ORIGINAL ARTICLE

The relationship between disease severity and functional status of post-covid-19 patients in Banda Aceh, Indonesia

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ABSTRACT

Introduction: Coronavirus Disease-2019 known as COVID-19 has spread rapidly worldwide, changing many aspects of life, including the functional status. Therefore, this study aims to assess the relationship between disease severity and the functional status of COVID-19 patients after recovery in Banda Aceh, Indonesia.

Methods: A cross-sectional study was conducted with 109 post COVID-19 patients having been cured for more than 4-8 weeks in a hospital in Banda Aceh, Indonesia. The history of disease severity of COVID-19 was collected from medical records and was divided into mild, moderate, severe, and very severe according to the WHO guidelines. The functional status was assessed using the Post-COVID-19 Functional Status Scale (PCFS) questionnaire and divided into five categories namely no functional limitation, negligible, slight, moderate, and severe functional limitation. The relationship between the severity of COVID-19 and functional status was assessed statistically using the Spearman rank test.

Results: Out of 109 selected respondents, there was one patient with mild severity, and 68, 37, and three patients have a history of moderate, severe, and very severe COVID-19, respectively. Those imply the functional status with no functional limitation (6%), negligible (21%), slight (4%), moderate (42%), and severe functional limitation (28%). In addition, fatigue was the most common symptom that persisted among respondents. Furthermore, the statistical result showed that the history of COVID-19 severity had a significant relationship with the post-COVID-19 functional status ($p<0.05$).

Conclusions: This study showed that post-COVID-19 cases have varying functional limitations ranging from negligible to severe. The COVID-19 severity significantly correlates with the functional status post-recovery. Hence, it is recommended to conduct a monitoring program to assess the post-COVID-19 functional status regularly, especially in outpatient clinics of the government healthcare center, in order to enhance the research findings.

Keywords: disease severity; post-COVID-19 functional status; post-COVID-19 persistent symptom

Introduction

According to data released by World Health Organization (WHO), there have been more than 100 million confirmed cases of COVID-19 and more than two million deaths worldwide since the pandemic (Hawlader *et al.*, 2021). In Indonesia, 5.667,355 confirmed cases based on the Indonesian Ministry of Health have been recorded and 149,268 deaths as of March 3, 2022 (Indonesian Health Ministry, 2022). According to the United Nations (UN) (2020), this disease continually shows conditions of uncertainty, exhaustion, and changes in the overall pattern of life, thereby having a tremendous impact on the world. It is well-known that the symptoms are highly variable and can result in a long-term disorder with persistent symptoms, regardless of age, comorbid conditions, in young adults

and without chronic disease (Poudel *et al.*, 2021). The recovering case of COVID-19 is a tremendous pressure worldwide. Furthermore, the primary functional side is estimated to affect physical, mental, cognitive, and public health status (United Nations, 2020). This outbreak has previously been associated with a persistent disruption in lung function, muscle weakness, pain, lethargy, depression, anxiety, vocational disorders, and impaired quality of life at various levels (Catherine *et al.*, 2007; Neufeld *et al.*, 2020). The clinical spectrum of Coronavirus Disease 19 (COVID-19), which has caused a global pandemic, varies from a moderate illness to a life-threatening condition. Most COVID-19 patients initially only experience minor symptoms like fever and cough, but a tiny percentage develop severe pneumonia and experience life-threatening side effects, including acute respiratory distress syndrome, multi-organ failure, and death. Therefore, the World Health Association has made a guideline to classify the severity of COVID-19 from mild, moderate, severe, and very severe (WHO, 2021).

The prevalence of post-COVID-19 symptoms varies widely, ranging from 13% - 83%, in patients undergoing self-isolation by 10% - 30%, while those treated in hospitals are as high as 80%. In Indonesia, it was recorded that 63.5% of patients experienced persistent symptoms (Callard and Perego, 2021). These are often similar to the symptoms that developed during the acute phase of this virus. Furthermore, the most common manifestation of post-COVID-19 symptoms is fatigue, shortness of breath, cough, joint pain, and chest pain. Adult survivors have limitations in Activities of Daily Life (ADLs), such as walking, bathing, and wearing clothes. Therefore, the disabilities in activities of daily living result in increased use of health services, such as nursing, and a higher risk of mortality (Aiyegbusi *et al.*, 2021). Even though the majority of these symptoms are curable, some persist over time and profoundly influence daily living. It can develop into chronic illnesses with severe economic and public health implications. Therefore, a study is required related to the severity of the disease on the daily functional ability of post-COVID-19 patients in Indonesia.

According to the World Health Organization, quality of life refers to an individual's view of their position in life, which includes their culture and values in connection to goals, expectations, standards, and concerns. COVID-19 is considered a significant physical and psychological disorder, which leads to deterioration in health as well as affects the quality of daily life. A simple and basic assessment is needed to monitor the progression of symptoms and their effect on the functional status of the sick patient. This is because many recovered cases require regular, easy, and measurable monitoring to categorize those patients with slow recovery or needing assistance (World Health Organization, 1996). Therefore, Klok, Boon and Barko (2020) compiled THE Post-COVID-19 Functional Status Scale (PCFS) which (after slight adaptation) is helpful during the pandemic. A new scale is recommended for use in patients discharged from the hospital after 4-8 weeks or six months to evaluate the functional status Mohamed Hussein *et al.*, (2021).

There are still limited studies assessing the functional status of people recovering from COVID-19, especially in Indonesia. Therefore, this study aims to determine the relationship between disease severity and the functional

Table 1 Scale Assessment of Post-COVID-19 Functional Status (PCFS) scale

1. Constant Care	**Yes**	**No**
1.1 Do you require constant care after recovering from Covid-19?		

2. Basic Activities of Daily Living	**Yes**	**No**
2.1 I can't eat alone after recovering from Covid-19		
2.2 I can't shower or dress myself after recovering from Covid-19		
2.3 I can't clean my face, brush my teeth, do my hair after recovering from Covid-19		
2.4 I can't walk like walking in the park, in the yard or around the house after recovering from Covid-19		

3. Instrumental Activities of Daily Living (iADL)	**Yes**	**No**
3.1 I can't do activities such as washing dishes, preparing food, taking out trash, sweeping the house, watering plants after recovering from Covid-19		
3.2 I can't travel like using a vehicle as usual after recovering from Covid-19		
3.3 I can't buy daily supplies after recovering from Covid-19		

4. Participation in usual social roles	**Yes**	**No**
4.1 I am reducing my activity/task time at home or at work after recovering from Covid-19		
4.2 I need to avoid or reduce activities at home or work that I usually do after recovering from Covid-19		
4.3 I am not able to take care of my family such as husband or wife, children, grandchildren and parents as usual after recovering from Covid-19		
4.4 Since being diagnosed with COVID-19 positive, have you had problems with your neighbors or at work?		
4.5 I am limiting my participation in social and recreational activities such as doing hobbies, going to public places, playing games after recovering from Covid-19		

status of recovered COVID-19 patients in Aceh, Indonesia

Materials and Methods

Study Setting

This research was a cross-sectional study design on confirmed COVID-19 patients that have been treated in New Emerging and Re-Emerging Infectious Diseases Ward and Respiratory Intensive Care Unit at Dr. Zainoel Abidin Hospital, Banda Aceh, Indonesia. Respondents aged 18 to 70 years, declared cured for more than 4-8 weeks, willing for an interview met the criteria for inclusion. Meanwhile, patients with probable and suspected virus cases without symptoms were excluded from this study. As many as 109 respondents were involved in this research by using a total sampling technique for one month in 2021. The research variables were the history of disease severity of COVID-19 and the post0COVID-19 functional status with additional information of post-COVID-19 persistent symptoms.

Assessment of The Disease Severity

The history of disease severity of COVID-19 was divided according to the WHO guidelines into mild,

Table 2 Characteristics of Respondents

Characteristics	Frequency(n)	Percentage (%)
Gender		
Male	66	61
Female	43	39
Age		
25-44 years old	17	15.5
45-64 years old	69	63.3
65> years old	23	21.1
Occupation		
Entrepreneur	56	52
Civil servant	25	24
Jobless	27	25
College student	1	1
History of COVID-19 severity		
Mild	1	1
Moderate	68	62
Severe	37	34
Very severe	3	3
Post-COVID-19 Functional Status Scale		
No Functional Limitation	6	6
Negligible Functional Limitation	23	21
Slight Functional Limitation	4	4
Moderate Functional Limitation	46	42
Severe Functional Limitation	30	28
Total	109	100

moderate, severe, and very severe (Son, Lee and Hwang, 2021) and provided from medical records.

Assessment of Post-COVID-19 Functional Status (PCFS) Scale

The demographic data collected include gender, age, occupation, and severity of disease. The patient's functional status was assessed using the Post-COVID-19 Functional Status scale (PCFS) questionnaire, which consisted of several questions and was divided into five grades, namely grade 0 (no functional limitations), grade 1 (negligible functional limitations), grade 2 (slight functional limitations), grade 3 (moderate functional limitation), and grade 4 (severe functional limitation), as measured by constant care needs, limitations in basic and instrumental activities of daily living, and participation in usual social role after recovering from COVID-19. Grade 4 shows severe functional limitation, which involves having limitations in daily activities, being unable to take care of oneself, still require treatment and has symptoms such as anxiety, fatigue, weakness muscle tone, difficulty breathing, depression, memory impairment, and cough.

The PFCS questionnaire used in this study was adopted from previous study (Klok, Boon and Barco, 2020). The original language of the questionnaire was English, which was then translated into Bahasa by other independent experts. For validation, the questionnaire was tested in an outpatient clinic. Completing the survey takes approximately 10 minutes. This study evaluated the questionnaire questions and gained reliability of 0.9 and the validity was lower than 0.5. The blueprint of the questionnaire is shown in Table 1.

Statistical Analysis

This study uses descriptive analysis to describe the characteristics, patient's clinical symptoms, and the post-COVID-19 functional status. Furthermore, the relationship between the severity COVID-19 and PCFS was assessed statistically using the Spearman rank test. This statistical analysis uses SPSS (Statistical Package for Social Sciences) for Windows version 25.0 (IBM SPSS Inc., USA). This study was approved by the Health Research Ethics Committee at the Faculty of Medicine, Syiah Kuala University/Dr. Zainoel Abidin No. 310/EA/FK-RSUDZA/2021.

Results

This study collected 109 respondents and more than half (61%) were male (n = 66) with age range of 45-64 years found to be the most (63.3%), and more than half (52%) work as self-employed (n = 56). This study

Table 3 The Relationship between History of COVID-19 severity and Functional Status of Post-COVID-19

History of Severity	Functional limitation										Total		p-value	r
	None		Negligible		Slight		Moderate		Severe					
	n	%	n	%	n	%	n	%	n	%	n	%		
Mild	0	0	1	100	0	0	0	0	0	0	1	100		
Moderate	4	5.9	18	25.5	3	4.4	33	48.5	10	14.7	68	100		
Severe	2	5.4	4	10.8	1	2.7	12	32.4	18	48.6	37	100	0.000	0.358
Very Severe	0	0	0	0	0	0	1	33.3	2	66.7	3	100		
Total	6	5.5	23	21.1	4	3.7	46	42.2	30	27.5	109	100		

revealed that the most disease severity history of COVID-19 was in the moderate grade (n = 68 or 62%). The majority of respondents (46 patients or 42%) had severe degrees of PCFS and only 4% (four respondents) showed a slight functional limitation (Table 2). The most common post-COVID-19 persistent symptoms were fatigue (89%), muscle weakness (60%), cough (53%), and depression (43%) (Figure 1). Furthermore, this study shows that the disease severity of COVID-19 has a significant relationship with post-COVID-19 functional status with $p < 0.05$ (Table 3). The patients with moderate severity of COVID-19 (n = 43) show PCFS at the moderate grade (n = 33 or 48.5%) or even more severe (n = 10 or 14.7%).

Discussions

COVID-19 patients with mild (1,1%), moderate (68,62%), severe (37,34%), and very severe (3,3%) severity were included in the study, with fatigue and persistent cough being present in 90% and 50% of the respondents, respectively. During the COVID-19 pandemic, the most common complaints were mild clinical symptoms such as cough, fever, shortness of breath, musculoskeletal (lethargy and joint pain), gastrointestinal and sleep disturbances (Docherty et al., 2020; Wang et al., 2020). According to the course of the disease, the Coronavirus (SARS-CoV-2) has the highest affinity for the angiotensin-converting enzyme-2 (ACE-2) receptor, primarily located in the lungs. Pulmonary damage occurs when the virus attacks type II pneumocytes of the alveolar epithelium in the lungs. It can develop lung injury and sequels persistent such as scarring and pulmonary fibrosis, leading to long-term breathing problems. In addition, endothelium damage can trigger an inflammatory response in the capillaries and form microthrombi with extensive pulmonary consolidation. COVID-19 changes the lungs' ability to diffuse carbon monoxide (DLCO). This pathophysiology describes the extent and severity of COVID-19 and manifests in symptoms (Thomas, Price and Hull, 2021).

A previous study of 355 patients with mild to severe COVID-19 showed that approximately 46% of them experienced post-COVID-19 symptoms in female

patients, with fatigue often appearing as the primary symptom (Mahmud, Rahman and Rassel, 2021). Furthermore, a study observed patients with mild to severe disease that met WHO criteria and discovered that approximately 87% had persistent clinical complaints such as fatigue (53.1%), dyspnea (43.4%), joint pain (27.3%), and chest tightness (21.7%) (Carf, Bernabei and Landi, 2020).

Fatigue is a disabling mental and physical exhaustion sensation and is more common in people with post-COVID-19 syndrome (Diem et al., 2022). Another study that also supports the results is from Aiyegbusi et al. (2021), which states that the most common post-COVID-19 clinical symptoms experienced by patients were fatigue (47%), dyspnea (32%), muscle pain (25%), pain Head (18%), and cough (18%). Also, an additional study conducted by Qi et al. (2021) on 1171 COVID-19 patients in China stated that 21.4% and 22.6% of them experienced post-COVID-19 anxiety and depression, respectively Taquet et al. (2021) conducted a retrospective cohort study of 236,379 COVID-19 patients in the United States, of which 19.15% experienced an anxiety event within six months after infection. Pant et al. (2021) reported that nearly 90% of patients had at least clinical symptoms. Fever is the most common symptom, followed by cough, shortness of breath, and chest pain. Therefore, impaired lung function, mental health problems, and decreased quality of life have a long-term impact on physical, mental, social, and cognitive health, leading to decreased functional status (Pant et al., 2021).

The virus enters the host cells, seizes control of cellular metabolism, and activates catabolic mechanisms like apoptosis and autophagy that primarily destroy cell proteins to provide amino acids for the generation of virions. This virus's tactics cause cellular damage, protein malfunction, mitochondrial energy loss, and iron leakage, which causes an increase in serum ferritin and the symptoms of weakness and fatigue (Pasini et al., 2021). This mechanism links it to the two physical symptoms that are most frequently reported: fatigue and unexpected shortness of breath that impair daily activities (Thomas, Price and Hull, 2021). The
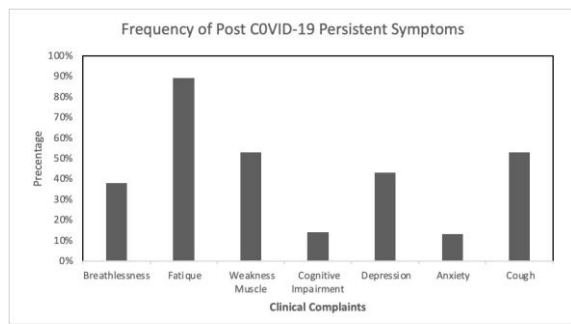
Figure 1 Post-COVID-19 Persistent Symptoms

duration of treatment and psychological disturbances while suffering from this disease result in extraordinary mental and attitude disorders. In addition, these play an essential role in causing physical activity disorders. (World Health Organization, 2020).

Indeed, post-COVID patients have not entirely recovered from the disease's health issues even though they recovered from the disease. In addition to the risk of lasting disruption from COVID-19, many patients must contend with it daily in the community. This study assessed any persistent functional impairment in recovered COVID-19 patients using the recommended PCFS questionnaire. Patients had varying degrees of functional limitation ranging from no functional limitation (6%), negligible functional limitation (21%), slight functional limitation (4%), moderate functional limitation (42%), and severe functional limitation (30%) based on PCFS. Sepsis survivors are likely to have similar difficulties as other survivors of severe COVID-19. In addition, COVID-19 can lead to many consequences due to the severe course of infection. Minimized sedation, daily breathing testing, early mobility, and other evidence-based practices can improve ICU outcomes. However, this practice is not implemented in ICUs overloaded with other COVID-19-related problems that interfere with routine care. Therefore, patients with severe COVID-19 may experience deeper drowsiness, less respiratory effort, and limited mobility compared to other severe patients, all of which can impact day-to-day living and result in a poorer prognosis (Iwashyna et al., 2010).

The results were supported by a study conducted by Machado et al. (2021), which stated that 1,011 people (52%) of the 1,939 respondents experienced the Post-COVID-19 Functional Status scale (PCFS) at severe degree. However, according to Pant et al. (2021), 60 people (56.6%) experienced the Post-COVID-19 Functional Status scale at no functional limitation, followed by mild degree up to 29 people (27.3%) and four (1.9%) of the respondents experienced severe degree. Additionally, Hussein et al. (2021) stated that of

444 respondents, 280 (63.1%) experienced Post-COVID-19 Functional Status scale at mild degree (Mohamed Hussein et al., 2021).

This study showed a significant relationship between disease severity and post-COVID-19 functional status (p<0.05). The main target population for the intervention of long-term recovery is patients who were more seriously unwell during their hospital stay and had more severe decreased pulmonary diffusion capabilities due to severe pneumonia and abnormal chest imaging entity. In severe COVID-19 pneumonia, respiratory virus infection may cause different fibroblast activation throughout the convalescence phase and cause pathological fibroproliferation in the lung. Both of these effects have a significant impact on both short- and long-term outcomes in functional status. In addition, pulmonary diffusion abnormalities and value CT imaging change were related to the severity of the disease during the acute phase (Nalbandian et al., 2021).

In all the studies analyzed, there was a decrease in the performance of daily activities after COVID-19 infection regardless of the rating scale used. Patients that developed complications during hospitalization, such as ICU admission (Poudel et al., 2021), mechanical ventilation (Region and Maugeri, 2020), decreased consciousness (Mcloughlin et al., 2020), or greater oxygen demand (Curci et al., 2020), all had poorer outcomes with persistent symptoms postoperatively after COVID-19. Participation in a rehabilitation program is also a factor that might alter outcomes in functional status; however, Activity Daily Living (ADLs) performance does not improve in all cases. Various factors related to the patient's condition, such as disease severity, tend to affect functional capacity and performance of activities of daily living (Pizarro-Pennarolli et al., 2021). Likewise, Hussein et al. (2021) stated that only 3% of patients treated in the ICU had no functional status restrictions and 97% had limited functional status where 93% had only negligible functional status limitation.

This study has several limitations. The proportion of patients with comorbidities was not disclosed in this study. In addition, this study is only based on a questionnaire of clinical symptoms related to impaired lung function, not directly carried out tests, so that it may not arise from COVID-19. The data for new symptoms in early COVID-19 were not further stratified to establish whether the symptoms were post-discharge, exacerbated after COVID-19 recovery, or persisted after COVID-19. Mild COVID-19 symptoms did not qualify patients for enrollment. More work is

required to compare the long-term results between inpatients and outpatients.

Conclusions

Most post-COVID-19 cases have varying degrees of functional limitations ranging from negligible to severe according to PCFS. This study discovered that history of severe COVID-19 significantly impacted the functional status after recovering from the disease. Therefore, it is recommended to conduct a regular post-COVID-19 monitoring program at a government clinic or be part of an outpatient program, following the patient's functional status during the 1st, 3rd, and 6th months of visit.

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Conflict of Interest

The author declares that there is no conflict of interest in this study.

References

Aiyegbusi, O. L. *et al.* (2021) 'Symptoms , complications and management of long COVID : a review', *Journal of the Royal Society of Medicine*, 114(9), pp. 1–15. doi: 10.1177/01410768211032850.

Hussein, A. AR. M. *et al.* (2021) 'Post-COVID-19 functional status: Relation to age, smoking, hospitalization, and previous comorbidities', *Annals of Thoracic Medicine*, 16, pp. 260–5. doi: 10.4103/atm.atm.

Callard, F. and Perego, E. (2021) 'Social Science & Medicine How and why patients made Long Covid', *Social Science & Medicine,* 268, p. 113426. doi: 10.1016/j.socscimed.2020.113426.

Carf, A., Bernabei, R. and Landi, F. (2020) 'Persistent Symptoms in Patients After Acute COVID-19', *JAMA*, 324(6), p. 603. doi: 10.1136/bmj.m1985.

Catherine, M., T. *et al.* (2007) 'One-year outcomes and health care utilization in survivors of severe acute respiratory syndrome', *Archives of Internal Medicine*, 167(12), pp. 1312–1320. Available at: http://solo.bodleian.ox.ac.uk/OXVU1:LSCOP_OX:oxfaleph010495 829%0Ahttps://jamanetwork.com/journals/jamainternalmedicin e/articlepdf/412710/ioi70065_1312_1320.pdf.

Curci, C. *et al.* (2020) 'Early rehabilitation in post-acute COVID-19 patients: data from an Italian COVID-19 Rehabilitation Unit and proposal of a treatment protocol', *European journal of physical and rehabilitation medicine*, 56(5), 633–641. doi: 10.23736/S1973-9087.20.06339-X.

Diem, L. *et al.* (2022) 'Fatigue in Post-COVID-19 Syndrome: Clinical Phenomenology, Comorbidities and Association With Initial Course of COVID-19', *Journal of Central Nervous System Disease*, 14, p. 117957352211027. doi: 10.1177/11795735221102727.

Docherty, A. B. *et al.* (2020) 'Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol : prospective observational cohort study', *BMJ*, 2, pp. 1–12. doi: 10.1136/bmj.m1985.

Hawlader, M. D. H. *et al.* (2021) 'Quality of life of COVID-19 recovered patients in Bangladesh', *PLOS ONE*, 16(10 October), pp. 1–18. doi: 10.1371/journal.pone.0257421.

Indonesian Health Ministry (2022) The Latest Situation of Covid-19 in Indonesia.

Iwashyna, T. J. *et al.* (2010) 'Long-term cognitive impairment and functional disability among survivors of severe sepsis', *JAMA - Journal of the American Medical Association*, 304(16), pp. 1787–1794. doi: 10.1001/jama.2010.1553.

Klok FA, Boon GJAM, Barco S, *et al.* (2020) 'Post COVID-19 Functional Status scale Manual Version May 2020', *European Respiratory Journal*, (2), pp. 1–16.

Klok FA. *et al.* (2020) 'Incidence of thrombotic complications in critically ill ICU patients with COVID-19', *Thromb Res*, 191, pp. 145–147. https://doi.org/10.1016/j.thromres.2020.04.013

Machado, F. V. C. *et al.* (2021) 'Construct validity of the Post - COVID - 19 Functional Status Scale in adult subjects with COVID - 19', *Health and Quality of Life Outcomes*, pp. 1–10. doi: 10.1186/s12955-021-01691-2.

Mahmud, R., Rahman, M. and Rassel, M. A. (2021) 'Post-COVID-19 syndrome among symptomatic COVID-19 patients: A prospective cohort study in a tertiary care center of Bangladesh', *PLoS ONE*, 16(4), p. e0249644. doi: 10.1371/journal.pone.0249644.

Mcloughlin, B. C. *et al.* (2020) 'Functional and cognitive outcomes after COVID - 19 delirium', *European Geriatric Medicine*, 11(5), pp. 857–862. doi: 10.1007/s41999-020-00353-8.

Nalbandian, A. *et al.* (2021) 'Post-acute COVID-19 syndrome', *Nature Medicine*, 27(4), pp. 601–615. doi: 10.1038/s41591-021-01283-z.

Neufeld, K. J. *et al.* (2020) 'Fatigue Symptoms During the First Year Following ARDS', *Chest*, 158(3), pp. 999–1007. doi: 10.1016/j.chest.2020.03.059.

Pant, P. *et al.* (2021) 'Prevalence of Functional Limitation in COVID-19 Recovered Patients Using the Post COVID-19 Functional Status Scale Correspondence', *journal of the Nepal Medical Association*, 59(233), pp. 7–11. doi: 10.31729/jnma.5980.

Pasini, E. *et al.* (2021) 'Serum Metabolic Profile in Patients With Long-Covid (PASC) Syndrome: Clinical Implications', *Frontiers in Medicine*, 8, pp. 1–8. doi: 10.3389/fmed.2021.714426.

Pizarro-pennarolli, C. *et al.* (2021) 'Assessment of activities of daily living in patients post COVID-19 : a systematic review', *PeerJ*, 9, p. e11026. doi: 10.7717/peerj.11026.

Poudel, A. N. *et al.* (2021) 'Impact of Covid-19 on health-related quality of life of patients: A structured review', *PLoS ONE*, 16, pp. 1–20. doi: 10.1371/journal.pone.0259164.

Region, P. and Maugeri, C. S. (2020) 'Performance of activities of daily living in a sample of applicants for home modification services. Scandinavian journal of occupational therapy, 14(1), 44–53. https://doi.org/10.1080/11038120601094997

Son, K. B., Lee, T. J. and Hwang, S. S. (2021) 'Disease severity classification and covid-19 outcomes, Republic of Korea', *Bulletin of the World Health Organization*, 99(1), pp. 62–66. doi: 10.2471/BLT.20.257758.

Taquet, M. *et al.* (2021) '6-month neurological and psychiatric outcomes in 236 379 survivors of COVID-19: a retrospective cohort study using electronic health records', *The Lancet Psychiatry*, 8(5), pp. 416–427. doi: 10.1016/S2215-0366(21)00084-5.

Thomas, M., Price, O. J. and Hull, J. H. (2021) 'Pulmonary function and COVID-19', *Current Opinion in Physiology*, 21, pp. 29–35. doi: 10.1016/j.cophys.2021.03.005.

Tian, Q. *et al.* (2021) 'COVID-19 pandemic related long-term chronic stress on the prevalence of depression and anxiety in the general population', *BMC Psychiatry*, 21(1), pp. 1–10. doi: 10.1186/s12888-021-03385-x.

United Nations (2020) UN Research Roadmap for the COVID-19 Recovery. Available at: https://www.un.org/en/coronavirus/communication-resources/un-research-roadmap-covid-19-recovery

Wang, D. *et al.* (2020) 'Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China', *JAMA - Journal of the American Medical Association*, 323(11), pp. 1061–1069. doi: 10.1001/jama.2020.1585.

WHO (2021) Living Guidance for clinical management of COVID-19,

World Health Organization. Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-clinical-2021-1.

World Health Organization (WHO). (1996) 'Division of Mental Health. WHOQOL-BREF: introduction, administration, scoring and generic version of the assessment: field trial version, December 1996', p. https://apps.who.int/iris/handle/10665/63529.

World Health Organization (WHO). (2020) Mental health and psychosocial considerations during the COVID-19 outbreak. *World Health Organization* Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-MentalHealth-2020.1