ORIGINAL ARTICLE

Association between COVID-19 Post-infection and Work Capacity among Healthcare Workers in the National Referral Hospital in Indonesia

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ABSTRACT

Background. Patients who had severe COVID-19 infection were thought to be one of the factors affecting the suitability of work capacity. Functional capacity can be measured by 6-minute walking test (6MWT). Some particular jobs have a minimum functional capacity to be met.

Objectives. The aim of this research is to determine the relationship between severity of COVID-19 infection and work capacity among post-infected healthcare workers in the National Referral Hospital.

Methods. A cross-sectional study among healthcare workers who had COVID-19 infection from June to July 2021, and had undergone functional capacity examination from September to November 2021 was conducted. Data processing was carried out by collecting data from medical records of infected healthcare workers. Bivariate analysis statistic test was done to determine the association between degree of severity and work capacity. Determination of the suitability of work capacity was done by comparing the results of the functional capacity examination with the minimum estimated matabolic equivalents (METs) needs of workers.

Results. A total of 102 employees data from ages 25 to 58 years were collected. The result showed that 81 employees had unsuitable work capacity with most of them coming from the mild infected group (83.3%).

Conclusion. There is no significant relationship ($p>0.05$) between age, gender, BMI, sequelae, comorbidities, and degree of severity of COVID-19 infection and work capacity among healthcare workers. Even though there is no signficant relationship between severity of COVID-19 and work capacity, this research shows there are more than 50% post-infected healthcare workers who have unsuitable work capacity.

Keywords: COVID-19, work capacity, healthcare workers

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INTRODUCTION

COVID-19 caused by the virus SARS-CoV-2 was first reported in China in December 2019, and has since spread rapidly to other regions. On March 11, 2020, the World Health Organization (WHO) has declared COVID-19 as a pandemic, and as of October 2021, more than 240 million cases of COVID-19 have been reported globally, including more than 4.9 million deaths. Healthcare workers are one of the populations with a high risk of developing COVID-19 infection.[1,2]

Reflecting on the previous endemic, with the spread of the coronavirus that resulted in Severe Acute Respiratory Syndrome (SARS) in 2002, one-third of patients who have

been infected and recovered experienced chronic shortness of breath and other respiratory symptoms for up to 12 months or more after acute infection.[3,4]

The severity of COVID-19 infection can be divided into four groups: asymptomatic, mild, moderate, and severe. The Centers for Disease Control and Prevention (CDC) in China found 1,717 (3.8%) patients were health workers out of 44,672 confirmed cases of COVID-19, of which 14.8% were severe infections. Research on the relationship between the severity of COVID-19 infection and post-COVID-19 physical work capacity in health workers is still lacking. A previous study found there is a decrease in physical work capacity in the examination of patients after being infected with COVID-19.[5]

One of the most common tests performed to measure functional capacity is a 6-minute walking test (6MWT) - light activity level is below 3.0 METs, moderate activity is 3.0-5.9 METs, and vigorous activity is more than 6 METs. This is a simple test to perform which intends to measure the functional capacity of patients who have had previous diseases. This test measures the submaximal functional capacity of the patient. The main purpose of this examination is to measure the distance that can be achieved by the patient within 6 minutes, which will later be converted into the maximum value (max oxygen consumption) of VO2 and METs.[6] Several factors that can affect the achievement of a person's functional capacity are age, gender, body mass index (BMI), health and nutritional conditions, and history of physical activities.[7] The absence of data related to the severity of the disease on physical work capacity, raises concerns about the impact of COVID-19 infection symptoms in predicting the suitability of physical work capacity in health workers.

METHODS

Study Design and Population

A cross-sectional study in March 2022 was conducted using the medical record database of patients at the National Referral Hospital. All selected subjects were workers who had undergone functional capacity testing with 6MWT at the medical rehabilitation outpatient clinic, and who had history of COVID-19 infection based on the *Implementasi Budaya dan Human Capital* (IBUHC) database. Inclusion criteria are data from healthcare workers who had confirmed COVID-19 infection from June to July 2021 and who had undergone the functional capacity examination from September to November 2021. The selection of confirmed time was based on the high incidence of COVID-19 infection in Indonesia during this period. Exclusion criteria are incomplete data of healthcare workers' medical records.

Ethical Approval

Researchers have obtained approval from *Bagian Penelitian Departemen Ilmu Kedokteran Komunitas* at the Faculty of Medicine, University Indonesia, Jakarta, and received a letter passing the Ethics Review of the *Kaji Etik Komite Penelitian Kesehatan* FKUI-RSCM Committee for data collection through medical records on March 7, 2022 (KET-227/UN2.FI/ETIK/PPM.00.02/2022).

Data Collection

The data used in this study was taken from the medical record dataset of examination and occupational disease assessment after COVID-19 infection of employees who were confirmed positive in the period of June to July 2021, and the functional capacity examination results in the period of September to November 2021. The data collection time was carried out as a program from medical rehabilitation doctors in determining the physical capacity of health workers after COVID-19 infection. Data on the results of functional capacity was obtained on March 10, 2022 from the recapitulation of the results of examinations conducted by the Physical Medicine and Rehabilitation Division. Then the employee identity data, occupation, job description, vaccination status, positive and negative confirmed dates, symptoms at the time of positive confirmation, sequelae, and comorbidity were obtained from the results of interviews and form fillings when employees conduct assessments after COVID-19 infection by Occupational Health Residence; data collection was conducted from March 14 to 25, 2022.

One hundred six employees who had undergone an examination of functional capacity were collected by the researchers as preliminary data. The data contain patient identity, medical record number, and results of functional capacity examination in the form of METs. Researchers then reviewed the examination and occupational disease assessment data according to the name and medical record number listed and then completed the employee data. Researchers obtained 102 complete employee data while four were not found.

Assessment of the suitability of work capacity was carried out by determining the results of the 6MWT examination in METs, adjusted to the minimum estimate of functional capacity. The 6MWT examination is one of the common tests that is quite reliable to describe the submaximal functional capacity; the subjects studied had post-infection, thus the examination was carried out with a submaximal test. Researchers grouped the demands of functional capacity into four based on activities in the 2011 Compendium of Physical Activities.[8] The American Medical Association (AMA) recommends counting on whether a person can work for eight hours in one day with proper rest, the worker has at least 40% of the maximum functional capacity (METs) acquired by the worker.[9] The needs for working activities are divided into: 3.75 METs for sitting tasks, light effort; 7.5 for standing, light/moderate effort; 8.75 for walking on job, slow speed and carrying light objects; and 11.25 for standing, moderate effort, lifting items continuously.

Statistical Analysis

Researchers used descriptive data analytics which consisted of univariate analysis data of frequencies. Bivariate analysis using chi-square and fisher's exact test was also done to determine the factors included in the multivariate analysis with $P<0.25$. Age variables presented in the descriptive statistics then determined the median value that will be used as the basis for grouping data.

RESULTS

Data collection is shown in Figure 1.

Among 102 respondents, 51% are over 42 years old with age range of 25 to 58 years old; as much as 77.5% are female. Respondents with a body mass index ≥23 kg/m^2 (59.8%) are more than those with BMI of <23 kg/m^2 (40.2%). The functional capacity among respondents is 4.54 ± 0.36 (Table 1).

Eighty-five (83.3%) respondents had mild COVID-19 infection, 78 (76.5%) had sequelae. There was only one respondent who did not get the full vaccine dose, the rest of the respondents had received the vaccine dose twice. Fifty-nine (57.8%) of the respondents do not have comorbidities that are suspected to aggravate the degree of COVID-19 infection. Distribution of characteristics of respondents infected with COVID-19 can be seen in Table 2.

Based on the data in Table 3, age, gender, BMI, sequelae, comorbidity and degree of severity are not significantly related ($p>0.05$) to the suitability of work capacity among healthcare workers.

DISCUSSION

Studies in China found that male gender, older age, and comorbidity (hypertension, diabetes mellitus, COPD, malignancy, cardiovascular disorders) contributed significantly to the occurrence of more severe COVID-19 infection and even a higher risk of death.[10,11]

Factors that affect functional capacity are age, gender, BMI, health, and fitness conditions. The results obtained by researchers showed that employees who were found to have a discrepancy in work capacity came from a group that had a BMI of more than 23 kg/m^2. This is in accordance with a previous research that obesity can reduce functional capacity.[12]

Researchers also found that nurses have mild and moderate COVID-19 infections (51.8% and 68.8%, respectively), while medical support assistants (4.2%) have

Table 1. Characteristics of Respondents

Variable	Total (%) n=102	Median (min-max) / Mean ± SD
Age		42 (25-58)
≥42 years	52 (51.0)	
<42 years	50 (49.0)	
Gender		
Female	79 (77.5)	
Male	23 (22.5)	
Body Mass Index		
≥23 kg/m^2	61 (59.8)	
<23 kg/m^2	41 (40.2)	
Functional Capacity		
METs		4.54 ± 0.36

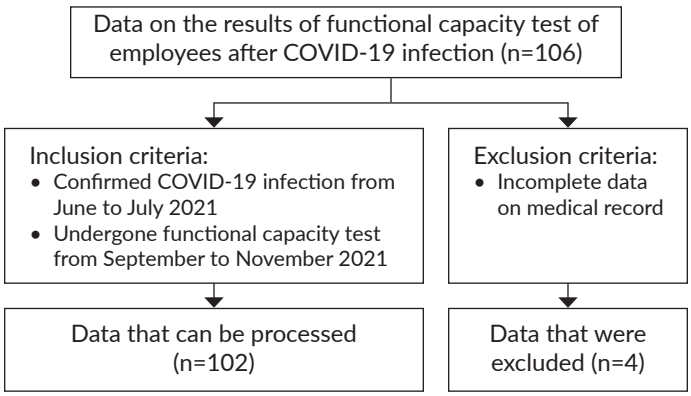

Figure 1. Data collection flow.

Table 2. Characteristics of Respondents with COVID-19 Infection

Variable	Total (%) n=102
Profession	
Nurse	55 (53.9)
Medical support	24 (23.5)
Non-Medic	19 (18.6)
Doctor	4 (4.0)
Severity	
Mild	85 (83.3)
Moderate	16 (15.7)
Severe	1 (1.0)
Sequelae	
Yes	78 (76.5)
No	24 (23.5)
Vaccination Status	
Complete	101 (99.0)
Incomplete	1 (1.0)
Comorbidity	
No	59 (57.8)
Yes	43 (42.2)
Job Description	
Standing light effort – 7.5 METs	67 (65.7)
Sitting task, light effort – 3.75 METs	21 (20.6)
Walking and carrying light objects – 8.75 METs	11 (10.8)
Standing moderate effort – 11.25 METs	3 (2.9)

Table 3. Relationship of Characteristics to Suitability of Work Capacity

	Work capacity (n=102)		*p*	OR	CI 95%	
	Suitable	Unsuitable			lower	upper
Age						
<42 year	11 (22)	39 (78.0)	0.730[cs]	1.185	0.453	3.097
≥42 year	10 (19.2)	42 (80.8)				
Gender						
Female	16 (20.3)	63 (79.7)	1.000[f]	0.914	0.295	2.838
Male	5 (21.7)	18 (78.3)				
Body Mass Index						
≥23 kg/m^2	10 (16.4)	51 (83.6)	0.201[cs]	1.870	0.710	4.922
<23 kg/m^2	11 (26.8)	30 (73.2)				
Sequelae						
Yes	14 (17.9)	64 (82.1)	0.256[f]	1.882	0.657	5.396
No	7 (29.2)	17 (70.8)				
Comorbidity						
No	9 (20.9)	34 (79.1)	0.942[cs]	0.965	0.365	2.545
Yes	12 (20.3)	47 (79.7)				
Severity						
Mild	17 (20.0)	68 (80.0)	0.747[f]	0.813	0.235	2.809
Moderate-Severe	4 (23.5)	13 (76.5)				

cs = chi square, f = fisher's exact test

severe COVID-19 infection.[13] This is in accordance with a previous research that the nursing profession has the highest incidence rate compared to other healthcare workers.[13]

Researchers found that workers need a minimum estimated functional capacity of 7.5 METs, with job descriptions in the form of standing; light effort is the most functional capacity needed, as much as 65.7%.

In this study, most patients had mild infection (83.3%), followed by moderate (15.7%) and severe (1%). Researchers also found that employees who did not have suitability of work capacity came mostly from the group of mild infections. This is slightly different from the study by Wong et al. where a decrease in functional capacity is lower at moderate [-51m (95% CI -85, - 17), p=0.04] and severe [-68m (95% CI -134, -3) p = 0.04] degrees of infection.[3] The study concluded that with moderate or severe COVID-19 infection, the results of the 6 minute walking test is lower, compared to patients with mild infection, and the relationship between degree of severity is not statistically significant (p = 0.55). From the results of the 6MWT examination obtained, the employer implemented recommendations for exercises plan to increase physical work capacity and reassessment upon returning to work.

Researchers found the following characteristics that may influence the suitability of work capacity in employees after being infected with COVID-19: age, gender, BMI, sequealae, comorbidity and the severity of COVID-19 infection. Decreased physical capacity can also occur due to restrictions on activities during the pandemic. From the results of regrouping and statistical test calculations, researchers found no characteristics that were statistically significant to the suitability of work capacity (p>0.05). In this study, 81 employees do not have a suitable work capacity. These employees who have unsuitable functional capacity mostly belong to the group of mild COVID-19 infection. This condition is slightly different from a research conducted by Szekely et al. that employees with severe infection, or even critical conditions have a decrease in functional capacity compared to mild infection, with organ damage and hemodynamic changes during infection, and post-infection recovery, this condition is suspected to cause unsuitability in work capacity.[14]

One of the limitations of this study is using secondary data. Factors other than the workplace such as previous physical activities and activities during the pandemic were not assessed in detail which could affect the physical capacity of health workers after COVID-19. In addition, the research method conducted is a cross-sectional study, so that the data from the physical activity examination is only done at one time, which is about 16 weeks after confirming COVID-19. This condition makes researchers unable to know whether the results of the suitability of work capacity will persist or will improve over time.

CONCLUSION

Age, gender, BMI, sequelae, comorbidity, and degree of severity did not have significant relationship (p>0.05) to the suitability of work capacity in employees infected with COVID-19. Functional capacity test using 6MWT

can be performed to predict work capacity in workers after COVID-19 infection before they return to work. It is necessary to conduct similar research in the working population or other locations to compare with the results obtained by researchers.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declare no conflicts of interest.

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