Research article

Mental health status of university healthcare workers during the COVID-19 pandemic: A post-movement lockdown assessment

Luke Sy-Cherng Woon[1], Hatta Sidi[1], Nik Ruzyanei Nik Jaafar[1], Mohammad Farris Iman Leong Bin Abdullah[2,*]

[1]   Department of Psychiatry, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia; lukewoon@gmail.com (L.S-C.W); hattasidi@hotmail.com (H.S); njruzyanei@gmail.com (N.R.N.J)

[2]   Lifestyle Science Cluster, Advanced Medical and Dental Institute, Universiti Sains Malaysia, 13200 Kepala Batas, Pulau Pinang, Malaysia; farris@usm.my (M.F.I.L.B.A)

* Correspondence: farris@usm.my; Tel.: +6-04-5622482 (M.F.I.L.B.A)

Abstract

This study investigated the prevalence and severity of depression, anxiety, and stress and determined the association between various factors, social support, and depression and anxiety among university healthcare workers in Malaysia after the government lifted the movement control order (MCO) put in place to curb the coronavirus disease 2019 (COVID-19) pandemic. This online, cross-sectional survey recruited 399 participants from two university hospitals, and they were administered a self-reported questionnaire on demographic, personal, and clinical characteristics; COVID-19-related stressors; and coping. In addition, they completed the Multidimensional Scale of Perceived Social Support (MSPSS) to measure perceived social support, as well as the 21-item Depression, Anxiety, and Stress Scale (DASS-21) to assess depression, anxiety, and stress. We found that the prevalence of depression, anxiety, and stress were 21.8%, 31.6%, and 29.1%, respectively. Participants with moderate to extremely severe depression, anxiety, and stress made up 13.3%, 25.8%, and 8.1% of the sample, respectively. Being single or divorced, fear of frequent exposure to COVID-19 patients, those who agreed that their area of living had a high prevalence of COVID-19 cases, and uncertainty regarding the prevalence of COVID-19 cases in the area of living were associated with higher odds of depression and anxiety. Conversely, having more than three children and greater perceived friend support were associated with lower odds of depression and anxiety. The prevalence of depression, anxiety, and stress remained elevated even after the MCO was lifted.

Keywords: Depression, anxiety, stress, university healthcare workers, COVID-19, post–movement lockdown

1. Introduction

Coronavirus disease 2019 (COVID-19), caused by the previously unknown Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), began in the city of Wuhan, China in December 2020 as clusters of mysterious respiratory tract infections [1]. Since then, the infection has rapidly spread throughout China and to other parts of the world. Consequently, the World Health Organization declared COVID-19 a global pandemic on March 11, 2020 [2]. In the Malaysian context, COVID-19 was initially transmitted from travelers to the local population between January and February 2020, which resulted in a massive spread of infection in early March, when a large cluster of infections emerged called the Tablighi Jamaat cluster [3]. A movement control order (MCO) was imposed by the government from March 18, 2020 to June 9, 2020; this prohibited the population from organizing any social activities and gatherings, including cultural, religious, sporting, work-related, and educational activities [4].

Because of the prolonged confinement during movement lockdowns, psychological distress in the population has been reported during infection epidemics; this presents in the form of various symptoms, including low mood, insomnia, stress, anxiety, anger, irritability, and emotional exhaustion [5]. Healthcare workers who provide clinical services have to continue working in a high-risk environment. The risk of contracting the disease, worry about lack of medical supplies, and long working hours are some of the main stressors these workers have experienced during the challenging time of the COVID-19 pandemic, putting them at high risk of developing depression, anxiety, and insomnia [6, 7]. There are a few studies on the Malaysian population that have investigated the psychological impact of the COVID-19 pandemic. Sundarasen et al. (2020) reported a high prevalence of anxiety in a cohort of Malaysian university students at the peak of the COVID-19 pandemic and identified a few predisposing factors related to higher levels of anxiety, such as younger age, female gender, lower education level, living alone, and being enrolled in management courses [8]. Several psychological sequelae have been reported in the general population in Malaysia during the MCO, such as fear, boredom, insomnia, agitation, and helplessness, increased prevalence of depressive and anxiety symptoms, anxiety resulting from the spread of fake news regarding the COVID-19 situation in the country, and high levels of negative emotion among women under 35 years old [9]. Despite various psychological complications reported in the Malaysian general population, data regarding the psychological impact of COVID-19 on healthcare workers in Malaysia is scarce. Moreover, to the best of our knowledge, data on the mental health status of healthcare workers after the movement lockdown was lifted is also lacking, although the literature reported that psychological sequelae may persist beyond the movement lockdown [5]. Hence, this study was designed to accomplish the following: (1) investigate the prevalence and severity of depression, anxiety, and stress in university healthcare workers; and (2) determine the association between various factors (demographic, personal, and clinical characteristics; COVID-19-related stressors; and coping), perceived social support, and depression and anxiety among university healthcare workers in Malaysia after the movement lockdown was lifted.

2. Materials and Methods

2.1. Study design and participants

This was an online, cross-sectional study conducted using the Google Forms platform. This online survey was administered from July 1, 2020 to July 21, 2020, starting about three weeks after the MCO ended in Malaysia. The source population was active full-time staff members at the university hospitals of two Malaysian public universities, namely Hospital Universiti Sains Malaysia (HUSM) and Universiti Kebangsaan Malaysia Medical Centre (UKMMC). The source population included healthcare professionals, academic staff, and allied healthcare staff who were involved in clinical care in the two university hospitals. HUSM was selected because it is the largest university hospital in the northern region of Peninsular Malaysia, while UKMMC is a large university hospital in the Klang Valley of Peninsular Malaysia, an urban conglomeration with a population of 8 million people. The study sample was recruited via snowball sampling because it was conducted online to abide by the new norm of social distancing during the COVID-19 pandemic. With permission obtained from the hospital management authorities, an invitation email to participate in the study was circulated to the academic staff of HUSM and UKMMC. Then, the participants were asked to share the email invitation with other healthcare professionals, academic staff, and allied healthcare staff who were involved in clinical care in the two university hospitals. The setting of the online survey form was adjusted to prevent repeated submissions from the same participant. Healthcare workers were eligible to participate in the study if they met the following criteria: (1) age 18 years and above, (2) active full-time staff members of HUSM and UKMMC who were involved in clinical care of patients (healthcare professionals, academic staff, and allied healthcare staff), and (3) free from a history of pre-existing psychotic disorders, bipolar mood disorder, and illicit drug use or alcohol dependence. Details of the study procedures were provided to the participants in the invitation email, and informed consent to participate in the study was considered approved by the participants when they completed and submitted their responses to the online survey. This study received approval from the Medical Research Committee of the Faculty of Medicine, Universiti Kebangsaan Malaysia (UKMPPI/111/8/JEP-2020-370) and the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/COVID19-21).

2.2. Measures

Data on demographic and personal characteristics, clinical factors, COVID-19-related stressors, and religious coping of the participants were collected by administering a self-reported questionnaire. This self-reported questionnaire was constructed based on the information from previous studies on the psychological impact of infection epidemics among the general population, such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) [10-16]. In addition, the participants were administered the Malay version of the Multidimensional Scale of Perceived Social Support (MSPSS) to assess the degree of perceived social support, as well as the Malay version of the 21-item Depression, Anxiety, and Stress Scale (DASS-21) to evaluate depression, anxiety, and stress.

2.2.1. Demographic and personal characteristics

Data on demographic characteristics, such as age, gender, marital status, education status, and religion, were collected. Personal characteristics, such as the number of children that the participant had and living arrangements during the COVID-19 pandemic, were also recorded. The ages of the participants were categorized into 18 to 29 years old, 30 to 45 years old, and 46 to 60 years old (none of the participants was above 60 years old as the compulsory

retirement age of university staff is 60 years). Gender was grouped into males and females. Marital status was recorded as married and single/divorced. For education status, we used a two-category variable, which was up to secondary education (up to high school qualification or certificate) and tertiary education (diploma or degree). The number of children that the participant had was grouped into none, one to three children, and more than three children. Living arrangements during the COVID-19 pandemic were divided into three categories: lived alone, lived with friends or colleagues, and lived with family.

2.2.2. Clinical factors

We collected data on two clinical factors, which were a pre-existing history of medical illness and a pre-existing history of psychiatric illness. Pre-existing medical illness was documented as a self-reported physician diagnosis of hypertension, diabetes, chronic lung disease, heart disease, endocrine diseases, central nervous system diseases, renal diseases, gynecological and genitourinary tract diseases, or cancer. Pre-existing psychiatric illness involved a self-reported psychiatrist diagnosis of depression and anxiety disorders.

2.2.3. COVID-19-related stressors and religious coping

Several stressors related to the COVID-19 pandemic were documented, such as worrying about family during the pandemic, frustration due to loss of daily routine during the pandemic, feeling stress because annual leave was frozen during the pandemic, average working hours per week during the pandemic, fear of frequent exposure to COVID-19 patients, experiencing fear when physical symptoms similar to COVID-19 symptoms developed, area of living was highly prevalent for COVID-19-positive cases, and having a history of quarantine after coming into close contact with COVID-19-positive cases. Worry about family during the COVID-19 pandemic was investigated via the following question: "Were you worried about your family during the COVID-19 pandemic?" The responses were coded as "no" and "yes." Frustration due to loss of daily routine during the COVID-19 pandemic was documented based on the following question: "Were you frustrated due to loss of daily routine during the COVID-19 pandemic?" The responses were coded as "no" and "yes." Feeling stress because annual leave was frozen during the COVID-19 pandemic was determined via the following question: "Did you feel stress because your annual leave was frozen during the COVID-19 pandemic?" The responses were coded as "no" and "yes." The average working hours per week during the COVID-19 pandemic was investigated via the following question: "What was your number of average working hours per week during the COVID-19 pandemic?" The responses were documented as a continuous variable. Fear of frequent exposure to COVID-19 patients was assessed through the following question: "Were you afraid of being frequently exposed to COVID-19 patients?" The responses were coded as "no," "neutral," and "yes." Fear when developing physical symptoms that were similar to COVID-19 symptoms was investigated through the following question: "Were you afraid if you developed cough, flu, or fever during the COVID-19 pandemic?" The responses were recorded as "no," "neutral," and "yes." The area of living was highly prevalent for COVID-19-positive cases was evaluated via the following question: "Was your area of living highly prevalent for COVID-19-positive cases?" The responses were coded as "no," "I don't know," and "yes." History of quarantine after coming into close contact with COVID-19-positive cases was investigated through the following question: "Were you quarantined for 14 days because you were a close contact of a COVID-19-positive patient?" The responses were

coded as "no" and "yes." The perception that religious coping helped to manage stress during the COVID-19 pandemic was assessed through the following question: "Did religion help you to cope with the COVID-19 pandemic?" The responses were coded as "no," "neutral," and "yes."

2.2.4. Perceived social support

The perceived social support of the participants was measured using the MSPSS. This self-reported tool evaluates the social support received by an individual in three domains (family, friends, and significant others social support). Each domain consists of 4 items; hence, it is made up of a total of 12 items. Each item is scored on a 7-point Likert scale with a range of scores from 1 to 7. Therefore, each domain registers a cumulative score of 4 to 28. A higher score signifies a greater degree of social support. The MSPSS has demonstrated good internal consistency (Cronbach's $\alpha = 0.88$) and test-retest reliability (Cronbach's $\alpha = 0.85$) [17]. The validated Malay version of the MSPSS also showed satisfactory internal consistency (Cronbach's $\alpha = 0.89$) and test-retest reliability (Cronbach's $\alpha = 0.77$) [18].

2.2.5. Depression, anxiety, and stress

The depression, anxiety, and stress symptoms of the participants were assessed using the DASS-21. This self-reported instrument is comprised of 21 items designated to three subscales, which are the depression, anxiety, and stress subscales. Each subscale consists of seven items, and each item is scored on a Likert scale of 0 to 3. The cumulative score for each subscale is computed by summing the scores for the items and multiplying by two. A higher score indicates more severe symptoms. The cut-off points for a case finding are 9 for depression, 7 for anxiety, and 14 for stress [19]. The Malay version of the DASS-21 has been demonstrated to have acceptable internal consistency with Cronbach's α values of 0.75, 0.74, and 0.79 for the depression, anxiety, and stress subscales, respectively. It also exhibited good construct validity [20].

2.3. Statistical analyses

Data analyses were conducted using IBM SPSS Statistics version 26 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics for demographic and personal characteristics; clinical factors; COVID-19-related stressors; religious coping; the social support domain scores; and the prevalence and severity of depression, anxiety, and stress were computed. There were no missing values. Categorical variables were presented as frequencies and percentages, while continuous variables were described as mean and standard deviation. Then, simple logistic regression analyses were applied to determine the individual association between various demographic and personal characteristics, clinical factors, COVID-19-related stressors, religious coping, the social support domain scores (independent variables) and depression, anxiety, and stress (dependent variables) by computing the crude odds ratios (ORs), in which absence of depression or anxiety was coded as 0 (reference) and presence of depression or anxiety was coded as 1. Then, variables with $p < 0.1$ were entered into multiple logistic regression models to determine their adjusted ORs in terms of predicting depression and anxiety (dependent variables). Similarly, absence of depression or anxiety was coded as 0 (reference), and presence of depression or anxiety was coded as 1. The multiple logistic regression model fi was assessed by referring to the Hosmer–Lemeshow test, where $p > 0.05$

indicated model fit. Statistical significance was set at $p < 0.05$, and all p-values were two-sided.

3. Results

3.1. Participant characteristics

In total, 399 participants completed the online survey. The demographic and personal characteristics, clinical factors, COVID-19-related stressors, and coping of the participants are summarized in Table 1. More than half the participants were 30 to 45 years old ($n = 266$, 66.7%), and nearly three-quarters were females ($n = 292$, 73.2%). About three-quarters of the participants were married (n= 308, 77.2%), and most had up to tertiary education ($n = 354$, 88.7%). Most lived with family during the COVID-19 pandemic ($n = 350$, 87.7%). About half the participants had one to three children ($n = 201$, 50.4%), while almost one-quarter had more than three children ($n = 88$, 22.0%).

Assessment of the COVID-19-related stressors revealed that only a minority of the participants worried about their family ($n = 45$, 11.3%), but almost one-third felt frustrated due to loss of daily routine as a consequence of social distancing ($n = 125$, 31.3%). More than half the participants were bothered by fear when they developed physical symptoms that were similar to COVID-19 symptoms, such as cough, fever, and flu ($n = 239$, 59.9%), while only one-fifth of them agreed that their area of living was highly prevalent for COVID-19-positive cases ($n = 80$, 20.1%). Regarding work-related stressors during the COVID-19 pandemic, only a minority of participants experienced stress due to their annual leave being frozen as part of the hospital management's strategy to strengthen the clinical service at the time of the COVID-19 pandemic ($n = 67$, 16.8%), and only a small proportion of them were quarantined for 14 days due to being a close contact of COVID-19-positive cases ($n = 31$, 7.8%). However, almost half experienced fear due to frequent exposure to COVID-19 patients as a consequence of the nature of their work ($n = 192$, 48.1%). Most participants agreed that religion helped them to cope with stress during the COVID-19 pandemic ($n = 344$, 86.2%). Assessment of the clinical factors showed that more than one-fifth of the participants had pre-existing medical illness ($n = 107$, 26.8%), but only a minority had pre-existing psychiatric illness ($n = 11$, 2.8%).

Table 1. Demographic and personal characteristics, clinical factors, COVID-19-related stressors, and religious coping among the participants

Variables	n	%
Demographic characteristics:		
-Age:		
18–29 years old	47	11.8
30–45 years old	266	66.7
46–60 years old	86	21.6
-Gender:		
Male	107	26.8

Female	292	73.2
-Marital status:		
Married	308	77.2
Single/divorced	91	22.8
-Education status:		
Up to secondary education	45	11.3
Up to tertiary education	354	88.7
Personal characteristics:		
-Number of children:		
None	110	27.6
1–3 children	201	50.4
> 3 children	88	22.0
-Living arrangement during COVID-19:		
Living alone	24	6.0
Living with friends	25	6.3
Living with family	350	87.7
Clinical factors:		
-Pre-existing medical illnesses?		
No	292	73.2
Yes	107	26.8
-Pre-existing psychiatric illnesses?		
No	388	97.2
Yes	11	2.8
COVID-19-related stressors and religious coping:		
-Did religion help you to cope with the COVID-19 pandemic?		
No	10	2.5
Neutral	45	11.3
Yes	344	86.2
-Were you worried about your family during the COVID-19 pandemic?		
No	354	88.7
Yes	45	11.3
-Were you frustrated due to loss of daily routine during MCO?		
No	274	68.7
Yes	125	31.3
-Did you feel stress because your leave was frozen during the COVID-19 pandemic?		
No	332	83.2
Yes	67	16.8
-Average working hours per week during the COVID-19 pandemic	24.75[#]	17.55[$]
- Were you afraid of being frequently exposed to COVID-19 patients?		
No	65	16.3
Neutral	142	35.6
Yes	192	48.1

-Were you afraid if you developed cough, flu, or fever during the COVID-19 pandemic?	50	12.5
No	110	27.6
Neutral	239	59.9
Yes		
- Was your area of living highly prevalent for COVID-19-positive cases?	277	69.4
No	42	10.5
I don't know	80	20.1
Yes		
-Quarantine for being a close contact of COVID-19 patients:	368	92.2
No	31	7.8
Yes		

$^{\#}$ = Mean, $^{\$}$ = standard deviation

The perceived social support and psychological characteristics of the participants are illustrated in Table 2. Based on the DASS-21 scores, 21.8% of participants had depression, with 8.5% exhibiting mild depression, 9.8% moderate depression, and 3.8% severe to extremely severe depression. In addition, 31.6% of the participants had anxiety, where 5.8% exhibited mild anxiety, 18.0% moderate anxiety, and 7.8% severe to extremely severe anxiety. The proportion of participants with stress was 29.1%, where 21.1% exhibited mild stress, 4.8% moderate stress, and 3.3% severe to extremely severe stress. The mean scores for the three domains of MSPSS were 22.51 (standard deviation [SD] = 4.77) for the family support domain, 20.96 (SD = 4.56) for the friend support domain, and 22.05 (SD = 5.39) for the significant other support domain.

Table 2. Psychological characteristics and social support of the participants

Variables	*n*	%
Depression:		
No	312	78.2
Yes	87	21.8
Severity of depression:		
No depression	311	77.9
Mild depression	34	8.5
Moderate depression	39	9.8
Severe depression	5	1.3
Extremely severe depression	10	2.5
Anxiety:		
No	273	68.4
Yes	126	31.6
Severity of anxiety:		

No anxiety	273	68.4
Mild anxiety	23	5.8
Moderate anxiety	72	18.0
Severe anxiety;l.	14	3.5
Extremely severe anxiety	17	4.3
Stress:		
No	283	70.9
Yes	116	29.1
Severity of stress:		
No stress	283	70.9
Mild stress	84	21.1
Moderate stress	19	4.8
Severe stress	9	2.3
Extremely severe stress	4	1.0
Social support:		
Mean family support score	22.51[#]	4.77[$]
Mean friend support score	20.96[#]	4.56[$]
Mean significant other support score	22.05[#]	5.39[$]

[#] = Mean, [$] = standard deviation

3.2. The associations among clinical factors, COVID-19-related stressors, and coping, social support, and depression

Table 3 shows the association between various demographic, personal, and clinical factors; COVID-19-related stressors; and coping, social support, and depression among the participants. Simple logistic regression analyses indicated that several factors were significantly associated with depression ($p < 0.1$), and these are listed in the table. However, the multiple linear regression model revealed that there were only two COVID-19-related stressors, experiencing fear due to frequent exposure to COVID-19 patients (adjusted OR = 3.74, 95% confidence interval [CI] = 1.21–11.55, $p = 0.022$) and those who agreed that their area of living had a high prevalence of COVID-19 cases (adjusted OR = 2.78, 95% CI = 1.28–6.07, $p = 0.010$), that significantly predicted a higher likelihood of depression. Having more than three children was protective against depression (adjusted OR = 0.24, 95% CI = 0.06–0.92, $p = 0.038$). Nevertheless, none of the clinical factors precipitated depression, and none of the social support modalities were protective against depression. The multiple logistic regression model reported a Nagelkerke R^2 of 0.315 ($p < 0.001$), and the Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 6.59$, $p = 0.582$) indicated good fit of the model.

Table 3. Association between various factors and depression among the participants

Variables	Crude OR[a] (95% CI)	Adjusted OR[b] (95% CI)
Demographic characteristics:		
-Age:		
18–29 years old	1	

30–45 years old	0.89 (0.43–1.81)	
45–60 years old	0.52 (0.22–1.26)	-
-Gender:		
Male	1	
Female	1.20 (0.69–2.07)	-
-Marital status:		
Married	1	1
Single/divorced	2.02 (1.19–3.41)*	0.37 (0.10–1.37)
-Education status:		
Up to secondary education	1	
Up to tertiary education	1.59 (0.68-3.69)	-
Personal characteristics:		
-Number of children:		
None	1	1
1–3 children	0.53 (0.31–0.89)*	0.50 (0.17–1.52)
> 3 children	0.26 (0.12–0.57)*	0.24 (0.06–0.92)**
-Living arrangement during COVID-19:		
Living alone	1	1
Living with friends	0.78 (0.24–2.55)	1.14 (0.18–7.11)
Living with family	0.42 (0.18–0.99)*	3.73 (0.08–183.68)
Clinical factors:		
-Pre-existing medical illnesses?		
No	1	
Yes	1.31 (0.78–2.20)	-
-Pre-existing psychiatric illnesses?		
No	1	1
Yes	6.74 (1.93–23.58)*	4.29 (0.64–29.04)
COVID-19-related stressors and religious coping:		
-Did religion help you to cope with the COVID-19 pandemic?		
No	1	
Neutral	2.67 (0.28–25.84)	
Yes	0.99 (0.11–8.96)	-
-Were you worried about your family during the COVID-19 pandemic?		
No	1	1
Yes	2.20 (1.13–4.27)*	5.19 (0.10–284.52)
-Were you frustrated due to loss of daily routine during the MCO?		
No	1	1
Yes	3.76 (2.29–6.16)*	1.86 (0.90–3.84)
-Did you feel stress because your leave was frozen during the COVID-19 pandemic?		
No	1	
Yes	1.40 (0.77–2.56)	-
-Average working hours per week during the COVID-19 pandemic	1.01 (0.99–1.02)	-

-*Were you afraid of being frequently exposed to COVID-19 patients?*		
No	1	1
Neutral	2.21 (0.72–6.83)	1.33 (0.41–4.31)
Yes	7.81 (2.72–22.41)*	3.74 (1.21–11.55)**
-*Were you afraid if you developed cough, flu, or fever during the COVID-19 pandemic?*		
No	1	
Neutral	1.10 (0.44–2.71)	
Yes	1.76 (0.78–3.96)	-
- *Was your area of living highly prevalent for COVID-19-positive cases?*		
No	1	1
I don't know	3.09 (1.54–6.21)*	2.08 (0.80–5.39)
Yes	2.28 (1.29–4.03)*	2.78 (1.28–6.07)**
-*Quarantine for being a close contact of COVID-19 patients:*		
No	1	
Yes	1.27 (0.55–2.95)	-
Social support:		
-Mean family support score	0.55 (0.44–0.70)*	0.93 (0.83–1.04)
-Mean friend support score	0.57 (0.45–0.72)*	0.93 (0.84–1.02)
-Mean significant other support score	0.66 (0.54–0.80)*	0.95 (0.87–1.04)

$* = p < 0.1$, $** = $ statistical significance at $p < 0.05$, [a] = absence of depression coded 0 (reference), presence of depression coded 1; [b] = absence of depression coded 0 (reference), presence of depression coded 1; OR = odds ratio; multiple logistic regression model reported Nagelkerke $R^2 = 0.315$, $p < 0.001$, Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 6.59$, $p = 0.582$)

3.3. Associations among clinical factors, COVID-19-related stressors, and coping, social support, and anxiety

Table 4 summarizes the association among various demographic, personal, and clinical factors; COVID-19-related stressors; and coping, social support, and anxiety for the participants. Simple logistic regression analyses indicated that several factors were significantly associated with anxiety ($p < 0.1$), and these are listed in the table. The multiple logistic regression model revealed that one demographic factor, being single/divorce (adjusted OR = 3.96, 95% CI = 1.33–11.84, $p = 0.014$), and two COVID-19-related stressors, experiencing fear due to frequent exposure to COVID-19 patients (adjusted OR = 4.33, 95% CI = 1.52–12.36, $p = 0.006$), and not knowing whether the area of living was highly prevalent for COVID-19-positive cases (adjusted OR = 2.51, 95% CI = 1.09–5.83, $p = 0.032$), significantly predicted a higher likelihood of anxiety. In contrast, higher perceived social support from friends was the only protective factor against anxiety (adjusted OR = 0.89, 95% CI = 0.82–0.97, $p = 0.009$). The multiple logistic regression model reported a Nagelkerke R^2

of 0.289 ($p < 0.001$), and the Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 11.47$, $p = 0.176$) indicated good fit of the model.

Table 4. Associations among various factors and anxiety in the participants

Variables	Crude OR[a] (95% CI)	Adjusted OR[b] (95% CI)
Demographic characteristics:		
-Age:		
18–29 years old	1	1
30–45 years old	0.69 (0.37–1.31)	0.91 (0.36–2.29)
45–60 years old	0.51 (0.24–1.08)*	0.93 (0.32–2.73)
-Gender:		
Male	1	
Female	1.18 (0.73–1.92)	-
-Marital status:		
Married	1	1
Single/divorced	2.15 (1.33–3.49)*	3.96 (1.33–11.84)**
-Education status:		
Up to secondary education	1	
Up to tertiary education	1.15 (0.58–2.28)	-
Personal characteristics:		
-Number of children:		
None	1	1
1–3 children	0.60 (0.37–0.98)*	2.13 (0.71–6.36)
> 3 children	0.48 (0.26–0.89)*	1.75 (0.51–6.06)
-Living arrangement during the COVID-19 pandemic:		
Living alone	1	
Living with friends	0.67 (0.21–2.09)	
Living with family	0.51 (0.22–1.18)	-
Clinical factors:		
-Pre-existing medical illnesses?		
No	1	
Yes	1.14 (0.71–1.82)	-
-Pre-existing psychiatric illnesses?		
No	1	1
Yes	10.42 (2.22–48.98)*	4.053 (0.61–27.10)
COVID-19-related stressors and religious coping:		
-Did religion help you to cope with the COVID-19 pandemic?		
No	1	
Neutral	2.92 (0.30–28.29)	
Yes	1.75 (0.19–15.80)	-
-Were you worried about your family during the COVID-19 pandemic?		
No	1	

Yes	1.69 (0.90–3.18)	-
-Were you frustrated due to loss of daily routine due to the MCO?		
No	1	1
Yes	2.25 (1.44–3.51)*	1.19 (0.60–2.34)
-Did you feel stress because your leave was frozen during the COVID-19 pandemic?		
No	1	1
Yes	1.71 (1.00–2.94)*	1.43 (0.69–2.93)
-Average working hours per week during the COVID-19 pandemic	1.00 (0.99–1.01)	-
- Were you afraid of being frequently exposed to COVID-19 patients?		
No	1	1
Neutral	2.59 (0.83–5.00)	1.62 (0.67–4.23)
Yes	7.33 (3.02–17.80)*	4.33 (1.52–12.36)**
-Were you afraid if you developed cough, flu, or fever during the COVID-19 pandemic?		
No	1	1
Neutral	1.34 (0.57–3.13)	1.42 (0.46–4.38)
Yes	2.85 (1.32–6.14)*	2.72 (0.93–8.00)
- Was your area of living highly prevalent for COVID-19-positive cases?		
No	1	1
I don't know	3.26 (1.68–6.33)*	2.51 (1.09–5.83)**
Yes	1.45 (0.85–2.47)	1.47 (0.74–2.92)
-Quarantine for being a close contact of COVID-19 patients:		
No	1	
Yes	0.88 (0.39–1.97)	-
Social support:		
-Mean family support score	0.61 (0.50–0.75)*	0.97 (0.88–1.07)
-Mean friend support score	0.56 (0.45–0.70)*	0.89 (0.82–0.97)**
-Mean significant other support score	0.70 (0.59–0.84)*	1.00 (0.93–1.09)

* = $p < 0.1$, ** = statistical significance at $p < 0.05$, [a] = absence of anxiety coded 0 (reference), presence of anxiety coded 1; [b] = absence of anxiety coded 0 (reference), presence of anxiety coded 1; OR = odds ratio; multiple logistic regression model reported Nagelkerke $R^2 = 0.289$, $p < 0.001$, Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 11.47$, $p = 0.176$)

4. Discussion

This study investigated the prevalence and severity of depression, anxiety, and stress and determined the association among various demographic, personal, and clinical characteristics; COVID-19 stressors and coping; perceived social support; and depression and anxiety among university healthcare and allied healthcare workers after the MCO was lifted. Interestingly,

the prevalence rates of depression (21.8%), anxiety (31.6%), and stress (29.1%) among the university healthcare workers found in our study remain within the range of depression (12.2% to 50.4%), anxiety (13.0% to 44.6%), and stress (29.1% to 71.5%) reported in healthcare workers during the peak of the COVID-19 outbreak and when the movement lockdown was in place [21-25]. When we compared the severity of the psychological symptoms, the prevalence of moderate to extremely severe depression (13.3%), moderate to extremely severe anxiety (25.8%), and moderate to extremely severe stress (8.1%) were relatively higher in our study than in a study of a cohort of Singaporean and Indian healthcare workers in response to the COVID-19 pandemic, which also used the DASS-21 as the screening tool (moderate to severe depression = 5.8%, moderate to severe anxiety = 8.7%, and moderate to severe stress = 2.2%) [26]. Our findings indicate that depression, anxiety, and stress could be persistent during an infection pandemic even after the movement lockdown was lifted, which confirmed the findings observed from previous infection epidemics, such as SARS and MERS [5].

Our findings identified two COVID-19-related stressors that significantly predisposed university healthcare workers to depression, namely, fear of frequent exposure to COVID-19 patients and those who agreed that their area of living had a high prevalence of COVID-19 cases. Having more than three children was the only factor that protected against depression. Studies of healthcare workers in China during the peak of the COVID-19 outbreak reported that those who worked in medical units and those who worked as frontliners had a high risk of exposure to COVID-19 patients and the fear of being infected, which predisposed healthcare workers to depression [21, 22, 24, 27]. Moreover, those who worked in the epicenter of the COVID-19 outbreak also had higher likelihood of developing depression [23]. Hence, our finding that fear of frequent exposure to COVID-19 patients and those who agreed that their area of living had a high prevalence of COVID-19 positive cases were predisposing factors of depression was in line with other studies. In contrast, stressors related to the movement lockdown, such as frustration due to loss of daily routine during the MCO, were not predisposed to depression. Interestingly, these findings illustrated that the fear that stems from the direct effect of the COVID-19 pandemic is independent of the psychological impact of the movement lockdown. In essence, the COVID-19 pandemic may pose a threat to the mental health of healthcare workers, independent of the effect of the movement lockdown.

Another interesting finding revealed by this study was the significant association between participants with more than three children and reduced the likelihood of depression. Further questioning of those participants who had more than three children showed that they enjoyed spending time with their children, and one coping strategy that they utilized to manage their COVID-19-related work stress was to create jokes and play games with their children at home to create laughter within the family when they were not working. This finding indicated that participants who had more than three children tended to utilize affiliative and self-enhancing humor to manage their stress, which are reported to reduce the risk of depression [28].

The only demographic characteristic predisposing participants to anxiety was being single or divorced. In addition, COVID-19-related stressors, such as fear of being frequently exposed to COVID-19 patients and not knowing the infection rate of COVID-19 at their area of living, were also predisposing factors for anxiety. In contrast, greater perceived social support from

friends was protective against anxiety. Being unmarried was reported as a predisposing factor for psychological distress in a study of a cohort of 1,599 people drawn from the general population in China during the peak of the COVID-19 outbreak [29]. The reasons for the association between being unmarried and anxiety indicated by this study are the lack of social commitment, feelings of loneliness under the uncertainty of the COVID-19 pandemic, and lack of sharing of the financial burden during this difficult time experienced by those who were single or divorced, which may increase their risk of anxiety [30]. Those who were fearful of frequent exposure to COVID-19-positive cases had higher odds of anxiety, which was consistent with the findings of other studies on healthcare workers [21, 22, 24, 27]. Further questioning of the participants of what leads to the fear of frequent exposure to COVID-19 positive cases indicated that they were afraid that if they were infected, they may be asymptomatic and unknowingly spread the infection to their family members. In addition, some participants also worried that they may not have enough stock of personal protective equipment (PPE) to protect them from being infected if they were exposed to COVID-19 patients during their work assignment. These uncontrolled fears may have predisposed the participants to anxiety. Our study highlighted an interesting finding, in which those who were unsure of the rate of infection in their area of living were at higher odds of acquiring anxiety compared with those who already knew the infection rate in their place of living. This indicated the importance of obtaining sufficient information regarding COVID-19, particularly in one's neighborhood, as this may play a role in reducing the odds of anxiety [31-33].

Social support is pivotal in safeguarding mental health during an uncertain time like the COVID-19 pandemic; social support may mediate reduced levels of anxiety [34, 35]. Friend social support is of great importance, particularly for healthcare workers, as they work for long hours and are at risk of being infected due to their work commitment to taking care of COVID-19 patients. Hence, their main source of social support in the workplace would be from friends and colleagues. For instance, greater social support from friends allowed healthcare workers to share feelings and stressors. They could also receive more care and attention from each other [36].

Based on our findings, we recommend a few points to safeguard the mental health of university healthcare workers. First, as fear of frequent exposure to COVID-19 patients predisposed these workers to depression and anxiety, university hospitals should ensure that there is a sufficient supply of PPE for use by university healthcare workers to reduce such exposure. In addition, all hospital healthcare workers should be briefed on sufficient, easy-to-follow precautionary measures and standard operating procedures to manage COVID-19 patients and prevent the spread of the infection in the workplace; this will enhance their confidence in managing COVID-19-infected patients, a task that has become a new norm and work routine. Second, as healthcare workers who were unsure of the COVID-19 situation in their area of living had increased odds of developing anxiety, university hospitals and the government should ensure dissemination of sufficient information to university healthcare workers regarding the current situation of COVID-19 in all regions of the country via university websites, blogs, and social media to keep them well informed. Third, as those who lived in areas with a high prevalence of COVID-19 cases and those who were single/divorced had increased odds of developing depression and anxiety, respectively, the higher authority of university hospitals should pay more attention to these groups of healthcare workers. Online

mental health consultations and counseling or psychotherapy services should be made easily available to assist university healthcare workers who are emotionally disturbed in response to their work commitment during the COVID-19 pandemic. As psychological sequelae may persist even beyond the period of movement lockdown, these online mental health facilities should be maintained for as long as the COVID-19 pandemic persists. Fourth, as greater social support from friends may alleviate anxiety, a healthcare worker support group should be initiated to allow university healthcare workers to share problems pertaining to the COVID-19 pandemic and work stress, as well as to enhance emotional support among healthcare workers. Finally, as having more children was a protective factor against depression, proper scheduling of duty in the workplace should be ensured to allow healthcare workers to have a sufficient amount of time for family members to maintain their mental well-being.

The findings of our study should be interpreted in light of a few limitations. First, the cross-sectional design of the present study did not allow causal inferences to be made regarding the relationship between various significant factors and depression and anxiety. Second, the use of self-reported questionnaires in this study may have led to response bias from the participants. Although we were aware of this limitation, the research team was unable to conduct in-person interviews with clinician-administered questionnaires due to the social distancing imposed by the government as a preventive measure to control the spread of COVID-19. Third, university healthcare workers were only recruited from two university hospitals in Malaysia; hence, the findings may not be generalized to reflect the entire university hospital healthcare worker population of the country. However, we selected two large university hospitals in the country for data collection. Notwithstanding the limitations of the study, our findings provide valuable information on the mental health status of healthcare workers in Malaysia, which is still lacking.

5. Conclusion

This online, cross-sectional study, which investigated the mental state of university healthcare workers, revealed that the prevalence and severity of depression, anxiety, and stress remained high even after the MCO was lifted. We found that being single or divorced, fear of frequent exposure to COVID-19 patients, and those who agreed that their place of living had a high prevalence of COVID-19-positive cases or being unsure of the COVID-19 situation in the area of living predisposed participants to depression and anxiety. In contrast, greater perceived social support from friends and having more than three children were protective factors against anxiety and depression. Based on our findings, we suggested a few recommendations to help improve the mental well-being of university healthcare workers during the COVID-19 pandemic.

Author Contributions: Conceptualization, M.F.I.L.B.A and L.S-C.W; methodology, M.F.I.L.B.A; software, L.S-C.W; validation, M.F.I.L.B.A, L.S-C.W and H.S; formal analysis, M.F.I.L.B.A and L.S-C.W; investigation, N.R.N.J; resources, M.F.I.L.B.A, L.S-C.W, and N.R.N.J; data curation, H.S; writing—original draft preparation, M.F.I.L.B.A;

References

1. Mahase, E. Coronavirus: covid-19 has killed more people than SARS and MERS combined, despite lower case fatality rate. *BMJ.* **2020**, 368, m641.
2. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Available online: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020 (accessed on 10 November 2020).
3. The Straits Times. Coronavirus: Malaysia records eight deaths; 153 new cases bring total to 1,183. Available online: https://www.straitstimes.com/asia/se-asia/malaysia-records-fourth-coronavirus-death (accessed on 10 November 2020).
4. South China Morning Post. Coronavirus: Malaysia in partial lockdown from March 18 to limit outbreak. Available online: https://www.scmp.com/week-asia/health-environment/article/3075456/coronavirus-malaysias-prime-minister-muhyiddin-yassin (accessed on 10 November 2020).
5. Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., Rubin, G. J. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet.* **2020**, 395, 912–920.
6. Cai, H. Z., Tu, B. R., Ma, J., Chen, L. M., Fu, L., Jiang, Y. F., Zhuang, Q. Psychological impact and coping strategies of frontline medical staff in Hunan between January and March 2020 during the outbreak of Coronavirus Disease 2019 (COVID-19) in Hubei, China. *Med Sci Monit.* **2020**, 26, e924171-1–e924171-16.
7. Liu, S., Yang, L., Zhang, C., Xiang, Y-T., Liu, Z., Hu, S., Zhang, B. Online mental health services in China during the COVID-19 outbreak. *Lancet Psychiatry.* **2020**, 7, e17-e18.
8. Sundarasen, S., Chinna, K., Kamaludin, K., Nurunnabi, M., Mohammad Baloch, G., Khoshaimet, H. B., Abid Hossain, S. F., Sukayt, A. Psychological impact of COVID-

19 and lockdown among university students in Malaysia: implications and policy recommendations. *Int J Environ Res Public Health.* **2020**, 17, 6206.

9. Kaur, S. The Coronavirus pandemic in Malaysia: a commentary. *Psychological Trauma: Theory, Research, Practice, and Policy*. **2020**, 12, 482-484.

10. Hawryluck, L., Gold, W. L., Robinson, S., Pogorski, S., Galea, S., Styra, R. SARS control and psychological effects of quarantine, Toronto, Canada. *Emerg. Infect. Dis.* **2004**, 10, 1206–1212.

11. Marjanovic, Z., Greenglass, E. R., Coffey, S. The relevance of psychosocial variables and working conditions in predicting nurses' coping strategies during the SARS crisis: an online questionnaire survey. *Int. J. Nurs. Stud.* **2007**, 44, 991–998.

12. Reynolds, D. L., Garay, J. R., Deamond, S. L., Moran, M. K., Gold, W., Styra, R. Understanding, compliance and psychological impact of the SARS quarantine experience. *Epidemiol. Infect.* **2008**, 136, 997–1007.

13. Braunack-Mayer, A., Tooher, R., Collins, J. E., Street, J. M., Marshall, H. Understanding the school community's response to school closures during the H1N1 2009 influenza pandemic. *BMC Public Health.* **2013**, 13, 344.

14. Jeong, H., Yim, H. W., Song, Y. J., Ki, M., Min, J. A., Cho, J., Chae, J. H. Mental health status of people isolated due to Middle East respiratory syndrome. *Epidemiol. Health.* **2016**, 38, e2016048.

15. Desclaux, A., Badji, D., Ndione, A. G., Sow, K. Accepted monitoring or endured quarantine? Ebola contacts' perceptions in Senegal. *Soc. Sci. Med.* **2017**, 178, 38–45.

16. Wilken, J. A., Pordell, P., Goode, B., Jarteh, R., Miller, Z., Saygar, B. G., Maximore, L., Borbor, W. M., Carmue, M., Walker, G. W., Yeiah, A. Knowledge, Attitudes, and Practices among Members of Households Actively Monitored or Quarantined to Prevent Transmission of Ebola Virus Disease - Margibi County, Liberia: February-March 2015. *Prehosp. Disaster Med.* **2017**, 32, 673-678.

17. Zimet, G. D., Dahlem, N. W., Zimet, S. G., Farley, G. K. The Multidimensional Scale of Perceived Social Support. *J Pers. Assess.* **1988**, 52, 30-41.

18. Ng, C. G., Amer Siddiq, A. N., Aida, S. A., Zainal, N. Z., Koh, O. H. Validation of the Malay version of the Multidimensional Scale of Perceived Social Support (MSPSS-M) among a group of medical students in Faculty of Medicine, University Malaya. *Asian J Psychiatr.* **2010**, 3, 3-6.

19. Lovibond, S. H., Lovibond, P. F. Manual for the Depression Anxiety Stress Scales. Psychology Foundation of Australia: Sydney, NSW, Australia, 1995.

20. Musa, R., Fadzil, M. A., Zain, Z. Translation, validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS). *ASEAN Journal of Psychiatry.* **2007**, 8, 82-89.

21. Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., Hu, S. Factors associated with mental health outcomes among health care workers exposed to Coronavirus Disease 2019. *JAMA Netw Open.* **2020**, 3, e203976.

22. Lu, W., Wang, H., Lin, Y. X., Li, L. Psychological status of medical workforce during the COVID-19 pandemic: A cross-sectional study. *Psychiatry Res.* **2020**, 288, 112936.

23. Song, X., Fu, W., Liu, X., Luo, Z., Wang, R., Zhou, N., Yan, S. J., Lv, C. Z. Mental health status of medical staff in emergency departments during the Coronavirus disease 2019 epidemic in China. *Brain Behav Immun.* **2020**, 88, 60-65.

24. Zhang, W. R., Wang, K., Yin, L., Zhao, W. F., Xue, Q., Peng, M., Min, B. Q., Tian, Q., Leng, H. X., Du, J. L., Chang, H., Yang, Y., Li, W., Shangguan. F. F., Yan, T. Y., Dong, H. Q., Han, Y., Wang, Y. P., Cosci, F., Wang, H. X. Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. *Psychother Psychosom.* **2020**, 89, 242–250.

25. Zhu, J., Sun, L., Zhang, L., Wang, H., Fan, A., Yang, B., Li, W., Xiao, S. F. Prevalence and influencing factors of anxiety and depression symptoms in the first-line medical staff fighting against COVID-19 in Gansu. *Front. Psychiatry.* **2020**, 11, 386.

26. Chew, N. W.S., Lee, G. K. H., Tan, B. Y. Q., Jing, M. X., Goh, Y. H., Ngiam, N. J. H., Yeo, L. L. L., Ahmad, A., Khan, F. A., Shanmugam, G. N., Sharma, A. K., Komalkumar, R. N., Meenakshi, P. V., Shah, K., Patel, B., Chan, B. P. L., Sunny, S., Chandra, B., Ong, J. J. Y., Paliwal, P. R., Wong, L. Y. H., Sagayanathan, R., Chen, J. T., Ng, A. Y. Y., Teoh, H. L., Tsivgoulis, G., Ho, S. C., Ho, R. C., Sharma, V. K. A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav Immun.* **2020**, 88, 559–565.

27. Kang, L. J., Ma, S. M., Chen, M., Yang, J., Wang, Y., Li, R. T., Yao, L. H., Bai, H. P., Cai, Z. X., Yang, B. X., Hu, S. H., Zhang, K. R., Wang, G. H., Ma, C., Liu, Z. C. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. *Brain Behav Immun.* **2020**, 87, 11-17.

28. Menéndez-Aller, A., Postigo, A., Montes-Álvarez, P., González-Primo, F. J., García-Cueto, E. Humor as a protective factor against anxiety and depression. *Int J Clin Health Psychol.* **2020**, 20, 38-45.

29. Wang, H. Y., Xia, Q., Xiong Z. Z., Li, Z. X., Xiang, W. Y., Yuan, Y. W., Liu, Y. Y., Li, Z. The psychological distress and coping styles in the early stages of the 2019 coronavirus disease (COVID-19) epidemic in the general mainland Chinese population: A web-based survey. *PLoS One.* **2020**, 15, e0233410.

30. Ta, V. P., Gesselman, A. N., Perry, B. L., Fisher, H. E., Garcia, J. R. Stress of singlehood: marital status, domain-specific stress, and anxiety in a national U.S. sample. *J Soc Clin Psychol.* **2017**, 36, 461-485.

31. Wang, C. Y., Pan, R. Y., Wan, X. Y., Tan, Y. L., Xu, L. K., Ho, C. S., Ho, R. C. Immediate psychological responses and associated factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health.* **2020**, 17, 1729.

32. Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., Choo, F. N., Tran, B., Ho, R., Sharma, V. K., Ho, C. (2020). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav Immun.* **2020**, 87, 40–48.

19

33. Liu X, Luo W, Li Y, Li C, Hong Z, Chen H, Xiao, F., Xia, J. Y. Psychological status and behavior changes of the public during the COVID-19 epidemic in China. *Infect Dis Poverty.* **2020**, 9, 58.

34. Xiao, H., Zhang, Y., Kong, D. S., Li, S. Y., Yang, N. X. The effects of social support on sleep quality of medical staff treating patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Med Sci Monit.* **2020a**, 26, e923549.

35. Xiao, H., Zhang, Y., Kong, D. S., Li, S. Y., Yang, N. X. Social capital and sleep quality in individuals who self-isolated for 14 days during the Coronavirus Disease 2019 (COVID-19) outbreak in January 2020 in China. *Med Sci Monit.* **2020**, 26, e923921.

36. Zhang, Y., Ma, Z. F. Impact of the COVID-19 Pandemic on Mental Health and Quality of Life among Local Residents in Liaoning Province, China: A Cross-Sectional Study. *Int J Environ Res Public Health.* **2020**, 17, 2381.