

## Post Covid-19 Symptoms among Covid-19 patients with comorbidities and non-comorbidities in Peninsular Malaysia

Abdelbaset Taher Abdelhalim<sup>1</sup>, Wael Mohamed<sup>2</sup>, Fatin Najihah binti Abdul Rahman<sup>3</sup>,  
Hairafazilah binti Abdullah Morjani<sup>3</sup>, Nurul Adlin binti Rujhan<sup>3</sup>, Wan Muhammad Arif  
Firdaus bin Wan Zulkafli<sup>3</sup>, Abdul Rahman bin Sohailur Rehman<sup>3</sup>, Abdus Salam<sup>4</sup>

<sup>1</sup>Pharmacology Unit and Paediatric Unit, Faculty of Medicine, Widad University College Malaysia, <sup>2</sup>Basic Medical Science Department, Faculty of Medicine, International Islamic University Kuantan Malaysia, <sup>3</sup>Medical students of year-4, session 2021 attached to Community Medicine Unit, Widad University College, Malaysia, <sup>4</sup>Community Medicine Unit and Medical Education Unit, Faculty of Medicine, Widad University College, Malaysia

*\*Corresponding Author: abdussalam.dr@gmail.com*

### Abstract

**Background:** The Covid-19 pandemic started in late 2019 has become a major global pandemic that affects the millions of people around the globe. It is found that patients having COVID-19 infection may continue the symptoms for weeks or months which is known as Long Covid. This new post COVID syndrome is particularly hazardous as it affects physical and mental health as well as quality of life which is a great concern for the health care system. **Objectives:** The aim of this study was to evaluate the long-term effect of COVID-19 among adult Peninsular Malaysians. **Methods:** This cross-sectional questionnaire-based study was conducted at Widad University College (WUC) from September 2021 to November 2021. The study population were adult Malaysian citizens of 18-65-years-old, who has been infected with Covid-19 and the questionnaire were distributed to them via a google form shared through WhatsApp, Instagram, Telegram and Facebook. The required sample size was 385 and a total 391 participants participate in this study. Data was collected and analysed using the Statistical package for Social Sciences (SPSS) version-

22. **Results:** Generalized fatigue, fever, breathlessness, cough, ear-ache, sore throat, loss of taste/smell were the most common post COVID-19 symptoms identified in both comorbid and incidence of persistence of symptoms till one month was found compared to comorbid group. In 2.5% of patients in comorbid group and 2.2% in non-comorbid group have persistence of symptoms till six months and more. **Conclusion:** Early detection is necessary for early management of the patients and thereby reduce the burden on the health care system.

**Keywords:** *Post COVID syndrome, Comorbid patients, Non-comorbid patients, Malaysians.*

## 1.0 Introduction

Coronavirus disease (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a global pandemic that began in Wuhan, China and spread rapidly to over 180 countries (Lu et al. 2020; Wang et al. 2020). This SARS-CoV-2 pandemic has resulted in more than 224 million infected cases and about 4.6 million deaths as of September 2021, at significant costs to healthcare systems and societies worldwide (WHO, 2021). As of 6th September 2021, a total of 1,862,187 people were infected with COVID-19 and 18,491 deaths were reported in Malaysia (Ministry of Health Malaysia, 2021).

There is documentation signifies that symptom associated with COVID-19 are highly divergent, ranging from no symptoms to mild (fever, cough, sneezing, or sore throat, malaise, headache, muscle pain etc), moderate (lower respiratory tract infection and oxygen saturation (SpO<sub>2</sub>)  $\geq$ 94% on room air), severe (SpO<sub>2</sub> <94% on room air, respiratory rate >30 breaths/min, or lung infiltrates >50%) and critical (acute respiratory failure, septic shock, or systemic multiple organ failure) (National Institutes of Health, 2021). There have also been evidences that show that patient's comorbidities such as older age, underlying cardiovascular disease, lung disease, diabetes, cancer, obesity, sickle cell disease or chronic kidney disease have an impact on the severity of the COVID-19 disease (CDC, 2020). Pregnancy, immunocompromised patients such as post-transplant patient, and patients receiving immunosuppressive therapy also showed progression to severe COVID-19 disease (CDC, 2020). Depending on the severity of the patient, length of hospital stays and service to the patient in General ward to High Dependency Units (HDU) and to intensive care units (ICU) varies (Rees et al. 2020). Patients with severe and critical condition

often need the ICU admission where patients may be intubated for mechanical ventilation. In Malaysia, patients requiring intubation/mechanical ventilation is 2.2% (Hasani et al. 2021), in China 2.3% (Guan et al. 2020) while a higher rate is observed in United States of America (12.2%) (Richardson et al. 2020).

The “post-COVID-19 syndrome” is also known as “Long Covid” which refers to the symptoms that last weeks or months after the infection has gone (National Health Service, 2021). It is estimated that 10% of patients having COVID-19 infection may continue the symptoms beyond three weeks or even months (Greenhalgh et al. 2020). A growing body of data suggests that long-term physical and mental health implications, are a rising source of worry for healthcare systems (Greenhalgh et al. 2020, National Institute for Health Research -NIHR, 2021). Study on persistence of symptoms and the development of sequelae following COVID-19 infection in hospitalized patients showed, fatigue, muscle weakness, and sleep difficulties as the most common symptoms in recovered patients (Huang et al. 2021). It has been found that within 60 days of discharge up to 20% of patients who survived needed to be readmit due to reinfection, sepsis, pneumonia and heart failure (Donnelly et al. 2020). Another study reported that 1 in 4 people did not get full recovery within 6-8 months after COVID -19 infection (Menges et al. 2021). Study showed that not only hospitalized patients, mild-to-moderate cases and younger age group of people who do not require hospitalization or ICU support also suffer the long term COVID symptoms (Yong, 2021). The long-term effect on physical health as well as mental health is a burden on the public health that is of great concern for the health care system. In this study, we evaluate the long-term effect of COVID-19 among adult Malaysians. The objective of this study was to evaluate post COVID-19 symptoms as perceived by the patients with comorbidities and non-comorbidities among the Peninsular Malaysians.

## **2.0 Materials and Methods**

### ***Study Design, Study Period and Sample Size***

This was a cross-sectional design online questionnaire-based study, carried out by 4<sup>th</sup> year medical students during their community medicine posting at Widad University College (WUC)

from September 2021 to November 2021. It was done as a part of the requirement of fulfilment of their community medicine posting under the guidance of supervisor. The study was on post COVID-19 symptoms among adult Malaysian citizens. Post COVID-19 symptoms were identified as the symptoms, patient suffered after they tested negative and the pink bracelet were taken off by the Health Department of Malaysia to finish the quarantine period. A minimum sample of 385 based on the Cochran formula for infinite population (Statistics How To, 2021) was calculated, while we were able to get data from 391 participants from Peninsular Malaysia.

### ***Inclusion and Exclusion Criteria***

The inclusion criteria in the sample were the participants with or without underlying conditions who were more than 18 years old and less than 65 years old. We limit the age until 65 years old because of certain probable external factors such as dementia, Alzheimer disease can influence the outcome. Patients with a history of COVID-19 infection confirmed by polymerase chain reaction (PCR) with a systematic assessment 10–14 weeks after disease onset were included in this study. The exclusion criteria included those unable to read and understand Bahasa Malaysia or English which make it challenging to understand the questionnaires, or having vision problems which cause difficulty to fill in the questionnaires, and any cognitive and memory problems such as in dementia and Alzheimer disease

### ***Instrument***

To gather information, a validated questionnaire was used which was developed originally in English and translated into Bahasa Malaysia based on WHO guidelines. The questionnaire was structured into 3 sections which included participants' consent, socio-demographic characteristics, health conditions, infection with COVID-19, and severity of post-COVID-19 symptoms.

### ***Section 1: Terms & Conditions***

In this section, the participants were informed that they were given freedom on whether or not to participate in the survey. Participants' permission was taken before they proceeded to answer the rest of the questionnaire and they were also informed about the publication of the data.

### *Section 2: Sociodemographic Characteristics*

The individuals' sociodemographic information on age, gender, race, place of residence, any existing health conditions, and whether or not they had been infected with COVID-19 was obtained.

### *Section 3: Information on Post COVID-19 Symptoms*

This section includes the participants' post-COVID-19 symptoms and which symptoms cause most trouble or inconvenience to them. They were asked how they were diagnosed by selecting the test PCR, RTK and COVID-19 test kit. They were asked whether vaccinated or not. If yes, they were asked to select the type of vaccine they had received from a given list. Then they were surveyed on hospitalization if any, what post COVID-19 symptoms they had, how long the symptoms persist and the severity of the symptoms based on the scale 'Mild, Moderate & Severe'. Regarding the post-COVID-19 symptoms, they were asked to put a tick mark in every row of the symptoms listed and they were also provided the option 'None' in case they were not presented with the mentioned symptoms.

### ***Methods of Data Collection***

To collect the data the questionnaires both Malay and English versions were distributed fully online using social media such as WhatsApp, Instagram, Telegram and Facebook, via Google Forms. We also provided an email in case there were any inquiries from the participants. Participants were assured about the confidentiality and privacy of their responses as no data such as addresses and even names of participants were required in this study.

### ***Methods of Data Analysis***

Data was collected, compiled, and analysed using the Statistical Package for Social Sciences (SPSS) software version 22. Descriptive statistics were used to analyse the socio-demographic characteristics, and post-COVID 19 symptoms which were presented as frequency and percentages among the comorbid and non-comorbid patients. Is there any correlation analysis?

.

### 3.0 Results

#### *Sociodemographic Data*

A total of 391 respondents who had suffered from COVID-19 were participated in this questionnaire survey. Table-1 showed the demographic data of the respondents as well as information regarding duration of hospitalization, vaccination status and comorbidities present in the respondents. Most of the respondents (43.2%) were in the age group of 18 to 29-years-old while least number of respondents (4.6%) were in the age group of 60 to 65-years-old. Most of them were males (57.5%) and were from the Malay ethnicity (86.4%).

**Table 1: Distribution of socio-demographic data along with hospitalization status, vaccination status and comorbidities. n=391**

Socio-demographic variables		Frequency and (%)
Age	18-29	169 (43.2)
	30-39	84 (21.5)
	40-49	73 (18.7)
	50-59	47 (12)
	60-65	18 (4.6)
Gender	Male	225 (57.5)
	Female	166 (42.5)
Race	Malay	338 (86.4)
	Chinese	31 (7.9)
	Indian	22 (5.6)

#### *Hospitalization Status, Vaccination Status and Comorbidities of the Respondents*

Table-2 showed the distribution of hospitalization status, vaccination status and comorbidities of the respondents. Out of 391 respondents, majority of the respondents (77.5%)

were not hospitalized while 88 respondents (22.5%) were hospitalized and among them, 12 respondents (3.1%) were hospitalized for three weeks, 39 respondents (10%) for two weeks and 37 respondents (9.5%) for one week only. In response to the vaccination status while they were tested positive, 232 respondents (59.3%) reported as not vaccinated. For those who were already vaccinated, the most common vaccine they had received was Sinovac (17.9%), followed by Pfizer (15.9%) and the least vaccine received was AstraZeneca (6.9%). Among the 391 respondents who had Covid-19, 163 people (41.7%) had comorbidities. The most common comorbidities were hypertension (19.9%), diabetes (12%) and asthma (11.5%).

**Table 2: Distribution of hospitalization status, vaccination status and comorbidities. n=391**

Status		Frequency and (%)
Hospitalization	None	303 (77.5)
	1 week	37 (9.5)
	2 weeks	39 (10)
	3 weeks	12 (3.1)
Vaccination	None	232 (59.3)
	Sinovac	70 (17.9)
	Pfizer	62 (15.9)
	AstraZeneca	27 (6.9)
Comorbidities	None	228 (58.3)
	Hypertension	78 (19.9)
	Diabetes	47 (12)
	Asthma	45 (11.5)
	Heart Disease	17 (4.3)

	Lung Disease	14 (3.6)
	Cancer	10 (2.6)
	Liver Disease	6 (1.5)
	Blood Disease	3 (0.8)

### *Post COVID-19 Symptoms among All Patients*

Table 3 showed the post-Covid-19 symptoms among all the respondents. The common symptoms were generalized fatigue and fever (73.4%), ENT symptoms of earache, sore throat and loss of taste/smell (69%), respiratory symptoms of breathlessness and cough (67%) and musculoskeletal symptoms of joint pain, muscle pain (52.7%). Total 42 patients did not have the post COVID symptoms and all of them belongs to the non-comorbid group.

**Table 3: Distribution of post COVID-19 symptoms among all comorbid and non-comorbid patients, n=391.**

Symptoms	Frequency / Number	Percent
Generalized: Fatigue, Fever	287	73.4
Ear/Nose/Throat (ENT): Earache, Sore throat, Loss of taste/smell	270	69
Respiratory: Breathlessness, Cough	262	67
Neurological: Headache, Dizziness, Loss of concentration	230	58.8
Musculoskeletal: Joint pain, Muscle pain	206	52.7
Cardiovascular: Chest tightness, Chest pain, Palpitation	183	46.8
Gastrointestinal: Abdominal pain, Nausea, Diarrhoea, Reduced appetite	177	45.3
Psychological: Depression, Anxiety	157	40.2
Dermatological: Skin rash	77	19.7
No symptoms at all	42	10.7



### ***Post COVID-19 Symptoms in Relation to Comorbidity***

Table-4 showed distribution of post COVID symptoms relating to comorbid and non-comorbid patients. It showed that, comorbid group has higher number of respondents presented with generalized symptoms (51.2%), gastrointestinal symptoms (54.8%), musculoskeletal symptoms (58.7%), respiratory (51.1%), neurological (51.3%), cardiovascular symptoms (56.3%), psychological (55.4%) and dermatological symptoms (68.8%) compared to the non-comorbid group. Only the ENT symptoms (51.1%) were presented by higher number of respondents in the non-comorbid group compared to comorbid group.

**Table 4: Distribution of post COVID symptoms relating to comorbid and non-comorbid patients.**

<b>Symptoms</b>	<b>Comorbid patients n (%)</b>	<b>Non-comorbid patients n (%)</b>
No symptoms at all (n=42)	0	42 (18.4)
Generalized: Fatigue, Fever (n=287)	147 (51.2)	140 (48.8)
Respiratory: Breathlessness, Cough (n=262)	134 (51.1)	128 (48.9)
Ear/Nose/Throat (ENT): Earache, Sore throat, Loss of taste/smell (n=270)	132 (48.9)	138 (51.1)
Musculoskeletal: Joint pain, Muscle pain (n=206)	121 (58.7)	85 (41.3)
Neurological: Headache, Dizziness, Loss of concentration (n=230)	118 (51.3)	112 (48.7)
Cardiovascular: Chest tightness, Chest pain, Palpitation (n=183)	103 (56.3)	80 (43.7)
Gastrointestinal: Abdominal pain, Nausea, Diarrhoea, Reduced appetite (n=177)	97 (54.8)	80 (45.2)
Psychological: Depression, Anxiety (n=157)	87 (55.4)	70 (44.6)
Dermatological: Skin rash (n=77)	53 (68.8)	24 (31.2)

### ***Most Troublesome Post COVID-19 Symptoms***

Table 5 depicts the respondents' perception about the most troublesome symptoms in the comorbid and non-comorbid group. In the non-comorbid group, 18.4% having no symptoms. Respiratory symptoms were cited by the highest number of participants as the most unpleasant symptoms in both comorbid (29.45%) and non-comorbid group (21.93%). Psychological and gastrointestinal symptoms, were the least troublesome symptoms perceived by the patients with comorbidities (3.06% in each) and without comorbidities (2.2% and 0.9% respectively).

**Table 5: Distribution of most troublesome symptoms by comorbid and non-comorbid patients, n=391.**

<b>Symptoms</b>	<b>Comorbid patients (n = 163) n (%)</b>	<b>Non-comorbid patients (n = 228) n (%)</b>
None	0	42 (18.4)
Respiratory: Breathlessness, Cough	48 (29.5)	50 (21.9)
Generalized: Fatigue, Fever	29 (17.8)	43 (18.9)
Ear/Nose/Throat (ENT): Earache, Sore throat, Loss of taste/smell	27 (16.6)	44 (19.3)
Cardiovascular: Chest tightness, Chest pain, Palpitation	21 (12.9)	21 (9.2)
Musculoskeletal: Joint pain, Muscle pain	16 (9.8)	3 (1.3)
Neurological: Headache, Dizziness, Loss of concentration	12 (7.4)	18 (7.9)
Gastrointestinal: Abdominal pain, Nausea, Diarrhoea, Reduced appetite	5 (3.1)	2 (0.9)
Psychological: Depression, Anxiety	5 (3.1)	5 (2.2)

### *Duration of Post COVID-19 Symptoms*

Table 6 showed distribution of the duration of post-covid-19 symptoms. Majority of patients in both comorbid and non-comorbid group (51.5% and 57.9% respectively) have post COVID-19 symptoms prolonged to 1 month. However, in 2.5% of patients in comorbid group and 2.2% in non-comorbid group have the symptoms continued to 6 months and more.

**Table 6: Distribution of duration of symptoms by comorbid and non-comorbid**

Duration of symptoms	Comorbid patients (n=163)	Non-comorbid patients (n=228)
	n (%)	n (%)
No symptoms	0	42(18.4)
1 month	84 (51.5)	132 (57.9)
2 to 3 months	55 (33.7)	40 (17.5)
4 to 5 months	20 (12.3)	9 (4)
6 months and above	4 (2.5)	5 (2.2)

## **4.0 Discussion**

This study has evaluated the post COVID-19 symptoms among adult Malaysians. Our study was carried out during the period from September 2021 to November 2021 because this time interval was suitable for WIDAD team work to conduct it as part of community medicine activities. One important finding is that a bigger percent of the participants suffered from COVID-19 infection and having long term effect were non-vaccinated population (59.3%) (Table-1). This proves the importance of vaccination in the prevention of the disease. Similar finding is showed by a study done during the period of July and September 2021 in Seremban district Malaysia where most of the COVID-19 infected patients had underlying comorbidity and did not complete their vaccination (Nor-Azila et al. 2022). In this present study, although most of the patients were not hospitalised (77.5%), a number of patients were hospitalized for one week to more than three weeks during the COVID-19 infection (Table -2). Most of the participants had no-comorbidities

(58.3%) (Table-2) and 42 participants among them had no post COVID symptoms (Table -3), only detected through the laboratory test.

In this present study, we found the most common post-COVID-19 symptoms among the respondents were generalized fatigue and fever, respiratory symptoms of breathlessness and cough, ENT symptoms of earache, sore throat and loss of taste/smell. This present study showed that incidence of post-COVID-19 symptoms were all higher in comorbid patients except for ENT symptoms which was higher in the non-comorbid patients. We identified the most troublesome symptoms were respiratory symptoms, generalized symptoms and ENT symptoms for both groups of patients. It is found that most of the post COVID symptoms exists for 1 months in both groups of comorbid and non-comorbid patients, however higher number was found in the non-comorbid group. Psychological symptoms of depression and anxiety were found in 44.6% -55.4% patients in non-comorbid and comorbid patients respectively (Table-4). Previous study has found that, most common symptoms of post COVID-19 infection are fatigue and shortness of breath (Shah et al. 2021, Yong et al. 2021, Carfi et al. 2020). Other reported symptoms of post COVID-19 infection are psychological impairments, headache, muscle and joint pains, loss of smell and taste, cough, nasal discharge and hair loss, sleeplessness, cardiac and gastrointestinal issues that persist for up to six months (Shah et al. 2021; Yong et al. 2021). Study in Malaysia showed, COVID-19 imposed a great variety of psychological consequences (Solehan et al. 2022).

It is reported that hospitalized COVID-19 patients showed long term post COVID-19 symptoms and its complications after recovery from acute infection (Huang et al. 2021). Persistence of symptoms as long as 6 months where patients were troubled with fatigue, muscle weakness, sleep difficulties and anxiety-depression after recovery from COVID-19 were noted. They found hospitalized patients with severe illness suffered impaired lung function 6 months after infection (Huang et al. 2021). There are other studies that showed persistence of impaired lung function post COVID-19 infection (Zhao et al. 2020; Mo et al. 2020). In our study, the persistence of the respiratory symptoms were the most troublesome symptoms for the patients (Table-5).

Fatigue is reported as an important symptom of post COVID infection by many studies that lasts from weeks to months (Huang et al. 2021; Sandler et al. 2021). It is the state of extreme tiredness due to mental or physical exertion or illness. Fatigue, is described by the patients as a

state of weakness, sore throat, headache, muscle pain, joint pain, difficulties in memory or concentration, drowsiness, exhaustion etc (Mayo clinic, 2020). In our study, this is the most common symptom that is present in both comorbid and non-comorbid patients and the highest duration one month was found in 52% comorbid and 58% non-comorbid patients (Table-6). Post COVID follow up is necessary for the early detection of cases. Early detection will help to take necessary intervention to these patients and rehabilitation can be employed for these group of patients.

This study has some limitation. The first limitation is that we were not able to conduct this study in person as the questionnaire was distributed online due to Movement Control Order. As a result, there is a chance of lack of number of respondents especially from the comorbid group as this group mostly comes from old age and have poor access to technology. This is a study on self-perceived data which might be biased. This study, has not taken the data on ICU admission although it is assumed that patients admitted for longer time of 2-3 weeks or more might have ICU admission. Due to online questionnaire survey, data may not represent the national population. Moreover, cross-sectional nature of the study represents data on that particular time only.

## **5.0 Conclusion**

In conclusion, this present study reveals that, generalized fatigue, fever, breathlessness, cough, ear-ache, sore throat, loss of taste/smell were the most common and critical post COVID-19 symptoms as identified in both comorbid and non-comorbid patients. In non-comorbid group, higher incidence of persistence of symptoms till 1 month was found compared to comorbid group. Early detection of post COVID symptoms is necessary for further the management and rehabilitation of the affected patients and thus to reduce the burden on the health care system.

## References

- Carfi, A., Bernabei, R., Landi, F. (2020). Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19. *JAMA*, 324(6), 603–605.
- Centers for Disease Control and Prevention (CDC). COVID-19 (coronavirus disease): people with certain medical conditions. (2020). Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>.
- Donnelly, J.P., Wang, X.Q., Iwashyna, T.J., & Prescott, H.C. (2021). Readmission and Death After Initial Hospital Discharge Among Patients with COVID-19 in a Large Multihospital System. *JAMA*, 325, 304.
- Greenhalgh, T., Knight, M., A’Court, C., Buxton, M., & Husain, L. (2020). Management of post-acute covid-19 in primary care. *BMJ*, 370(3026).
- Guan, W.J., Ni, Z.Y., Hu, Y., Liang, W.H., Ou, C.Q., He, J.X., et al. (2020). China Medical Treatment Expert Group for Covid-19. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*, 382(18), 1708-1720.
- Hasani, W.S.R., Ganapathy, S.S., Lin, C.Z., Rifin, H.M., Bahari, M.N., Ghazali, M.H., et al. (2021) Comorbidities and clinical features related to severe outcomes among COVID-19 cases in Selangor, Malaysia. *Western Pac Surveill Response J*, 12(1), 46-52.
- Huang, C., Huangm L., Wangm Y., Li, X., Ren, L., & Gu, X., et al. (2021). 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. *Lancet*, 397, 220–232.
- Lu, H., Stratton, C. W., & Tang, Y. (2020). Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle. *Journal of medical virology*, 92(4), 401-402. <https://onlinelibrary.wiley.com/doi/10.1002/jmv.25678>
- Mayo clinic. Chronic fatigue syndrome. (2020). Mayo Clinic Press. Retrieved from <https://www.mayoclinic.org/diseases-conditions/chronic-fatigue-syndrome/symptoms-causes/syc-20360490>
- Menges, D., Ballouz, T., Anagnostopoulos, A., Aschmann, H. E., Domenghino, A., Fehr, J. S., & Puhan, M. A. (2021). Burden of post-COVID-19 syndrome and implications for healthcare service planning: A population-based cohort study. *Plos One*. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0254523>.

- Ministry of Health Malaysia. Kenyataan Akhbar KPK 6 September 2021 – Situasi Semasa Jangkitan Penyakit Coronavirus 2019 (COVID-19) di Malaysia, (2021). Retrieved from <https://kpkesihatan.com/2021/09/06/kenyataan-akhbar-kpk-6-september-2021-situasi-semasa-jangkitan-penyakit-coronavirus-2019-covid-19-di-malaysia/>.
- Mo X., Jian W., & Su Z. (2020). Abnormal pulmonary function in COVID-19 patients at time of hospital discharge. *Eur Respir J*, 55(6), 2001217.
- National Health Service. (2021). Long-term effects of coronavirus (long COVID). Retrieved from <https://www.nhs.uk/conditions/coronavirus-covid-19/long-term-effects-of-coronavirus-long-covid/>.
- National Institute for Health Research (NIHR). (2021). Living with Covid19 - Second Review. Retrieved from <https://evidence.nihr.ac.uk/themedreview/living-with-covid19-second-review/>.
- Nor Azila, M.I., Ahmad Baihaqi, A., Nur Aslizah, A., Nur Haizumraimi, A.R., & Nur Saadah, M.A.R. (2022). An Observational Study on Clinical Characteristics and Outcomes of COVID-19 Patients Urgently Hospitalised from COVID Assessment Centres in Seremban, Malaysia. *International Journal of Human and Health Sciences (IJHHS)*, Supplementary Issue, S40.
- Rees, E.M., Nightingale, E.S., Jafari, Y., Waterlow, N.R., Clifford, S., & Pearson, C.A.B. et al. (2020). COVID-19 length of hospital stay: a systematic review and data synthesis. *BMC Med*, 18, 270.
- Richardson, S., Hirsch, J.S., Narasimhan, M., Crawford, J.M., McGinn, T., & Davidson, K.W. et al. (2020). Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized with COVID-19 in the New York City Area. *JAMA*, 323(20), 2052-2059.
- Sandler, C.X., Wyller, V.B.B., Moss-Morris, R., Buchwald, D., Crawley, E., Hautvast, J., Katz, B.Z., Knoop H., Little, P., Taylor, R., Wensaas, K.A., & Lloyd, A.R. (2021). Long COVID and Post-infective Fatigue Syndrome: A Review. *Open Forum Infect Dis*, 8(10), ofab440.
- Shah, W., Hillman, T., & Playford, E.D., et al. (2021). Managing the long term effects of covid-19: summary of NICE, SIGN, and RCGP rapid guideline. *BMJ*, 372, n136.
- Solehan, H.M., Mohamed, N.A., Rani, M.D.M., & Ithnin, M.A (2022). Qualitative Survey on Psychological Experiences Among Malaysian COVID-19 Patients. *International Journal of Human and Health Sciences (IJHHS)*, Supplementary Issue: S36.

Statistics How To. Sample Size in Statistics (How to Find it): Excel, Cochran's Formula, General Tips. Retrieved on 28 Sept 2021. <https://www.statisticshowto.com/probability-and-statistics/find-sample-size/>.

The National Institutes of Health. Clinical Spectrum of SARS-CoV-2 Infection. United States. 2021. Retrieved from <https://www.covid19treatmentguidelines.nih.gov/overview/clinical-spectrum/>

Wang, C., Horby, P.W., Hayden, F.G., & Gao, G.F. (2020). A novel coronavirus outbreak of global health concern. *Lancet*, 395(10223):470-473.

World Health Organization (WHO). Coronavirus Disease (COVID-19) Situation Reports. Weekly Epidemiological. (2021). Retrieved from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>

Yong, S.J. (2021). Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments. *Infect Dis*, 53(10), 737-754.

Zhao, Y.M., Shang, Y.M., Song, W.B., Li, Q.Q., Xie, H., & Xu, Q.F., et al. (2020). Follow-up study of the pulmonary function and related physiological characteristics of COVID-19 survivors three months after recovery. *E Clinical Medicine*, 25, 100463.