







## ORIGINAL RESEARCH PAPER

# Mental health outcomes among health-care workers in Oman during COVID-19: A cluster analysis

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## Abstract

**Aim:** Despite the much heralded epidemic of adjustment difficulties, health-care workers (HCW), who are likely to be at risk and impacted with mental health issues, have received scant attention. This study aimed to determine whether definable profiles exist in a cohort of HCWs associated with demographic and mental health problems.

**Methods:** An online cross-sectional survey was conducted in Oman. Demographic and mental health data were collected from 8 to 17 April 2020. A total of 1132 participants returned their completed questionnaire. A two-step cluster analysis was used to split the sample into three clusters.

**Results:** Cluster A ( $n = 416$ ) was from HCW in non-frontline roles, and constituted “low-risk and least-impacted”. Cluster B ( $n = 412$ ) and Cluster C ( $n = 304$ ) were from frontline HCW and constituted ‘high-risk and moderate-impacted’ and ‘high-risk and high-impacted’ groups, respectively. HCWs in Cluster C reported more depression ( $P < 0.001$ ), anxiety ( $P < 0.001$ ), stress ( $P < 0.001$ ) and clinical insomnia ( $P < 0.001$ ) compared with those in the other clusters. HCWs in Cluster C were at the highest risk for mental health problems during the pandemic.

**Conclusions:** Early psychological interventions targeting this vulnerable group may be beneficial. Management should develop different tailor-made strategic plans to address different mental health needs for each profile group.

## KEYWORDS

anxiety, COVID-19, depression, health-care worker, insomnia, Oman nursing

## Summary statement

What is already known about this topic?

- Nurses, physicians and allied health-care workers (HCWs) experienced many kinds of psychological problems, including depression, anxiety, stress and insomnia during the COVID-19 outbreak.

### What this paper adds?

- The HCWs in Cluster A were more experienced, did not work in the frontline and reported a lower prevalence of depression, anxiety, stress and insomnia. This group was labelled as the 'low risk and least impacts' group.
- The HCWs in Cluster B were predominantly nurses and doctors working in the frontline and reported a higher prevalence of anxiety and stress. This cluster was labelled as the 'high risk but moderate impacts' group.
- The HCWs in Cluster C were predominantly nurses who were younger, with less working experience and work in the frontline but reporting a higher prevalence of depression, anxiety, stress and insomnia. This cluster was labelled as the 'high risk and high impacts' group.

### The implications of this paper:

- Management should develop different tailor-made strategic plans to address different mental health needs for each profile group.
- Online cognitive behaviour therapy targeting this vulnerable group may be beneficial during the COVID-19 pandemic.

## 1 | INTRODUCTION

One of the fallouts of COVID-19 is its insidious mental health impact on the health-care worker (HCW) (Pan et al., 2020). A recent online survey in Vietnam reported that 742 health workers perceived a high risk of being infected with COVID-19 (Le et al., 2021). A cross-countries study of 906 HCWs in Singapore and India reported that they reported the commonest psychological symptom was headache (32.3%), and more than 33% of them reported depression, anxiety, stress and distress (Chew et al., 2020). A recent survey on 4283 surgical providers from 101 countries reported had occurred many kinds of the psychological problem, including depression (32.8%), anxiety (30.8%), stress (25.9%) and posttraumatic stress disorder (PTSD) (24.0%) (Tan et al., 2021). Many studies have emerged so far on the psychosocial issue among HCWs and reported statistics of the magnitude of mental health issues and their covariates (Le et al., 2021; Pan et al., 2020; Romero et al., 2020; Tan et al., 2020). A recent study reported that nurses were 0.56 times less likely than medical physicians at risk of exposure to COVID-19 (Le et al., 2021).

According to the abovementioned studies, nurses are the frontline HCWs facing more mental health problems than other HCWs during COVID-19. A previous study found that nurses are at a greater risk of anxiety than physicians as they were directly exposed to positive COVID-19 patients (Huang et al., 2020). Besides, a study in China reported that nurses' sleep quality, symptoms of stress, anxiety and depression varied positively over the COVID-19 outbreak (Sampaio et al., 2021). A study in Bangladesh reported that nurses have to face social stigma and violence because they are the frontline staff who frequently deal with COVID-19 patients and their relatives, so this contact will adverse their psychological problems (Prothom Alo, 2020). Also,

previous studies found that mental health symptoms were not associated with nurses' working position (Rossi et al., 2020) but were related to gender, having training courses on COVID-19, and availability of complete personal protective equipment (Chowdhury et al., 2021; Hendy et al., 2021). Additionally, a study in Indonesia reported that nurses who worked as a temporary contract were more likely to have stress than those with a permanent one (Marthoenis et al., 2021).

Although these studies should be welcome to lay the groundwork for preventing and managing the adjustment disorder among HCWs, the variations on the impact of mental health outcomes need to be explored. These include developing effective interventions on mitigating physical symptoms, including stress, anxiety, depression, PTSD and insomnia, although HCWs are working in high-risk areas due to COVID-19 (Chew et al., 2020; Pan et al., 2020; Tan et al., 2020; Tan et al., 2021). A review of the existing literature on HCWs and mental health outcomes revealed that scant attention had been given to shedding light on who is likely to be fit the status of low risk and least impacted, moderately impacted and high risk and high affected among the cadre of HCWs with mental health problems (Chew et al., 2020; Kang et al., 2020; Liu et al., 2020; Tan et al., 2020). A taxonomy analysis has the potential to identify and classify patterns in the pattern that are not apparent using cross-sectional studies (Shensa et al., 2018). Such an undertaking is likely to equip health-care planners to contemplate the prevention measures and management of mental health problems among HCWs.

Oman's health-care system is monitored by the Ministry of Health (MoH) with its primary, secondary and tertiary care. On 10 March 2020, the Supreme Committee for COVID-19 has been setting stringent containment measures across the different strata of Oman's societies. Due to a rapidly rising number of people who have tested positive for COVID-19, the MoH has embarked to heighten hospital

capacity and accommodate the complexity of those who have contacted COVID-19. The algorithm for caring for people with COVID-19 often starts with diagnostics in the regional catchment areas, which could be primary, polyclinic or tertiary care. Those with advanced pathology and, therefore, those who require dedicated care are sent to tertiary care. Despite its being a global pandemic (WHO, 2020), other than reports of the number of people who have accrued COVID-19 and deceased, fewer studies had reported mental health outcomes among HCWs in the Gulf Cooperation Council countries. Despite protracted lockdown, the increasing number of positive cases and fatalities in the region has yet to abate. There is a dearth of studies on adjustment disorders among HCWs except for anecdotal reports (Sohrabi et al., 2020).

## 2 | METHODS

### 2.1 | Aims

This study aimed to determine whether definable profiles exist in a cohort of HCWs regarding factors associated with demographic characteristics and mental health measures, including depression, anxiety, stress and insomnia during the COVID-19 outbreak in Oman. If different profiles of HCW existed in the pandemic, understanding each profile is important from a management perspective. Two specific research objectives were formulated:

1. To identify the profiles of HCWs based on demographic characteristics and mental health measures and
2. To explore differences among the profile groups in terms of these measures.

### 2.2 | Design

A cross-sectional online survey was conducted in different health services centres across Oman. Data were collected from 8 to 17 April 2020, utilizing data from a previous study conducted by the same research team (Alshekaili et al., 2020).

### 2.3 | Participants and sample sizes

The present study was conducted among HCWs working in different regions of Oman. All HCWs working full-time in the MoH in various health services centres were eligible to participate in the study. They include physicians, nurses and allied health professions. Sample sizes calculation is according to the depression level, which is one of the primary outcomes. If we expected, the prevalence rate of HWC's depression level was between 30% and 35% based on a previous report on the COVID-19 outbreak (Lai et al., 2020). Using the EPITO-OLS (an online software) with a precision of  $\pm 2.7\%$  at a 95% confidence level, the required samples were between 1107 and 1199

(Sergeant, 2018). If we expected the response rate for the online survey was around 26%, we need to send out questionnaires between 4258 ( $=1107/0.26$ ) and 4612 ( $=1199/0.26$ ). In the end, we send out 4357 e-mails, with 1167 participants who responded the survey (the response rate is 26.7%). However, 35 returned questionnaires were excluded, either incomplete ( $n = 7$ ) or duplicate ( $n = 28$ ), so only 1132 records were used for this report.

### 2.4 | Data collection and ethical issues

All the HCWs employed full-time for the MoH work in the 11 governorates across the country. After obtaining an ethical approval letter from the MoH (MOH/DGPS/CSR/20/2311), the MoH randomly selected a list of HCWs with contact e-mail (around 396 HCWs for each governorate) for the research team. An online questionnaire was disseminated using invitation e-mails to all selected samples. The online survey was available in Arabic and English and can be accessed via the Google platform. The e-mail includes the purpose of the survey and a Google link at the end if they want to participate. Participants' names, ID and e-mail, which governorate, are not required to provide to ensure confidentiality and anonymity. Informed consent is required by asking participants to click the 'yes' button before replying to the questions. Participants are allowed to withdraw anytime they like; their information will be treated as incomplete and will not be used on this report.

### 2.5 | Instrument

The instrument consisted of two parts:

Part 1 comprised demographic data included nationality, gender, age, job position, marital status, years of working in the health-care setting and type of working areas (primary, secondary, tertiary or polyclinic). Additional questions were asked, including have they previously sought consultation mental disorders; were they directly engaged in any frontline (clinical) activities such as diagnosing, treating or caring to patients with elevated temperatures or patients with confirmed Covid-19 infection and the number of COVID-19 infected cases they have handled during the pandemic.

Part 2 consisted of two sections (mental health measures). Section A is the Depression, Anxiety and Stress Scale (DASS-21), a validated self-report checklist for general populations. It is a self-reported 21-item, which provides independent measures of depression, stress and anxiety with recommended cut-off scores of 10+, 8+ and 16+ that represent a presence of depression, anxiety and stress, respectively (Alshekaili et al., 2020; Moussa et al., 2017). This tool has been validated and used in the COVID-19 outbreak in different countries with different languages, including Chinese (Wang, Pan, et al., 2020), Vietnamese (Le et al., 2021), Philippine (Tee et al., 2020), Spain (Wang, Lopez-Nunez, et al., 2021), Poland (Wang, Chudzicka-Czupala, et al., 2020) and Arabic (Moussa et al., 2017; Wang, Chudzicka-Czupala, et al., 2020). It has been found to have good internal reliability

(Cronbach's alpha) on stress (0.888–0.934), anxiety (0.845–0.891) and depression (0.878–0.940) (Le et al., 2021; Tee et al., 2020; Wang, Fardin, et al., 2021; Wang, Pan, et al., 2020).

Section B is the Insomnia Severity Index (ISI) to measure HCW's sleeping problems. A self-reported seven items with a recommended cut-off point of 14+ indicted clinical insomnia (Suleiman & Yates, 2011). This tool has been used and validated in the COVID-19 outbreak in different countries, including China (Hao et al., 2020) and Oman (Alshekaili et al., 2020). It has been found to have acceptable internal reliability (Cronbach's alpha) greater than 0.70.

## 2.6 | Data analysis

Cluster analysis is a statistical method that allows the researcher to explore whether a cohort of samples is homogeneous or not. A two-steps analysis was used to analyse nominal and numerical variables concurrently (Hair et al., 2014; Shensa et al., 2018). The analysis was performed with IBM SPSS v23 and included demographic and mental health outcomes. The number of clusters was determined based on the silhouette measure, Akaike information criterion (AIC) and size ratio (Chan, 2006; Hair et al., 2014). When clusters had been identified within the samples, cluster comparison was performed. Descriptive statistics were used to describe each profile cluster. Chi-square test and *t*-test test/ANOVA were used for nominal and numerical data, respectively, to examine any significant associations or differences between the clusters. The post hoc test (Bonferroni correction) was used for pair comparisons, and all results were considered significant at  $P < 0.05$ .

## 3 | RESULTS

### 3.1 | Cluster analysis

In Table 1, the two-step cluster analysis split the study sample into three clusters based on the average silhouette measure that is 0.30 and the size ratio that is 1.37. Clusters A, B and C contained 416 (36.7%), 412 (36.4%) and 304 (26.9%) HCWs, respectively. The three clusters were formed in accordance with the similarity with the demographic, DASS-21 and ISI measures. Subsequently, the three clusters were compared about these variables. Cluster A was characterized by HCWs who were older (Mean  $\pm$  SD,  $37.3 \pm 7.0$  years) with more working experience ( $13.6 \pm 7.1$  years) in the health-care setting. The majority were allied health (38.5%,  $n = 160$ ); none of whom were working in the frontline, and more than 84% ( $n = 353$ ) had not handled any COVID-19 cases during the pandemic period. The majority did not report any symptoms of depression (89.7%,  $n = 373$ ), anxiety (90.1%,  $n = 375$ ), stress (98.3%,  $n = 409$ ) and clinical insomnia (97.6%,  $n = 406$ ).

Cluster B was mostly around 36 years of age (SD = 6.3). The majority were physicians (43.4%,  $n = 179$ ) or nurses (42.5%,  $n = 175$ ) who were working in the primary workplace (44.9%,  $n = 185$ ). All

were working in the frontline, and more than 60% ( $n = 257$ ) had experienced COVID-19 cases in the pandemic. The majority did not report any symptoms of depression (87.1%,  $n = 359$ ), anxiety (84.5%,  $n = 348$ ), stress (93.2%,  $n = 384$ ) and clinical insomnia (96.6%,  $n = 398$ ).

In Cluster C, most HCWs were nurses (44.1%,  $n = 134$ ) and working in the tertiary care hospital (44.4%,  $n = 135$ ). They were younger ( $34.8 \pm 5.7$  years) and with less working experience ( $11.9 \pm 5.9$  years) than the other two clusters. There were around 50% ( $n = 159$ ) working in the frontline only. The majority reported depression (87.5%,  $n = 266$ ), anxiety (91.4%,  $n = 278$ ), stress (76.3%,  $n = 232$ ) and clinical insomnia (60.2%,  $n = 183$ ) during the pandemic.

### 3.2 | Comparison of data by clusters

In demographic variables, HCWs in Cluster A were significantly older ( $P < 0.001$ ) and with more working experience ( $P = 0.001$ ) than Cluster C. They were working in non-frontline settings ( $P < 0.001$ ) and were less likely to have handled COVID-19 cases ( $P < 0.001$ ) than HCWs in Clusters B and C, respectively. More HCWs in Cluster A were allied health than in Cluster B ( $P < 0.001$ ). In contrast, more nurses were in Cluster C than Cluster A ( $P = 0.003$ ). The HCWs in Cluster B had Cared for more COVID-19 cases than those in Clusters A ( $P < 0.001$ ) and C ( $P < 0.001$ ). In the frontline setting, significant differences were found between Clusters A and B. All of Cluster A were working in non-frontline settings. In contrast, all of Cluster B worked in the frontline ( $P < 0.001$ ). For HCWs in Cluster C, 52.3% and 47.7% were working in frontline and non-frontline roles, respectively. Regarding psychological impacts, HCWs in Cluster C indicated more depression ( $P < 0.001$ ), anxiety ( $P < 0.001$ ), stress ( $P < 0.001$ ) and clinical insomnia ( $P < 0.001$ ) compared with those in the other clusters. In contrast, significant differences were found between HCWs in Clusters A and B for anxiety ( $P = 0.014$ ) and stress ( $P < 0.001$ ) but not in depression ( $P = 0.278$ ) and clinical insomnia ( $P = 0.394$ ).

## 4 | DISCUSSION

In exploring the demographic and mental health measures of HCWs during the pandemic in Oman, this study's results identified three clusters. The findings suggest that these three groups of HCWs are different in response to depression, anxiety, stress, and insomnia. The HCWs in Cluster A were more experienced, working in tertiary care but not in the frontline setting. The majority did not handle COVID-19 cases and reported fewer symptoms of depression, anxiety, stress and insomnia than the other two clusters during the pandemic. This group was labelled as the 'low risk and least impacts' group. The HCWs in Cluster B were different from Cluster A, predominantly are working in the frontline either in the primary or tertiary care setting. The majority had experienced handling COVID-19 cases and reported more anxiety and stress than those in Cluster A. This cluster was identified as the 'high risk but moderate impacts' group, which comprised

**TABLE 1** Comparison of the health-care workers by cluster in the association of demographic and mental health factors during COVID-19 in Oman

Factors	Total (n = 1132) n (%)	Cluster			Statistics <sup>a</sup>	P-value (A vs. B; A vs. C; B vs. C) <sup>c</sup>
		A (n = 416) n (%)	B (n = 412) n (%)	C (n = 304) n (%)		
<b>Demographic</b>						
Age (years) mean ± SD	36.3 ± 6.5	37.3 ± 7.0	36.4 ± 6.3	34.8 ± 5.7	13.647 <sup>b</sup>	<0.001 (0.138; <0.001; 0.001)
<b>Gender</b>						
Male	227 (20.1)	110 (26.4)	84 (20.4)	33 (10.9)	26.664	<0.001 (0.040; <0.001; 0.001)
Female	905 (79.9)	306 (73.6)	328 (79.6)	271 (89.1)		
<b>Nationality</b>						
Omani	974 (86.0)	363 (87.3)	334 (81.1)	277 (91.1)	15.525	<0.001 (0.015; 0.104; <0.001)
Non-Omani	158 (14.0)	53 (12.7)	78 (18.9)	27 (8.9)		
<b>Profession</b>						
Physician	384 (33.9)	119 (28.6)	179 (43.4)	86 (28.3)	70.696	<0.001 (<0.001; 0.003; <0.001)
Nurse	446 (39.4)	137 (32.9)	175 (42.5)	134 (44.1)		
Allied health	302 (26.7)	160 (38.5)	58 (14.1)	84 (27.6)		
<b>Mental illness</b>						
No	1,014 (89.5)	391 (94.0)	384 (93.2)	239 (78.4)	54.465	<0.001 (0.650; <0.001; <0.001)
Yes	118 (10.5)	25 (6.0)	28 (6.8)	65 (21.6)		
<b>Marital status</b>						
Not married	150 (13.0)	39 (9.4)	62 (14.8)	49 (15.6)	7.809	0.020 (0.016; 0.012; 0.791)
Married	982 (87.0)	377 (90.6)	350 (85.2)	255 (84.4)		
<b>Number of COVID-19 cases handled</b>						
No	676 (59.6)	353 (84.9)	155 (37.3)	168 (55.3)	197.195	<0.001 (<0.001; <0.001; <0.001)
Yes	456 (40.4)	63 (15.1)	257 (62.7)	136 (44.7)		
1–5 cases	310 (68.0)	47 (74.6)	183 (71.2)	80 (58.8)	7.737	0.021 (0.591; 0.031; 0.013)
6+ cases	146 (32.0)	16 (25.4)	74 (28.8)	56 (41.2)		
<b>Workplace</b>						
Health centre (primary health care)	388 (34.4)	100 (24.0)	185 (44.9)	103 (33.9)	59.778	<0.001 (<0.001; <0.001; 0.014)
Polyclinic (secondary care)	164 (14.5)	66 (15.9)	48 (11.7)	50 (16.4)		
Hospital (tertiary care)	475 (42.0)	186 (44.7)	154 (37.4)	135 (44.4)		
Others	105 (9.3)	64 (15.4)	25 (6.1)	16 (5.3)		
<b>Work in the frontline during the pandemic</b>						
Yes	571 (50.4)	0 (0.0)	412 (100.0)	159 (52.3)	828.621	<0.001 (<0.001; <0.001; <0.001)
No	561 (49.6)	416 (100.0)	0 (0.0)	145 (47.7)		
Working experience (years) mean ± SD	12.7 ± 6.5	13.6 ± 7.1	12.4 ± 6.3	11.9 ± 5.9	6.788 <sup>b</sup>	0.001 (0.037; 0.001; 0.531)

(Continues)

TABLE 1 (Continued)

Factors	Total (n = 1132) n (%)	Cluster			Statistics <sup>a</sup>	P-value (A vs. B; A vs. C; B vs. C) <sup>c</sup>
		A (n = 416) n (%)	B (n = 412) n (%)	C (n = 304) n (%)		
Mental health						
DASS-21—depression (10+, depressed)						
Yes	362 (32.0)	43 (10.3)	53 (12.9)	266 (87.5)	589,588	<0.001 (0.278; <0.001; <0.001)
No	770 (68.0)	373 (89.7)	359 (87.1)	38 (12.5)		
DASS-21—anxiety (8+, anxiety)						
Yes	383 (33.8)	41 (9.9)	64 (15.5)	278 (91.4)	619,221	<0.001 (0.014; <0.001; <0.001)
No	749 (66.2)	375 (90.1)	348 (84.5)	26 (8.6)		
DASS-21—stress (16+, stress)						
Yes	267 (23.6)	7 (1.7)	28 (6.8)	232 (76.3)	644,150	<0.001 (<0.001; <0.001; <0.001)
No	865 (76.4)	409 (98.3)	384 (93.2)	72 (23.7)		
Insomnia (15+, clinical insomnia)						
Yes	207 (18.3)	10 (2.4)	14 (3.4)	183 (60.2)	488,710	<0.001 (0.394; <0.001; <0.001)
No	925 (81.7)	406 (97.6)	398 (96.6)	121 (39.8)		

Abbreviations: DASS, The Depression, Anxiety, and Stress Scale (DASS-21); Insomnia, Insomnia Severity Index.

<sup>a</sup>Chi-square test.<sup>b</sup>ANOVA.<sup>c</sup>Post hoc test in ANOVA, otherwise, chi-square test.

36.4% of our sample. The HCWs in Cluster C were predominantly with less working experience and have younger age. Only half of them are working in the frontline, either in the hospital or primary care setting. To handle COVID-19 cases, they reported more than those in Cluster A but lower than those in Cluster B in the frontline either in the primary or tertiary care setting. In contrast, the majority reported depression, anxiety, stress and insomnia, higher than the other two clusters. This cluster was labelled as the 'high risk and high impacts' group, which comprised 26.9% of our sample.

In China, a study reported that 50.4% ( $n = 1,257$ ) of the frontline HCWs in the Hubei province had a depressive symptom, 44.6% had anxiety and 71.5% had stress symptoms (Lai et al., 2020). In Singapore, a report from 470 HCWs, 8.9%, 14.5% and 6.6% had depression, anxiety and stress, respectively (Tan et al., 2020). In addition, a longitudinal survey was conducted in China on the general population. The results show that participants' stress, anxiety and depression level were no significant changes during the initial COVID-19 outbreak and 4 weeks later (Wang, Pan, et al., 2020). The highest mental health problem was found all over the World among HCWs who are mostly affected by COVID-19 (Pan et al., 2020; Romero et al., 2020; Wang, Chudzicka-Czupala, et al., 2020). These studies from different parts of the world suggest huge discrepancies in the prevalence of mental health symptomatology. In the time of emergency, stakeholders might prefer those who are at high risk and impact among HCWs. Even during a pandemic, it does not imply that all HCWs are exposed to the vagaries of COVID-19 (Sasangohar et al., 2020). The present study was defined what constitutes frontline workers, which, in turn, suggests that high-risk and highly impacted HCWs consisted of 26.9% ( $n = 304$ ) of the sample. Since the factors determining the high risk appear to have heuristic value, this can contemplate an algorithm for prevention and intervention.

As the pandemic continues, important clinical and policy strategies are needed to support HCWs (Kang et al., 2020; Liu et al., 2020). Our study reported similar results in line with other studies that HCWs are working under different levels of mental health problems in the pandemic. This study also identified three clusters of HCWs, and the impacts on their mental health problems are different. A previous study recommended that management focus on disseminating unbiased COVID-19 knowledge, enforcing personal precautionary measures, educating correct containment methods and providing sufficient financial support are key points to mitigate the mental health problem of the frontline HCWs (Wang, Chudzicka-Czupala, et al., 2020). Additionally, management could develop other psychological supports that could include cognitive behavioural therapy (CBT), counselling and support services on each profile group (Sasangohar et al., 2020; Soh et al., 2020; Zhang et al., 2020). A meta-analysis reported that those HCWs who joined the CBT improved their insomnia than the control group (Soh et al., 2020). In addition, those who are using online CBT had a greater improvement in insomnia level than those via a face-to-face CBT group (Soh et al., 2020), and using online CBT shows less costly but more effective to improve mental health symptom than the traditional face-to-face CBT (Zhang & Ho, 2017). Resources should be allocated to address the mental

health issues of younger and less working experienced HCWs like those HCWs in Cluster C. Hopefully, they can help them overcome their problems because they suffer from mental health outcomes. An integrated approach for each profile group to promote communication and recognition of workplace contributions in any pandemics is recommended (Zhang et al., 2020).

Additionally, encouraged HCWs to receive the COVID-19 vaccination is important because this will enhance their protection and reduced the risk of acquiring and transmitting COVID-19 infection. A recent study in six countries in Asia found that more than 95% of the HCWs are willing to receive COVID-19 vaccination (Chew et al., 2021). In contrast, a study in 21 Arab countries found that the overall COVID-19 vaccine acceptance rate on HCWS was 25.8%, lower than in other Western countries (Qunaibi et al., 2021). However, the reports in Oman on the acceptance and hesitancy rates were 23.1% and 38.5%, respectively. However, this finding may not represent Oman's truth because only 26 Omanis have participated in this study. A national survey conducted in Oman led by the MoH of Oman was highly recommended (Al-Awaidy & Khamis, 2020).

#### 4.1 | Study limitations and future research

There are a few limitations in this study that may have affected its findings. One limitation that might affect the outcomes of this online survey was that it used a self-administered questionnaire, and respondent honesty is a potential error that might affect the results. Another limitation is that this study was carried out early in the outbreak, limiting the generalizability of the findings. The present study used self-reported questionnaires to collect psychiatric symptoms and did not make a clinical diagnosis. Olszewska-Guizzo and his colleagues Olszewska-Guizzo et al. (2021) found that exposure to the COVID-19 pandemic could cause hemodynamic changes in the brain. A systematic review suggested that the gold standard for establishing psychiatric diagnosis should involve a clinical interview and functional neuroimaging (Husain et al., 2019; Husain et al., 2020) that were recommended for future study (Ho et al., 2020). Second, the study's cross-sectional design limits generalizability and does not differentiate cause and effect relationships among occupational outcomes on each cluster. A follow-up survey could help explore the progression effect of mental health issues on HCWs in the long run.

## 5 | CONCLUSION

Our study highlights that HCWs in Cluster C were at the highest risk for mental health problems during the COVID-19 pandemic. Early psychological interventions targeting this vulnerable group may be beneficial. In conclusion, management should develop tailor-made strategic plans for different profile groups to address different mental health needs from each pandemic profile group.



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## ETHICS STATEMENT

Ethical approval was approved by the Ministry of Health, Oman (MOH/DGPS/CSR/20/2311).

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## AUTHORSHIP STATEMENT

Study design: SAA, MAS, WH and FAS; Data collection: MAS, NAS, FAS, SKJ and AAM; Manuscript preparation: MFC, SAA, MAS, WH, NAS, FAS, SKJ and AAM.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to the raw data containing information that could compromise research participant privacy/consent.

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