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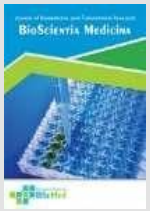

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The Relationship between COVID-19 Vaccination and the Severity of COVID-19 in Patients Treated for the Period August 2021 – August 2022 at Arifin Achmad General Hospital, Riau Province, Indonesia

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A B S T R A C T

Background: The use of the COVID-19 vaccine is very effective in controlling the pandemic, but it is important to know that no vaccine is 100% effective in preventing the COVID-19 pandemic. Vaccination can make the disease milder so that the risk of infection, hospitalization, and death is lower in people who have been vaccinated compared to those who have not been vaccinated. This study aims to determine the relationship between COVID-19 vaccination and the severity of COVID-19 infection in patients treated at Arifin Achmad General Hospital, Riau Province, for the period August 2021 to August 2022. **Methods:** This study is an analytical observational research with a cross-sectional approach. A total of 403 research subjects were included in this study. Data analysis using Chi-square by looking for the relationship between the dependent variable and the independent variable. Ineligible bivariate data will be performed using the Fisher test with a p-value < 0.05 considered significant based on statistical tests. **Results:** The percentage of mild and moderate severity patients was generally the highest in the group who did not receive vaccination, with the percentage being 45.8%, followed by those who received booster (30.4%). Of the 54 cases of patients with severe-critical severity, 27 cases were dominated by patients who had no vaccination status at all, with a percentage of 50.0%. Subjects who did not receive vaccination had a 3.37 times higher chance of developing severe COVID-19 than those who were vaccinated (odds ratio = 3,37; 95% confidence interval [THERE] = 1,95-4,80). **Conclusion:** The relationship between COVID-19 vaccination and the severity of COVID-19 infection in patients treated at Arifin Achmad General Hospital, Riau Province, for the period August 2021 to August 2022.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic is a global health crisis, and more than six million deaths were reported by the World Health Organization (WHO). COVID-19 is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which is also referred to as the 2019 novel Coronavirus (2019-nCoV). This virus was first discovered in China and then spread to all countries in the world. The World Health Organization (WHO) declared COVID-19 a global pandemic after this virus spread to almost all countries in the world. This virus spreads through respiratory droplets that come from coughing and sneezing.[1] The virus enters host cells through the angiotensin-converting enzyme-2 (ACE2) receptor, which is found in various body organs, including the lungs, heart, kidneys, liver, intestines, testicles, and blood vessels. There are many ACE2 receptors in the lungs in type II alveolar cells, so the lungs are the organs most affected by abnormalities caused by the SARS-CoV-2 virus. This is the basis for the fact that the lungs are the organ most affected by the SARS-CoV-2 virus.[2] Based on data obtained in December 2021, around 59.8 million confirmed cases

of COVID-19 were found in 218 countries in the world, and 1.41 million cases died. Data on cases in Indonesia up to December 2021 contained 506 thousand confirmed cases with 16 thousand deaths. Data on cases that occurred in Riau Province until December 2021 showed 20 thousand confirmed cases with 420 deaths.[3-5] Data obtained from the Arifin Achmad General Hospital Pekanbaru as of December 2021 was 426 confirmed cases with details including 397 people recovered, 17 people died, and 317 people declared suspect cases with details of 252 people recovered and 41 people died.[6,7]

The COVID-19 vaccination program in Indonesia started on January 13th, 2021.[8] The use of the COVID-19 vaccine is very effective in controlling the pandemic, but it is important to know that no vaccine is 100% effective in preventing the COVID-19 pandemic. Several other studies also stated that people who were not vaccinated experienced confirmed COVID-19 hospitalization or died due to COVID-19. Vaccination can make the disease milder so that the risk of infection, hospitalization, and death is lower in people who have been vaccinated compared to those who have not been vaccinated.[9] This study aims to determine the relationship between COVID-19 vaccination and the severity of COVID-19 infection in patients treated at Arifin Achmad General Hospital, Riau Province, for the period August 2021 to August 2022.

2. Methods

This study is an analytical observational research with a cross-sectional approach. This study uses secondary data obtained from the Medical Records Installation of Arifin Achmad General Hospital, Riau Province, Indonesia. A total of 403 research subjects were included in this study, where the research subjects met the inclusion criteria. The inclusion criteria for this study are patients with confirmed COVID-19 from asymptomatic to critical degrees who were treated at Arifin Achmad General Hospital, Riau Province, from August 2021 to August 2022, as well as medical records of patients confirmed with COVID-19 with comorbidities (diabetes mellitus, hypertension, kidney disorders) who were treated at Arifin Achmad General Hospital, Riau Province from August 2021 to August 2022. This study has received approval from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, Universitas Riau, with number B/043/UN19.5.1.1.8/UEPKK /2023.

Analyze data using Chi-square by looking for the relationship between the dependent variable and the independent variable. Ineligible bivariate data will be performed using the Fisher test with a p-value < 0.05 considered significant based on statistical tests. The independent variable in this study is the severity of COVID-19, and the dependent variable is the history of COVID-19 and vaccination.

3. Results

Table 1 shows the demographic characteristics of the sample in the research examined. The average age of COVID-19 patients in this study was 48.64 years ± 16.36, with the largest distribution in the 26 – 44 year group in this study (38.0%). The research sample was dominated by women at 56.3%, followed by men at 43.7%. Table 2 shows the distribution of the severity of COVID-19 experienced by patients who are included in this research. Mild and moderate degrees dominated in this research sample of 349 people (86.6%), followed by severe and critical degrees in 54 people (13.4%). Table 3 displays the vaccination status of COVID-19 patients in the research sample. The patient's vaccination status was dominated by 184 people (46.4%) who had no history of vaccination, followed by patients who had a history of vaccination. *booster* with a total of 104 people (25.8%). Table 4 shows the status that Sinnovac is the vaccine most frequently given to the first and second vaccines, with 155 people (71.7%) and 140 people (74.0%), respectively. Meanwhile, the third and fourth vaccines received the most Pfizer, namely 72 people (59.5%) and 12 people (66.6%).

Table 1. Sample demographic characteristics.

Variable	n	Percentage (%)
Age (years) Mean±SD	48,64 ± 16,36	
18-25 years old	16	4,0
26-44 years old	153	38,0
45-59 years old	120	29,8
60-74 years old	80	19,9
>74 years old	34	8,4
Gender		
Male	176	43,7
Female	227	56,3

Table 2. Severity degree of COVID-19.

Variable	n	Percentage (%)
Degree of severity		
Mild-moderate	349	86,6
Severe-critical	54	13,4

Table 3. Vaccination history in research samples.

Variable	n	Percentage (%)
Vaccination history		
No	187	46,4
Partial	24	6,0
Complete	70	17,4
Booster-1	104	25,8
Booster-2	18	4,5

Table 4. Types of vaccinations used in the research sample.

	Vaccine 1		Vaccine 2		Vaccine 3		Vaccine 4	
Variable	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
AZ	17	7,8	12	6,3	20	16,5	1	5,5
Modena	6	2,8	5	2,6	28	23,1	5	27,7
Pfizer	38	17,5	32	16,9	72	59,5	12	66,6
Sinnovac	155	71,7	140	74,0	1	0,8	0	0

Table 5. Relationship between vaccination history and severity of COVID-19.

	Vaccination status								p-value
	No		Partial		Complete		Boster		
Degree of severity	**n**	**%**	**n**	**%**	**n**	**%**	**N**	**%**	
Mild-moderate	160	45,8	20	5,7	63	18,1	106	30,4	0,007
Severe-critical	27	50,0	4	7,4	7	13,0	16	29,6	

This research shows that the percentage of mild and moderate severity patients is generally the highest in the group who did not receive vaccination, with the percentage being 45.8%, followed by those who received boosters (30.4%). Of the 54 cases of patients with severe-critical severity, 27 cases were dominated by patients who had no vaccination status at all, with a percentage of 50.0% (Table 5).

Table 6. Relationship between vaccination status and severity of COVID-19.

	Mild	Moderate/Severe/Critical	OR
Complete/partial/booster vaccination	164 (40,7%)	52 (12,9%)	3,37 (1,95-4,80)
No vaccination at all	185 (45,9%)	2 (0,5%)	

In Table 6 seeks to see the effect of vaccination on the degree of morbidity from COVID-19. From the results found, not getting vaccinated gives 3.37 times the chance of getting severe COVID-19 compared to those who are vaccinated (odds ratio = 3,37; 95% confidence interval [CI] = 1,95-4,80).

4. Discussion

Other research shows a significant difference between patient vaccination status and the severity of COVID-19 ($p < 0.001$), and a strong correlation was found in the number of vaccination doses on the severity of COVID-19 ($p < 0.001$), with complete vaccination status correlating with the severity of COVID-19. 19, which is low.[3] Other research shows that vaccination is significantly related to the recovery rate for moderate, severe, and critical COVID-19 patients with comorbid hypertension ($p = 0.018$). There was no significant difference between age and vaccination status in moderate, severe, and critical COVID-19 patients with comorbid hypertension and DM factors on recovery ($p = 0.953$).[10-13]

Previous research showed booster effectiveness of 76.5% (95% CI = 55.9%-87.5%) against Omicron-related hospitalizations and deaths. Recent data shows that people aged 60 years or older who received a fourth dose of BNT162b2 experienced increased protection against severe COVID-19. Another study conducted in individuals aged ≥60 years showed that complete vaccination and revaccination were associated with protection from pneumonia and the risk of serious COVID-19 caused by Omicron variant infection.[14]

A study examining the effectiveness and neutralization of mRNA in patients undergoing SARS-CoV-2 vaccination. The results showed that the effectiveness of the 2-dose mRNA vaccination against severe COVID-19 for up to six months could not be determined, but they showed that the boost to the mRNA vaccine was associated with a marked increase in protection against severe COVID-19 compared with those who did not vaccinate and booster. Protection against Omicron in the first two months after the third mRNA dose (booster) was similar to protection in the first two months after the second mRNA dose.[15,16]

Protection against confirmed infection for the second and third doses of mRNA diminished rapidly at the same rate. Vaccine protection booster mRNA against confirmed infections also differs from combination mRNA vaccines. Two months after the most recent vaccine dose, a triple inactivated SARS-CoV-2 vaccine may provide significantly less protection against infection compared to the period immediately following a two-dose mRNA vaccination. Three doses of inactivated SARS-CoV-2 vaccination provide greater protection than two-dose mRNA vaccination in the event of severe COVID-19.[17,18]

There are several limitations in this research. First, this study sample was dominated by patients who had not received any vaccinations at all. This can be caused by the fact that the research sample consists of all medical records of COVID-19 patients treated at Arifin Achmad General Hospital during the period August 2021 to August 2022. Meanwhile, the August 2021 period is the beginning of the vaccination Covid-19 for the general public. Second, this research is a single-center study. This means that the results of this study cannot be generalized to the population in general. Third, this research sample is dominated by patients with comorbidities, which can be biased because comorbidities can increase the severity of COVID-19. This dominant sample was taken at Arifin

Achmad General Hospital, Riau Province, because it is the main COVID-19 referral hospital for patients with comorbidities and requires intensive care. So, hospitals that are unable to handle COVID-19 with comorbidities will refer to Arifin Achmad General Hospital, which has more adequate facilities. Fourth, this research does not combine statistics with other possible variables that influence the degree of severity beyond the vaccination status itself, such as age, gender, and history of previous COVID-19 infection. The final weakness of this study is that it uses the period August 2021 – August 2022. Several other studies have found that vaccination status has an effect on reducing the severity of COVID-19, but this is not the case in this study. This certainly has the potential to influence research results, and it is hoped that there will be further studies that compare equally between patients who have not been vaccinated and those who have been fully vaccinated.[19,20]

5. Conclusion

The highest percentage of patients experiencing severe-critical grade COVID-19 was in the group who did not receive any vaccination at all, at 50%. Not getting vaccinated at all gives a 3-time chance of experiencing severe-critical grade COVID-19.

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