Social Determinants and Post Covid-19 Syndrome: A Cross-Sectional Study in Indonesia

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Abstract. Social determinants can lead to health status stratification, including post Covid-19 syndrome (PCS) incidence. Furthermore, studies related to PCS on physical, psychological and social determinants have not been widely studied in Indonesia. The purpose of this study was to analyze social determinants of risk factors for the incidence of PCS in patients who had been confirmed positive for COVID-19. This cross-sectional study was conducted in April – June 2022 on 79 respondents who had been confirmed as positive for Covid-19 and recorded in the medical records at public health center in Bandar Lampung, Indonesia period January – December 2020 by total sampling. The COVID-19 Yorkshire Rehabilitation Screening questionnaire was used to identify PCS symptoms in respondents. This study found 20.3% of respondents had at least one PCS symptom and 32.9% said their general health condition had deteriorated after being infected with COVID-19. The most common symptoms of PCS were disease-related nightmares (12.6%), fatigue (10.1%), impaired concentration (7.6%), and anxiety (7.6%). Logistic regression analysis showed that family income influenced PCS, while age and family income influenced psychological effects due to PCS (p-value <0.05). In conclusion, the follow-up of post-recovery patient care after being diagnosed with COVID-19 which regards social determinants is very important.

Keywords: COVID-19, risk factors, social determinants, post Covid syndrome

INTRODUCTION

In the end of 2019 – 2022, the world was facing the COVID-19 pandemic caused by coronavirus 2 (SARS-COV-2) [1]. The COVID-19 pandemic is an emergency that threatens all public health [2]. As of January 28, 2022, there were 364,191,494 confirmed cases of COVID-19 globally, with 5,631,457 deaths. In Indonesia, there are 4,309,270 confirmed cases and 144,261 deaths [3].

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Since the beginning of the COVID-19 pandemic caused by Coronavirus 2 (SARS-CoV-2), it has become increasingly clear that some infected individuals have long-term complications (Post COVID-19 Syndrome/ PCS) such as shortness of breath, weakness, brain fog, and fatigue [4-7]. Longitudinal studies of hospitalized COVID-19 patients showed that 74 - 88% had symptoms lasting more than 50-80 days, most commonly fatigue and dyspnea [8,9]. Another study found that up to 40% of COVID-19 patients exhibited pericarditis or myocarditis >70 days post-infection [10]. Loss of kidney function has also been reported in COVID-19 patients [11].

Although there are many case reports of the post-covid syndrome, which includes severe post-infection, most of the population does not experience symptoms severe enough to require hospitalization. It is known that there are several degrees of symptoms in patients infected with COVID-19, ranging from asymptomatic, mild, moderate, severe to critical symptoms [12, 13]. From a psychological point of view, the epidemic outbreak of infectious diseases has caused serious psychological effects on patients [14-16] including anxiety, fear, and depression. In severe cases, post-traumatic stress disorder (PTSD) and other mental disorders also occur [17].

Most health problems, including PCS, were caused by health inequality, which refers to the social determinants of health, which is a terminology to combine conditions of education, employment, income, social class, race, ethnicity and gender that cause stratification in society [18]. However, studies related to the effect of social determinants on PCS in the general population have not been widely studied in Indonesia. The purpose of this study was to analyze the social determinants of risk factors for the incidence of PCS in patients who had been confirmed positive for COVID-19. Even though the COVID-19 pandemic has ended, this knowledge can be used to mitigate the long-term effects of influenza like diseases if a pandemic similar to COVID-19 occurs

SUBJECT AND METHOD

Research design, study setting, and respondents

This cross-sectional study was conducted in April – June 2022 on 79 respondents who had been confirmed positive for Covid-19 and recorded in the medical records of a public health center in Bandar Lampung, Indonesia for the period January – December 2020. Respondents were selected by purposive sampling with inclusion criteria: 1) a minimum of 18 years; 2) have been confirmed to have COVID-19 with moderate, severe, or critical symptoms; 3) have been declared cured of COVID-19 at least 3 months after the last confirmed COVID-19; 4) currently or have experienced PCS symptoms; and 5) not in a state of illness related to Covid-19. Those who were not willing to become respondents were excluded from this study.

Research instruments

Information related to the characteristics of respondents in the form of age, gender, education, occupation, and monthly income were collected as social determinants. The Yorkshire Rehabilitation Screening (C19-YRS) COVID-19 questionnaire was used to identify PCS symptoms in respondents [19]. PCS symptoms are grouped according to the following system: general (fatigue, myalgia, and weight loss), respiratory (dyspnea, chest pain, cough, and wheezing), cardiovascular (palpitations), neuropsychiatric (headache, insomnia), hypersomnia, nightmares, concentration or memory deficits, and mood changes such as depression and anxiety), dermatological (hair loss and skin rash), gastrointestinal (abdominal pain, diarrhea, and constipation), and genitourinary system (uncontrolled bladder).

To evaluate the level of perceived PCS symptoms, respondents were asked to answer 19 questions with yes/no answer choices on a numerical scale of 0-10 for each symptom from 0 (no problem) to 10 (very extreme) [19]. Following the STROBE checklists for the cross-sectional studies, potential sources of bias in this study could occur due to the small sample size. In addition, we chose the respondents who declared to have been cured of COVID-19 at least three months after the last confirmed COVID-19, which may affect the respondents in answering the questions since they did not remember the COVID-19 symptoms anymore. Informed consent was requested at the start of the interview either by telephone or face-to-face. This survey takes approximately 20-25 minutes to answer all questions. Ethical clearance was obtained from the Health Research Ethics Committee, Faculty of Medicine, University of Lampung (No. 1217/UN26.18/PP.05.02.00/2022).

Statistical Analysis

Data were analyzed using IBM SPSS V.21 software version. Descriptive data is presented in terms of frequency and percentage for categorical data and mean, standard deviation (SD) for numerical data. Multivariate analysis using logistic regression was used to analyze the risk factors of social determinants of the incidence of PCS. The significance level used is p-value <0.05.

RESULTS

Refer to table 1, most of respondents were at 40 years old, male, had bachelor's degree, as private worker, had more than five million family income, had no family-owned business as well as position held by family members. Moreover, there were 16 respondents (20.3%) who had PCS syndromes as well as psychological effects.

Table 1. Sociodemographic of respondents and PCS (n=79)

Social determinants of respondents	Subtype	n (%)
Age (years), Mean ± SD	40.1 ± 14.9	
Gender	Male	50 (63.3)
	Female	29 (36.7)
Education	No school	3 (3.8)
	No / not finished elementary school	1 (1.3)
	Elementary School	2 (2.5)
	Junior highschool	4 (5.1)
	Senior high school	13 (16.5)
	Diploma	5 (6.3)
	Bachelor's degree	45 (57.0)
	Master's degree	6 (7.6)
Occupation	Unemployed	6 (7.6)
	Non-permanent laborer	1 (1.3)
	Permanent laborer	2 (2.5)
	Privateworker	44 (55.7)
	Civil servant	12 (15.2)
	Trader	6 (7.6)
	Retired	8 (10.1)
Monthly income of all family members (Rupiah)	> 0 – 1 million	6 (7.6)
	> 1 million – 2 million	2 (2.5)
	> 2 million – 3 million	4 (5.1)
	> 3 million – 4 million	10 (12.7)
	> 4 million – 5 million	28 (35.4)
	> 5 million	29 (36.7)
Type of family-owned business	None	64 (81.0)
	Shop	8 (10.1)
	Rice fields/ gardens	2 (2.5)
	Workshop	3 (3.8)
	Other	2 (2.5)
Positions held by family members	None	72 (91.1)
	Head of local community	1 (1.3)
	Religious leader	5 (6.3)
	Public figure	1 (1.3)
Post COVID-19 syndromes	Present	16 (20.3)

	Absent	63 (79.7)
Psychological Effects	Present	16 (20.3)
	Absent	63 (79.7)

In this research, of the 16 respondents (20.3%) who had PCS, most (93.7%) of the respondents did not have advanced medical problems after hospitalization as well as had not used other health services since leaving the hospital (91.1%). Regarding physical symptoms of PCS, four (5.1%) respondents experienced shortness of breath when resting and dressing, as well as when climbing stairs (6.3%) with varying scales(4 – 9) after being infected with COVID-19.The results also showed that types of PCS in this research consist of: four (5.1%) respondents experienced changes in throat sensitivity and voice changes, respondents experienced swallowing problems and physical mobility (2.5%), weight loss (1.3%), fatigue (10.1%), and self-care problems (2.5%) after being infected with COVID-19. Although all (100%) respondents did not have problems controlling defecation and urination, five (6.3%) respondents had problems in daily activities and complained of pain (2.5%) after infection of COVID-19. In addition, it was noted that at least 7.6% of respondents experienced impaired concentration, short-term memory disorders (5.1%), cognitive-communication changes (1.3%), anxiety (7.6%), depression (1.3%), and disease-related nightmares (12.6%) after recovering from COVID-19.

Logistic regression analysis showed that family income influenced PCS ($p < 0.05$). The greater the income of the PCS family, the possibility of someone suffering from PCS increases 1.847 times greater than families with lower incomes. Family income can explain 15.6% of the PCS variation (Table 2). It is also known that only about two thirds (67.1%) of respondents said their general health was very healthy after being infected with COVID-19, the rest (32.9%) said their general health condition had decreased after being infected with COVID-19.

Table 2. Effects of Social Determinants on PCS

Variable	B	p-value	Exp(B)	95% CI
Age	0.023	0.326	1.023	0.978 – 1.071
Gender	0.998	0.147	2.713	0.703 – 10.465
Education	0.047	0.815	1.048	0.705 – 1.559
Occupation	-0.214	0.280	0.807	0.548 – 1.190
Family income	0.613	0.028	1.847	1.068 – 3.192

Note: R^2=0.156

Psychologically, there were ten (11.4%) respondents who had negative feelings after being treated for COVID-19, where most respondents expressed concern about being infected again. Moreover, thirteen (16.5%) respondents stated that they were stressed after

being treated for COVID-19 and considered COVID-19 to be a disease that can spread quickly (27.8%).

Logistic regression analysis showed that age and family income influenced the psychological effect of PCS (p-value <0.05). The older the age, the psychological effect will increase by 1.069 compared to the younger age. The greater the family income, the lower the psychological effect (0.445) compared to respondents with less family income. Social determinants can explain 28.7% of the variation in post-Covid-19 psychological effects (Table 3).

Table 3. Effects of Social Determinants on Psychological Effects

Variable	B	p-value	Exp(B)	95% CI
Age	0.067	0.019	0.935	0.885 – 0.989
Gender	-0.039	0.958	1.039	0.249 – 4.339
Education	0.236	0.392	0.790	0.460 – 1.356
Occupation	-0.071	0.737	1.074	0.709 – 1.626
Family income	-0.810	0.015	2.249	1.173 – 4.309

Note: R^2=0.287

DISCUSSION

This study aims to identify PCS physically and psychologically in patients who have been confirmed to have COVID-19 and to analyze social determinants that are at risk of PCS occurrence in respondents who have been diagnosed with COVID-19. Several problems experienced by respondents after being infected with COVID-19 showed that respondents experienced at least one PCS symptom. In addition, the problem of pain and disruption of daily activities also complained by a small number of respondents after being infected with COVID-19. The psychological effects of COVID-19 can also be seen from the presence of impaired concentration, impaired short-term memory, anxiety, depression, and nightmares related to the disease in those who have been infected with COVID-19.

Several previous studies have shown that the majority of patients have at least one sequela after being infected with COVID-19 [20,21]. A study in Germany found 27.8% of patients had PCS after four months of being infected with COVID-19 and this increased to 34.8% after seven months of infection. Some of the symptoms felt by patients such as anosmia, shortness of breath, fatigue, ageusia, headache, alopecia and diarrhea [22]. Research at four hospitals in US found 56% of patients who had been treated for COVID-

19 with neurological complications experienced limitations in daily activities, 50% experienced cognitive impairment, and 47% were unable to return to work, and experienced anxiety, depression. and sleep disturbances were worse 6 months after hospitalization [20]. This suggests that the initial description of PCS describes the different symptoms of patients recovering from COVID-19 post-hospitalization [23].

Although in our study it was found that less than 10% of respondents complained of shortness of breath, infection with COVID-19 can have far-reaching implications. Long-term pulmonary complications after being infected with COVID-19 can occur such as dyspnea, ventilator dependence, oxygen dependence, pulmonary function test (PFT) abnormalities, and fibrotic lung disease. The most common symptom of pulmonary complications reported after COVID-19 is dyspnea which occurs in approximately 22.9% - 53% of patients after 2 months of infection [24-26]. PFT assessment during the three-months follow-up period revealed abnormalities in 25% of patients, with decreased diffusion capacity for carbon monoxide being the most common (16%) [27]. When assessed 3 months post-admission after severe COVID-19 pneumonia, 81% of patients had abnormal findings on chest CT [28].

Although in our study only 2.5% of respondents experienced impaired physical mobility after being infected with COVID-19, musculoskeletal symptoms are one of the most common complaints in patients after being infected with COVID-19, both at the beginning of the disease and in the post-acute phase [29-31]. This suggests that viral invasion of synovial tissue and skeletal muscle contributes to one of these PCS symptoms [32]. Among COVID-19 survivors, those with more severe acute illness had more muscle weakness, more problems with mobility, and had shorter walking distances in 6 minutes at 6-month follow-up [33]. Optimizing nutrition and rehabilitation, both in the early and post-acute phases of COVID-19, is urgently needed.

In our study, although only 10.1% of respondents complained of fatigue after being infected with COVID-19, this fatigue problem was the problem that most patients with PCS complained about [34, 35]. The possible cause of this fatigue is due to endothelial dysfunction in the brain capillaries which has been described in previous studies [36]. If this fatigue continues for up to 4 months, it can be categorized as Chronic Fatigue Syndrome (CFS), where the patient usually experiences post-activity fatigue, cognitive difficulties, sleep disturbances, and chronic pain [37]. This may cause other PCS symptoms such as impaired concentration, short-term memory impairment, and disease-related nightmares experienced by respondents in our study. Although the cause of CFS is still unclear, viral infection is suspected as one of the causes [38]. It should be noted, however, that fatigue can vary from person to person and there is no single test that confirms the diagnosis of fatigue.

Logistic regression analysis showed that family income influenced PCS ($p<0.05$). The greater the family income, the possibility of someone suffering from PCS increases 1.847 times greater than families with lower incomes. Family income can explain 15.6% of the PCS variation. In addition, age and family income affect the psychological effects of PCS

(p-value <0.05). The older the age, the psychological effect will increase by 1.069 compared to the younger age. Research in the US showed a significant relationship between age and Post-Acute Sequelae of COVID-19 (PASC). In addition, bad psychological effects such as anxiety and depression are factors that worsen the PASC condition [39]. A more convincing hypothesis about the cause of prolonged symptoms of COVID-19 suggests that it is caused by one or more mechanisms, such as a single but severe immunological response, viral reactivation, or a persistent immunological response to initial viral exposure [40]. Another possibility of prolonged symptoms is the result of circulating viral particles with a subsequent immunologic response leading to repeated pathological effects. Evidence suggests that persistent viral shedding can occur for more than 3 weeks, so if there is smoldering immunological activity, symptoms may last for at least this time [41].

The greater the family income, the lower the psychological effect (0.445) compared to respondents with less family income. Social determinants can explain 28.7% of the variation in post-Covid-19 psychological effects. This may be due to the feeling of being more secure from respondents with higher incomes in terms of meeting the daily basic needs of the family during the occurrence of PCS. This is supported by the results of a study in Malawi which stated that a higher prevalence of food insecurity was correlated with concerns about household health and family financial status [42].

Some of the limitations of this study include the relatively small number of samples only taken from one research location. In addition, the questionnaire used was also obtained from the results of the respondent's self-report so that there may be differences in understanding and tolerance in taking PCS symptoms seriously.

CONCLUSION

The symptoms of PCS, both physical and psychological with varying severity scales, were still felt by respondents who had been treated for COVID-19 infection. Family income influenced PCS, while age and family income were associated with psychological effects due to PCS. Although the symptoms of PCS are relatively not severe, the follow-up of post-recovery patient care after being diagnosed with COVID-19 is very important.

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References

1. Dai, M., et al., *Middle-aged and elderly patients with COVID-19 pneumonia arising from asymptomatic carriers: A report of six cases* MedComm, **1**(3), 420-422 (2020).
2. World Health Organization (WHO), *WHO Coronavirus Disease (COVID-19)* (2020).
3. World Health Organization. *WHO Coronavirus disease (COVID-19) Dashboard*, https://covid19.who.int/region/searo/country/id, last accessed 2022/01/31.
4. Marshall, M., *The lasting misery of coronavirus long-haulers.* Nature, **585,** 339–341 (2020).
5. Marshall, M., *How COVID-19 can damage the brain.* Nature, **585,** 342–343 (2020).
6. Yong, E., *COVID-19 Can Last for Several Months.* The Atlantic (2020).
7. Yong, E., *Long-Haulers Are Redefining COVID-19.* The Atlantic (2020).
8. Arnold, D.T., et al., *Patient outcomes after hospitalisation with COVID-19 and implications for follow-up; results from a prospective UK cohort.* Thorax, **76**:399–401 (2021).
9. Carfì, A., et al., *Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19.* JAMA, **324**, 603–605 (2020).
10. Eiros, R., et al., *Pericarditis and myocarditis long after SARS-CoV-2 infection: a cross-sectional descriptive study in health-care workers.* Rev Esp Cardiol (Engl Ed), **75**(9):734-746 (2022).
11. Chan L, et al., *Acute Kidney Injury in Hospitalized Patients with COVID-19.* J Am Soc Nephrol, **32**(1), 151-160 (2021).
12. Ministry of Health of Indonesia, *Keputusan Menteri Kesehatan Republik Indonesia Nomor HK. 01.07/MENKES/5671/2021 Tentang Manajemen Klinis Tata Laksana Corona Cirus Disease 2019 (COVID-19) di Fasilitas Kesehatan*, Kementerian Kesehatan RI, Jakarta (2021).
13. World Health Organization, *Clinical Management of COVID-19: Interim Guidance*. World Health Organization, Geneva (2020).
14. Hong, X., et al., *Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: a 4-year follow- up study.* Gen. Hosp. Psychiatry, **31(**6), 546–554 (2009).
15. James, P.B., et al., *Post-Ebola psychosocial experiences and coping mechanisms among Ebola survivors: a systematic review.* Trop. Med. Int. Health, **24(**6), 671–691 (2019).
16. Luyt, C.-E., et al., *Long-term outcomes of pandemic 2009 influenza A (H1N1)- associated severe ARDS.* Chest, **142(**3), 583–592 (2012).
17. Mak, I.W.C., et al., *Long-term psychiatric morbidities among SARS survivors.* Gen. Hosp. Psychiatry, **31**(4), 318–326 (2009).
18. Solar, O. and A. Irwin, *A Conceptual Framework for Action on the Social Determinants of Health. Social Determinants of Health Discussion Paper 2 (Policy and Practice)*, Geneva (2010).
19. Sivan, M., S. Halpin, and J. Gee, *Assessing long-term rehabilitation needs in COVID-19 survivors using a telephone screening tool (C19-YRS tool).* Advances in Clinical Neurosciences and Rehabilitation, **19**(4), 14-17 (2020).
20. Frontera, J.A., et al., *A prospective study of long-term outcomes among hospitalized COVID-19 patients with and without neurological complications.* Journal of the Neurological Sciences, **426(**117486), 1-8 (2021).
21. Sykes, D.L., et al., *Post-COVID-19 Symptom Burden: What is Long-COVID and How Should We Manage It?* Lung, **199**, 113–119, (2021).

22. Augustin, M., et al., *Post-COVID syndrome in non-hospitalised patients with COVID-19: a longitudinal prospective cohort study.* The Lancet Regional Health - Europe. **6(**100122), 1-8 (2021).
23. Nabavi N, *Long covid: How to define it and how to manage it.* BMJ, **370**(m3489), (2020).
24. Chopra V, et al., *Sixty-day outcomes among patients hospitalized with COVID-19.* Ann Intern Med, **174**, 576–578 (2021).
25. Mandal S, et al., *'Long-COVID': a cross-sectional study of persisting symptoms, bio- marker and imaging abnormalities following hospitalisation for COVID-19.* Thorax, **76**, 396–398 (2021).
26. Carfì A, et al., *Persistent symptoms in patients after acute COVID-19.* JAMA, **324**, 603–605 (2020).
27. Zhao Y-M, et al., *Follow-up study of the pulmonary function and related physiological characteristics of COVID-19 survivors three months after recovery.* EClinicalMedicine, **25**(100463), 1-9 (2020).
28. Balbi M, et al., *Post-dis- charge chest CT findings and pulmonary function tests in severe COVID-19 patients.* Eur J Radiol, **138**(109676), (2021).
29. Abdullahi A, et al., *Neurological and musculoskeletal features of COVID-19: a systematic review and meta-analysis.* Front Neurol, **11**, 687-694 (2020).
30. Aiyegbusi OL, et al., *Symptoms, complications and management of long COVID: a review.* J R Soc Med, **114**, 428– 442 (2021).
31. Stokes EK, et al., *Coronavirus Disease 2019 Case Surveillance - United States.* MMWR Morb Mortal Wkly Rep, **69**, 759–765 (2020).
32. Li, M.-Y., et al., *Expression of the SARS-CoV-2 cell receptor gene ACE2 in a wide variety of human tissues.* Infectious Diseases of Poverty, **9**(45), 1-7 (2020).
33. Huang C, et al., *6-month consequences of COVID-19 in patients discharged from hospital: a cohort study.* Lancet, **397**, 220–232 (2021).
34. Sudre CH, et al., *Attributes and predictors of Long-COVID: analysis of COVID cases and their symptoms collected by the Covid Symptoms Study App.* Nat Med, **27**(4), 626-631 (2021).
35. Townsend, L., et al., *Persistent fatigue following SARS-CoV-2 infection is common and independent of severity of initial infection.* PLoS ONE, **15**(11), e0240784 (2020).
36. Nauen DW, et al., *Assessing brain capillaries in coronavirus disease 2019.* JAMA Neurol, **78**(6), 760-762 (2021).
37. National Institute for Health and Care Excellece (NICE). *COVID-19 rapid guideline: managing the long-term effects of COVID-19*. https://www.nice.org.uk/guidance/ng188. last accessed 2022/7/7.
38. Yancey JR and Thomas SM, *Chronic fatigue syndrome: diagnosis and treatment.* Am Fam Physician, **86**(8), 741–746 (2012).
39. Knight, D.R.T., et al., *Perception, Prevalence, and Prediction of Severe Infection and Post-acute Sequelae of COVID-19.* The American Journal of Medical Sciences, **363**(4), 295-304 (2022).
40. Nalbandian, A., et al., *Post-acute COVID-19 syndrome.* Nature Medicine, **27**(4), 601-615 (2021).
41. Woodruff A, et al., *COVID-19 infection: Strategies on when to discontinue isolation, a retrospective study.* Am J Infect Control, **48**(9), 1032-1036 (2020).
42. Josephson, A., T. Kilic, and J.D. Michler, *Socioeconomic impacts of COVID-19 in low-income countries.* Nature Human Behaviour, **5**, 557-569 (2021).