVID-19 severity and death.[31] Therefore, it is important to control sugar levels in DM patients with COVID-19.[25]

CONCLUSION

There is a significant difference between the LOS of type II DM patients confirmed with COVID-19 and not confirmed with COVID-19 with the *results of the Mann-Whitney* test obtained *p-value* = 0.000. DM patients confirmed with COVID-19 have LOS longer than DM patients with not confirmed COVID-19.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

Suggestion

Future studies need to further examine the length of stay of diabetes mellitus and COVID-19 patients in different scopes such as comparing the length of stay of DM patients between hospitals in order to get a larger population, observing factors that affect the length of *stay* in these patients such as the accuracy *of* drug selection, comorbid influences and other factors, and observing the relationship between patient LOS and cost hospitalization.

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