Original Article

Association of The Vaccination Status of Health Workers of COVID-19 Survivors with The Outcomes of Treatment of COVID-19 at General Hospital In Padang City

Kornelis Aribowo, Masrul Basyar, Yessy Susanty Sabri

Department of Pulmonology and Respiratory Medicine, Faculty of Medicine, Universitas Andalas, Dr. M. Djamil Padang General Hospital, Padang, Indonesia

Abstract

Background: Health workers are on the front lines of treating and fighting the COVID-19 pandemic. Health workers face COVID-19 patients at work. Health workers are at increased risk of infection if they are not properly protected. Increased risk for health workers can be caused by contact with patients without personal protective equipment (PPE) and surfaces contaminated with the virus. Infected health workers can infect other people around them and will increase the workload of other health workers. One of the efforts to reduce the risk of transmission to health workers is vaccination. Vaccines against COVID-19 are considered very important to prevent and control COVID-19. The aim is to determine the relationship between the COVID-19 vaccine status and the outcomes of healthcare workers treated for confirmed COVID-19 at hospitals throughout Padang.

Methods: This observational study was conducted using a retrospective cohort method. The study was conducted from August 2021 to May 2022 in hospitals across Padang by completing a questionnaire in the form of a Google form link.

Results: Vaccination status of health workers who survived COVID-19 who were treated at Padang City General Hospital (66.97%) were not vaccinated, aged 26–35 years (57.80%), female (80.73%), worked as paramedics (63, 55%), symptom onset 3 to 7 days (44.95%), number of symptoms 3 (55.96%), most fever (24.68%), number of comorbid 1 to 2 (66.06%), obesity (66.67%), length of stay <21 days (84.40%), and mild clinical (55.96%) and recovered (92.66%). The highest degree of COVID-19 severity for health workers who were not vaccinated was moderate clinical, 42 samples (57.53%), and vaccinated, predominantly mild clinical, 34 samples (94.44%). The duration of stay of health workers vaccinated was higher than that who were not vaccinated (97.22% vs. 78.08%).

Conclusion: The vaccination status of health workers who have survived COVID-19 relates to a clinical degree, length of stay, and outpatient treatment.

Keywords: COVID-19, health workers, outcome hospitalization, vaccination

Corresponding Author:
Kornelis Aribowo | Department of Pulmonology and Respiratory Medicine, Faculty of Medicine, Universitas Andalas, Dr. M. Djamil Padang General Hospital, Padang, Indonesia | dokterkornelis@gmail.com

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INTRODUCTION

Health workers are the front-line medical personnel to treat and fight the COVID-19 pandemic.[1] Itodo's research states an increased risk of SARS-CoV-2 infection for health workers who treat COVID-19 compared to the general public.[2] This potential is because health workers work in long-term exposures. Failure to apply for adequate personal protection, PPE either does not meet standards or is reused, and lack of training, infection control, monitoring, prevention, and control mechanisms.[3]

The COVID-19 vaccine helps protect the body from falling ill due to COVID-19 by generating or stimulating specific immunity in the body. This process causes the vaccine to reduce the viral load in the infection process, thereby suppressing further transmission. This reduction in viral load implies a lower transmission potential, contributing to the vaccine's effect on virus spread.[4]

Bernal's study found that there were differences between vaccinated and unvaccinated patients. Of those who were not vaccinated, 543 (56%) had symptoms of COVID-19, and 140 (14%) were asymptomatic on or 14 days before the date of a positive PCR test, compared with 29 (36%) with typical COVID-19 symptoms and 15 (19%) were asymptomatic in the vaccinated group.[5]

The Redmon study found that 80 (5.7%) of 1.408 unvaccinated patients had COVID-19, and 12 (0.3%) of 4.222 were vaccinated. Patients who were vaccinated had mild symptoms, and none required

hospitalization.[6] Baz's research found that from 7240 COVID-19 patients, there were 260 (18.8%) people had been vaccinated, but only 161 people (11.7%) had symptoms and treated only 11 people (0.8%). These data show that vaccination can reduce the symptoms and treatment of COVID-19.[7] Hyams research stated that by vaccinating the older patients, >70 years of age to 180 COVID-19 patients, there was a decrease in care from 72% to 57% after the second vaccination and more treatment shorter than unvaccinated.[8]

METHODS

This study is an observational analytic study with a retrospective cohort method. The research was conducted in hospitals throughout the city of Padang, namely Regional General Hospital Dr. M. Djamil, Padang City, Andalas University Hospital, Semen Padang Hospital, BMC Hospital, Hermina Hospital, Yos Sudarso Hospital, Ibnu Sina Hospital, Reksowidiryo Army Hospital, Bhayangkara Hospital, Naili DBS Hospital, Siliguri Hospital, RS Aisyiyah. The research was carried out from August 2021 to May 2022.

According to the Law of the Republic of Indonesia Number 36 of 2014, health workers are every person who devotes himself to the health sector and has the knowledge and skills through education in the health sector which, for certain types, require the authority to carry out health efforts. They are broadly divided into a) medical personnel: specialist doctors, general practitioners, dentists, and specialist medical education programs; b) paramedics: nurses and midwives; c) supporting personnel: laboratory analysts, laboratory assistants, pharmacists, pharmacist assistants, radiographers, nutritionists, nutritionists and dietitians, electromedical, medical laboratory technologists, medical physicists, radiotherapists and prosthetic orthotics, medical recorders and health information, cardiovascular techniques, service technicians blood, optometrist, dental technician, anesthesiologist, dental and oral therapist, and audiologist, physiotherapist, occupational therapist, and speech therapist. Vaccination status for COVID-19 consists of a) not vaccinated: never been vaccinated until infected with COVID-19; and b) vaccinated: fully vaccinated against COVID-19 twice until infected with COVID-19.

The sampling technique of the inclusion criteria in this study was health workers who were confirmed to have COVID-19 from the results of the *Reverse Transcriptase – Polymerase Chain Reaction* (RT-PCR), hospitalized for COVID-19, willing to participate in this study and filled out the questionnaire. The exclusion criteria for this research is an incomplete *Google form*. The characteristics of the data are presented in tabular form and processed statistically.

RESULTS

The total number of survivors of COVID-19 health workers in COVID-19 treatment based on vaccine status consisted of 36 health workers who had been vaccinated (33.03%) and 73 health workers who were not vaccinated (66.97%), as shown in Figure 1.

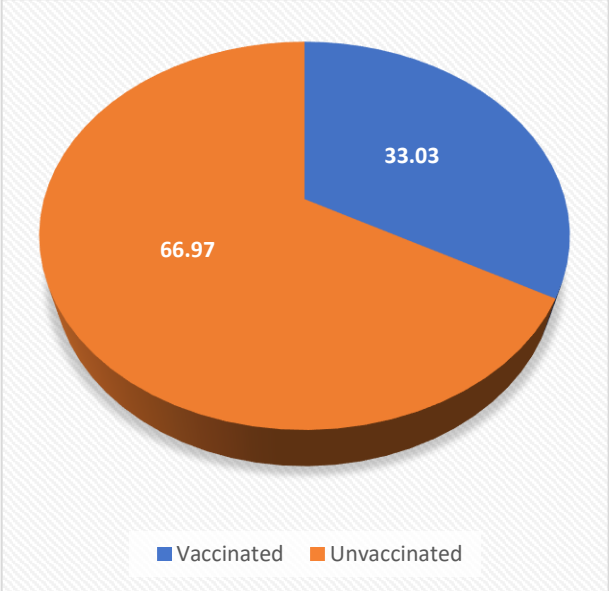

Figure 1. COVID-19 vaccine status in hospitalized health workers

Health workers suffering from COVID-19 treated at hospitals throughout the city of Padang were generally 26-35 years old (57.80%), followed by the 36–45 age group (19.27%). Females (80.73%) were treated more than males (19.27%).

Table 1. Characteristics of Health Workers suffering from COVID-19 being treated at General Hospital throughout the City of Padang

Characteristic	Total subject (N=109)	Vaccinated (N=36)	Unvaccinated (N=73)	*P*
Aged (years)				
17–25	16 (14.68)	8	8	
26–35	63 (57.80)	19	44	
36–45	21 (19.27)	6	15	0.399[b]
46–55	6 (5.50)	2	4	
>56	3 (2.75)	1	2	
Gender				
Male	21 (19.27)	6	15	0.629[a]
Female	88 (80.73)	30	58	
Occupation				
Medical personnel	25 (23.36)	13	14	
Paramedic	68 (63.55)	21	47	0.414[b]
Supporting Personnel	8 (7.48)	2	6	
Administration staff	6 (5.61)	0	6	
The onset of Symptoms (days)				
<3	31 (28.44)	14	17	
3–7	49 (44.95)	14	35	0.0001[a]
>7	29 (26.61)	8	21	
Symptoms				
Fever	76 (24.68)	29	47	0.084[a]
Cough	51 (16.56)	19	32	0.379[a]
Breathlessness	27 (8.77)	8	19	0.665[a]
Gastrointestinal disorders	23 (7.47)	5	18	0.195[a]
Anosmia	49 (15.90)	20	29	0.118[a]
Ageusia	18 (5.84)	12	6	0.001[a]
Headache	64 (20.78)	26	38	0.044 [a]
Number of symptoms				
No symptoms	13 (11.93)	2	11	
1-2	35 (32.11)	8	27	0.009[b]
≥3	61 (55.96)	26	35	
Number of comorbidities				
No comorbid	36 (33.03)	15	21	
1-2	72 (66.06)	21	51	0.546[b]
≥3	1 (0.91)	0	1	
Comorbidities				
Hypertension	10 (9.80)	2	8	0.016[a]
Diabetes mellitus	2 (1.96)	0	2	0.316[a]
Cerebrovascular	2 (1.96)	1	1	0.153[a]
Cardiovascular	7 (6.86)	2	5	0.734[a]
Kidney illness	2 (1.96)	1	1	0.153[a]
Asthma/COPD	9 (8.83)	3	6	0.363[a]
Obesity	68 (66.67)	18	50	0.544[a]
Autoimmune	2 (1.96)	0	2	0.316[a]

Note: [a]Chi-Square test; [b]Pearson chi-square test; *P*<0.05 significant

Table 2. The Relationship between COVID-19 Vaccination Status and the Clinical Degree of Padang City Health Workers

Vaccination Status	Clinical Degree			*P*
	Mild (N=61)	Moderate (N=44)	Severe (N=4)	
Unvaccinated	27 (36.99 %)	42 (57.53 %)	4 (5.48 %)	0.0001
Vaccinated	34 (94.44 %)	2 (5.56 %)	0 (0 %)	

The most occupations are paramedics (63.55%), followed by medical personnel (23.36%). The onset of symptoms when infected was highest at a distance of 3 to 7 days (45%), followed by <3 days (28.44%). The duration for confirmed COVID-19 health workers vaccinated and treated at the general

hospital throughout Padang is more than 28 days after vaccination (86.11%). The most common symptom was fever (24.68%) and followed by headache (20.8%), with the most complaints of three symptoms (55.96%). The highest number of comorbidities is 1 to 2 types (66.06%), with the most comorbidities in health workers being treated, namely obesity (66.67%), as shown in Table 1.

Health workers suffering from COVID-19 who were not vaccinated with mild clinical grade followed by moderate clinical and severe clinical-critical were different from those vaccinated. Health workers who had been vaccinated did not find any clinical severity critical. The clinical degree of mild after vaccination was 94.44%, and moderate clinical was 5.56%. Health workers confirmed to have COVID-19 after vaccination was found to be mainly at a mild clinical degree, while the highest number were not vaccinated at a moderate clinical degree, as shown in Table 2. Statistic analysis shows a significant relationship with the Pearson chi-square test between the status of the COVID-19 vaccination and the clinical degree of health workers suffering from COVID-19 treated at hospitals throughout Padang, with *P*=0.0001.

Health workers suffering from COVID-19 who were neither vaccinated nor vaccinated were the most in the length of stay <21 days (78.08% and 97.22%). Based on the table, the percentage of the length of stay for health workers suffering from COVID-19 who were treated at hospitals throughout the city of Padang for those who were not vaccinated was higher than those who were vaccinated (21.92% vs. 2.78%). The relationship between vaccine status and length of stay for health workers suffering from COVID-19 treated at hospitals throughout the city of Padang in a statistical test showed *P*=0.021 (*P*<0.05), which showed a significant relationship. The length of stay for COVID-19 in those vaccinated for <21 days was greater than that in those vaccinated because the clinical symptoms in health workers who were vaccinated mainly were mild clinical (94.44%), as shown in Table 3.

Health workers suffering from COVID-19 who were not vaccinated and vaccinated against outpatient healthcare treatment recovered (94.52% and 88.89%), followed by recovery with residual symptoms (5.48% and 11.11%). The relationship between vaccination status and the outpatient healthcare workers suffering from COVID-19 who were treated at hospitals throughout the city of Padang with a statistical test, the results obtained *P*=0.289 so that there was no significant relationship between the status of the COVID-19 vaccination and the outpatient of COVID-19 treatment in health workers who are being treated at hospitals throughout the city of Padang.

Table 3. The Relationship between the Status of the COVID-19 Vaccination and the Length of Hospitalization of Padang City Health Workers

Vaccination Status	Duration of Treatment		*P*
	<21 days (N = 92)	≥21 days (N=17)	
Unvaccinated	57 (78.08 %)	16 (21.92%)	0.021
Vaccinated	35 (97.22 %)	1 (2.78 %)	

Table 4. Relationship between COVID-19 Vaccination Status and Outpatient of COVID-19 Treatment at Padang City Health Workers

Vaccination Status	End of Treatment Status		*P*
	Healed (N=101)	Recover residual symptoms (N=8)	
Unvaccinated	69 (94.52 %)	4 (5.48 %)	0.289
Vaccinated	32 (88.89 %)	4 (11.11 %)	

DISCUSSION

This study shows that most COVID-19 health workers who are hospitalized are in the 26–35 year age group (57.80%), followed by the 36–45 year age group (19.27%). This study's results align with those of Soebandrio et al, who got the most age at <39 years.[9] Nguyen's study is slightly different from this study. Most health workers are aged 35–44 years (23.30%), followed by 25–34 years (21.95%).[2] The majority of this study was at the age of 26-35 because, in that age range, the active, productive age group worked in the COVID-19 isolation room, causing increased exposure to the SARS-COV-2 virus.

The highest gender in this study was female (80.73%). This result is the same as Antonelli's study, primarily women (62.50%) and Nguyen's (81%).[2,10] Different results were obtained in Hussen's study of health workers in Ethiopia, with 55.30% male.[11] This

study was mostly female because most health workers in Padang City were female, and women were more prone to suffering from stress fatigue, depression, and anxiety, usually related to longer shifts, poor working conditions, and lack of recognition, thereby lowering immunity and increasing the risk of COVID-19 infection.[11]

Most of this research is paramedics (62.40%) followed by medical personnel (24.80%). This result aligns with Bergwerk's study, where the highest number of paramedics (46%) and Manglano (33.90%).[12,13] This result differs from Soebandrio's study in Jakarta, where the highest number of medical personnel (48.40%) was followed by paramedics (44.20%).[9] Paramedics also dominated the population in this study, so the incidence of paramedics was more than medical personnel. In theory, high exposure is for paramedics and medical personnel.

This study showed the most symptom onset before confirmed COVID-19 at 3 to 7 days (44.95%) followed by <3 days (28.44%) and above seven days (26.61%) and statistically significant (*P*=0.0001). The incubation period for COVID-19 is the time interval between when a person is infected and the likelihood of developing COVID-19 disease or symptoms in a confirmed case. The time between the occurrence of exposure to the onset of symptoms, called the incubation period, usually occurs within two to 14 days.

This study found that the distance between confirmed COVID-19 with the second vaccination was more than 28 days (86.11%), followed by 15–27 days (8.33%) and 14 days (5.56%). This result is in line with the study of Bergwerk et al in the breakthrough case of COVID-19 in health workers, where the average interval from the second vaccination dose to the detection of SARS-CoV-2 was 39 days.[12] Different results from the Cucunawangsih study in Indonesia, obtained from 1.040 health workers who had received two doses of the COVID-19 vaccine, 13 (1.25%) tested positive for SARS-CoV-2 RNA with a mean between 2 and 11 days (median five days) after the second vaccination.[14] This study was mainly in >28 days, where according to the theory of SARS-CoV2, antibodies will decrease over time.

Most of the clinical symptoms in this study were fever (24.68%), followed by headache (20.78%), and cough (16.56%). The same study in Loon's study in Belgium on COVID-19 health workers, most of which was cough (82%), headache (78%), and fever (76%).[15] It is different in Magnavita's study, where the most common symptoms of infected COVID-19 health workers are muscle pain (52.40%), fatigue (47.60%), anosmia (42.70%) and dysgeusia (37.80%).[16] Symptoms of fever, headache, and cough in this study were the main complaints of patients to be treated.

Most health workers in this study had three clinical symptoms (55.96%), followed by one to two clinical symptoms (32.11%) and no symptoms (11.93%). Vahey's study in 128 treated patients found that the most symptoms were three, with the most being cough, but symptoms of vomiting, dyspnea, changes in mental status, dehydration, and shortness of breath were significantly associated with hospitalization.[17]

In contrast, rhinorrhea, headache, sore throat, and anosmia or ageusia were significantly associated with non-hospitalization.[17] The Magnavita study found that health workers affected by COVID-19 were most affected by two symptoms followed by three symptoms.[16] The number of these symptoms will be directly proportional and significantly to the severity of the disease.

The most comorbidities in this study were obesity (66.67%) followed by hypertension (9.80%) and asthma/COPD (8.82%). This study aligns with the Kambhampati study with the most obesity (72.50%).[18] This slightly differs from Bennasrallah's (2020) study on 265 COVID-19 patients. It was found that obesity was the third most comorbid (15.40%) after diabetes (16,80%) and hypertension (15.60%).[19] Healthcare workers with obesity are associated with reduced lung oxygen and low-grade inflammation associated with obesity, such as impaired secretion of abnormal cytokines, adipokines, and interferon consequences in the

immune response.[19]

Obese patients, also there will be an increase in acute phase reactants that are related to the severity of inflammation, namely CRP, serum ferritin, D-dimer, Erythrocyte sedimentation rate (ESR), and LDH.[20] Obesity is associated with an increased risk of diabetes mellitus, hypertension, and cardiovascular disease. The greater the number of co-morbidities in obese patients, the greater the severity of COVID-19. The respiratory system is also altered in obesity. Changes in the respiratory mechanism, increased airway resistance, and decreased lung volume can impair gas exchange.[15]

This study found that the group with comorbidities 1 to 2 was the most prominent (66.06%). This result is in line with the study by Giannouchous et al, who found that in patients treated based on the highest number of comorbidities, one comorbid (26.85%) was followed by two comorbid (12.65%).[20] The same result also occurred in Richardson's study, most of which had more than one comorbid (88%) followed by one comorbid (6.30%) and no comorbid (6.10%).[21] The number of comorbidities has a close relationship with poor outcomes because multiple comorbidities will contribute to the disease's complexity, impacting disease progression.[20]

Health workers who did not vaccinate were the highest at the moderate clinical degree at 57.53% and vaccinated at 94.44%. Mild clinical degrees in the unvaccinated and vaccinated were 36.99% and 94.44%, respectively. Moderate clinical degrees in the unvaccinated and vaccinated were 57.53% and 5.56%, respectively. Critical severity (2.7%) was only found in health workers who were not vaccinated. This study found a significant relationship between the status of the COVID-19 vaccination and the clinical degree of health workers treated at the Padang City Hospital (*P*=0.0001). In the Tenforde et al study, mortality within 28 days was related to vaccination status (8.6% not vaccinated vs. 6.3% vaccinated).[22]

Some unvaccinated individuals with COVID-19 had a longer duration of illness.[22] The World Health Organization's Clinical Progression Scale states that the highest severity was significantly lower in the breakthrough case than in the unvaccinated. COVID-19 patients vaccinated have the highest degree of severity, namely mild 14 patients (42.4%) followed by severe nine patients (30.3%).[23] Ramakrishnan's study of 3301 unvaccinated patients found 291 patients (8.8%) required an ICU, and this was significantly less (*P*=0.03) than among the vaccinated 31 of 519 patients (6%).[24]

Patients who were not vaccinated were more likely to be hospitalized (2.8%), admitted to the ICU (0.5%), and required intubation for mechanical ventilation (0.2%); these results were less common in people who were fully vaccinated with a booster (0.7%, 0.08%, and 0.03%, respectively) and people who were utterly vaccinated without a booster (1.0%, 0. 12%, and 0.05%) (*P*<0.001). Death was also more likely among people who were not vaccinated (0.3%) than among those who were fully vaccinated with a booster (0.07%) or without (0.08%) (*P*<0.001).[23]

In this study, vaccinated health workers, the length of stay for <21 days was 35 people (97.22%), and >21 days was one person (2.78%). Unvaccinated health workers also had a more extended stay of <21 days than a more prolonged stay of >21 days (78.08% vs 21.92%). Statistical tests obtained significant results (*P*=0.02). This study found that the length of stay <21 days was highest in those vaccinated because health workers were mostly in mild clinical cases. The results obtained in Tenforde's study for COVID-19 treatment, 1197 patients who received hospitalization (<28 days) were higher in patients who were vaccinated than those who were not vaccinated (88% vs. 77.20%) and statistically significant (*P*=0.003).[22]

Singh's study found a statistically significant value for the length of stay for COVID-19 on vaccinated and unvaccinated (10 days vs. 12 days; *P*=0.034).[23] Vaccination can protect against the SARS-CoV2 virus, is associated with length of stay for COVID-19, and provides a protective barrier against re-infection.[25] Some individuals who are not vaccinated against COVID-19 have a longer duration

of illness.[10] Other factors contributing to the length of hospitalization in addition to vaccination are comorbid. Jang's research in Korea found that the more comorbidities, the longer the length of stay.[26]

Health workers suffering from COVID-19 who were not vaccinated and vaccinated against the final status of COVID-19 treatment recovered (94.52% and 88.89%), followed by recovery with residual symptoms (5.48% and 11.11%). The statistical test found that there was no significant relationship with the *P=0.*289. The results were the same in Singh's study, where the percentage of cure was 81.80% for those who were vaccinated and 71.80% for those who were not vaccinated, but the mortality rate was higher for those who were not vaccinated (28.20% vs. 18.20%).[23]

Research by Johnson et al conducted on 22.305 COVID-19 patients based on vaccination status, the mortality rate in unvaccinated patients was 7.8% (16.527 patients), and the mortality rate was lower in fully vaccinated patients by 0.6% (5.493 patients).[27] In a multivariable analysis, vaccination reduced mortality by 60 days (*P*<0.001).[24] The Washington State Department of Health found higher mortality at age 65 based on vaccination status.[28]

LIMITATION

This study did not include the last time they were vaccinated when they tested positive for COVID-19 because the effectiveness of vaccinations can decrease over time.

CONCLUSION

The vaccination status of health workers who survived COVID-19 who were treated at the Padang City Hospital consisted of 66.97% unvaccinated and 33.03% vaccinated. Characteristics of health workers who survived COVID-19 aged 26–35 years, female, working as a paramedic, onset of symptoms 3 to 7 days, number of symptoms 3, highest fever, number of co-morbidities 1 to 2, obesity, length of stay <21 days, and clinical light. The vaccination status of health workers for COVID-19 survivors is related to the clinical degree and length of hospitalization. Vaccinated patients are not associated with post-COVID-19 survivor sequelae.

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CONFLICT OF INTEREST

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