ORIGINAL ARTICLE

Work and non-work concerns and impact on healthcare workers during the COVID-19 first wave in Brunei Darussalam: Identifying key risk groups for targeted support

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ABSTRACT

Healthcare workers (HCWs) played an integral role as front-line essential workers during the COVID-19 pandemic. They were at high risk of COVID-19 transmission and faced psychological effects of fatigue and burnout, which ultimately influenced their participation and performance during the pandemic. This study was conducted to assess work and non-work concerns and the impact of COVID-19 on HCWs in Brunei Darussalam. A cross-sectional study using a web-based and self-administered questionnaire was conducted from July to August 2020, with 511 HCWs in Brunei Darussalam. Data were analysed for associations between demographic profile and perceived work, non-work concerns, and impact of the outbreak on the HCWs during the first wave of the COVID-19 pandemic. The risk of acquiring COVID-19 (79.8%) and the risk of transmission to family members (90.8%), friends (88.6%) and colleagues (87.2%) were the primary concerns reported by HCWs. Additionally, 62.8% reported being tasked with additional work duties, 59.2% experienced increased workload, 54.5% experienced feeling stressed, and 45.5% felt the effects of manpower shortages. Multivariate analysis showed higher work concerns among doctors (OR=2.29, CI:1.14-4.61), nurses (OR=2.47, CI:1.37-4.48), and those working in hospitals (OR=3.22, CI:1.54-6.73), health centres/clinics (OR=3.82, CI:1.78-8.18), and the National Isolation Centre (OR=6.16, CI:1.97-19.2). HCWs reporting stigma and discrimination had greater non-work concerns (OR=1.74, CI:1.09-2.79) and perceived impact (OR=4.57, CI:2.82-7.46). In conclusion, front-line HCWs, such as medical and nursing staff working in hospitals and health centres, reported higher work concerns compared to allied health professionals and support staff. The majority of HCWs experienced staff shortages, increased workload, and stress due to the demands of the pandemic. These findings highlight the need for targeted organisational and psychosocial support measures and increased awareness for frontline HCWs to improve their resilience during such health crises.

Keywords:
Healthcare workers (HCWs), COVID-19, Concerns, Impact, Stigma, Discrimination

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INTRODUCTION

At the global scale, the COVID-19 pandemic lasted more than three years before the World Health Organization (WHO) officially lifted its status as a public health emergency of international concern on 5 May 2023. By 11 June 2023, there were over 767 million confirmed cases and 6.9 million COVID-19 related deaths.[1,2] Of the front-line occupational groups that played a vital role in the preparedness and response to the COVID-19 pandemic, healthcare workers (HCWs) were often described as warriors or soldiers. This was similarly observed in previous pandemics such as H1N1 Influenza in 2009 and severe acute respiratory syndrome (SARS) in 2002–2004.[3-5] The negative impact of these pandemics on HCWs often results in fatigue and burnout due to excessive workload and long working hours, increased occupational risk of acquiring infectious diseases, public stigma and discrimination, and verbal abuse and physical violence.[4-6] According to WHO estimates, HCWs accounted for 6.2% of all reported COVID-19 infections and 115 000 deaths by May 2021.[7] Studies from Finland and the United States of America reported a high risk of workplace exposure to COVID-19 among HCWs whereby 53.6% and 55% of infected HCWs respectively had a positive workplace contact.[8,9] Additionally, other studies indicated that HCWs experienced increased physical and psychological effects from the pandemic due to long working hours, cutaneous manifestations from prolonged use of personal protective equipment (PPE), stress, anxiety, depression, post-traumatic stress disorder, as well as stigma and discrimination in the community.[6,10,11]

Effective response during a pandemic or any major health emergency requires high levels of participation and willingness to work among HCWs. Preserving healthy HCWs is vital to achieve and maintain a good pandemic response; however, various studies have reported that HCWs' safety concerns for themselves and their family members can adversely affect their willingness to remain as front-line HCWs.[12-14] Studies from the United Kingdom and Singapore during the Avian Influenza pandemic identified that major concerns of HCWs were risk of falling ill, family responsibilities, and perceived threat of social rejection of themselves and their families.[12,13] Similarly, recent studies also highlighted that the risk of being infected as well as infecting others (such as family and colleagues), increased workload, and facing stigma or discrimination were major concerns and impacts of the COVID-19 pandemic on HCWs.[15-17]

Brunei Darussalam, with a population of approximately 460,000, provides health-care services through four government hospitals (including a National Isolation Centre), three private hospitals, several government primary health centres, and several private clinics.[18] In 2019, there were 4150 recorded health-care professionals comprising doctors, dentists, nurses, midwives, and allied health professionals, working in the government and private health-care sectors.[19]

During the COVID-19 pandemic, Brunei Darussalam recorded 337 cases in the first wave (9 March 2020 to 31 July 2021), followed by 16,139 additional cases by 31 January 2022 during the second wave, and a further 136,033 cases by 11 June 2022 in the third wave. When the country entered the endemic phase in June 2022, a total of more than 308,000 cases had been recorded.[20-23] During the early outbreak of the pandemic and before the COVID-19 vaccine was developed, the safety and protection of frontline workers including HCWs were recognised as of utmost importance. Training on preparedness and response, increased awareness and adherence to PPE, and regular respirator fit-testing sessions were enhanced.[24,25]

Nevertheless, concerns about safety, wellbeing, and psychological impact, such as stress and burnout, were reported by HCWs since the early phase of the pandemic, mostly from countries with high case burdens, where the healthcare systems were heavily strained.[26] However, limited data were available from countries with low case burdens earlier in the pandemic, where HCWs may have experienced different types of concerns and impacts related to uncertainties and operational challenges. Understanding occupational and personal concerns is important as these can influence HCWs' psychological wellbeing, participation, and performance at work, and can be mitigated by better social as well as organisational support.[26,27] This study, therefore, aimed to assess the individual magnitude of HCWs' perceived work and non-work concerns during the pandemic, and the impact on the work and personal lives of HCWs in Brunei Darussalam during the early phase of the pandemic. This study provides baseline data on such perceptions of HCWs during the early phase of the pandemic, a period of uncertainty and evolving pandemic protocols for improved preparedness, and for comparison with subsequent studies or retrospective analyses conducted with more severe Delta and Omicron waves.

METHODS

This was a cross-sectional study that used a web-based and self-administered questionnaire on HCWs from the government and private health sectors who were involved in the COVID-19 health response in Brunei Darussalam. For this study, HCWs were defined as those who were engaged in tasks with the primary purpose of enhancing health-care services to the public or patients, thereby comprising doctors, nursing staff, allied health professionals (AHP), health-care support staff, and health voluntary workers.[28] The questionnaire was adapted from those used in similar pandemic studies following the Avian Influenza and SARS outbreaks in Singapore.[12,29] The original questionnaire was modified by removing the 'Impact of Event Scale' to reduce the length of the questionnaire and make it more suitable for the early phase of the pandemic. Pilot testing was conducted using the adapted questionnaire on 15 HCWs who were not part of the main study to ensure clarity, relevance, and flow. To ensure the reliability of the adapted instrument, we calculated Cronbach's alpha for key sections, including work concerns, non-work concerns, and impact. The values were 0.73, 0.81, and 0.71, respectively, indicating acceptable internal consistency. The questionnaire included questions on the HCWs' demographic profile, their perceived work concerns (7 items), non-work concerns (7 items), their perceived impact of COVID-19 on their personal life and work (13 items), as well as perceived discrimination and stigma faced by them. The variables in the work and non-work concerns and perceived impact were measured on a 5-point Likert scale (strongly disagree, disagree, not sure, agree, strongly agree).

This study, conducted from July to August 2020 during the first wave of the COVID-19 outbreak in the country, used convenience sampling on HCWs who were screened at either the occupational health clinic or flu clinics (located at primary health centres) for influenza-like illness (ILI) symptoms, recent overseas travel, or for occupational and non-occupational close contact with suspected or confirmed COVID-19 cases. The flu clinics were designated for consultation of patients with ILI symptoms and close contacts of confirmed or suspected COVID-19 cases. These patients were consulted separately from other clinics to minimise close contact

with non-ILI patients and to ensure smooth functioning of other essential health-care services. A weblink to the questionnaire containing a participant information sheet and consent form in the local language and English was distributed to invited participants through a text messaging application, followed by a reminder one week later. With a 95% confidence level, 5% margin of error, 50% prevalence of concerns or impact among HCWs reported in earlier pandemic studies, and adjusted for a 10% non-response, the calculated sample size using Epi-Info 7.0 was 385.[12,29] Out of a total of 989 invited participants, 511 completed the survey, giving a response rate of 51.7%. As all the questions in the online survey were compulsory to be answered, there were no incomplete responses. Participants were invited throughout the study period, and the distribution of different categories of HCWs in the sample (17% doctors; 64% nurses; 8% AHPs) was broadly comparable to the composition of the health workforce in the country (19% doctors and dentists, 72% nurses and midwives, and 9% AHPs).[19]

Data were analysed using SPSS 20.0 and presented as percentages for categorical data, and range and mean (±SD) for continuous data. For comparison, Likert scale responses for each questionnaire item under the work concerns, non-work concerns, and impact domains were converted to numeric scores (strongly disagree=1, disagree=2, not sure=3, agree=4, strongly agree=5), with reverse scoring applied to negatively worded questions. For each respondent, the numeric scores for individual items under a particular domain were summed to calculate the total domain scores representing perceived work concerns, non-work concerns, and impact on their work and personal life. Higher domain scores indicated greater concerns or impact. These scores were checked for normality to assess data distribution and selection of appropriate statistical tests. The scores were found to have a non-normal distribution when tested using the Kolmogorov-Smirnov ($p<0.001$) and Shapiro-Wilk ($p<0.001$) tests. Accordingly, non-parametric significance tests (Mann-Whitney U and Kruskal-Wallis) and ordinal logistic regression with the total domain score as dependent variable (higher scores representing higher levels of concerns or impact on an ordinal scale) were used for statistical analysis. In addition, thematic analysis was conducted on HCWs' responses to open-ended questions regarding discrimination and stigma. This analysis involved coding the responses, identifying recurring themes related to HCWs' experiences of discrimination, and reviewing and finalising the themes to ensure they accurately captured the key aspects of their experiences. The study was approved by the Medical and Health Research and Ethics Committee, Ministry of Health [Ref. No. MHREC/MOH/2020/7(1) dated 30 June 2020].

RESULTS

A total of 511 HCWs participated in this study. The demographic profile indicated that participants were predominantly female (77.1%), Bruneian (86.5%), in the 36-45 age group (33.3%), married (72.6%), and living with family or friends (85.1%). Among the occupational groups, nursing staff comprised the majority (64%), followed by doctors (17%), AHP (7.8%), and others (11.2%). The majority of the HCWs were employed in the government sector (96.7%), working in a hospital setting (66.1%), while 21% worked in a health centre/clinic, 3.9% worked at the National Isolation Centre, and 2.3% worked in a flu clinic. Additionally, 73.6% of participants reported varying degrees of exposure to COVID-19 cases due to their work, with the majority (63.6%) having daily or frequent

(a few times a week) exposure. Furthermore, 49.5% of HCWs were involved in aerosol generating procedures (Table 1).

Table 1. Sociodemographic and work characteristics of participating HCWs.

Socio-demographic characteristic		Number (%) (N=511)
Age group (in years)		
	≤25	66 (12.9)
	26-35	149 (29.2)
	36-45	170 (33.3)
	46-55	106 (20.7)
	>55	20 (3.9)
	Range	19-64
	Mean (+/-SD[1])	38.1 (+/- 9.5)
Gender		
	Male	116 (22.7)
	Female	394 (77.1)
	No data	1 (0.2)
Nationality		
	Bruneian (local)	442 (86.5)
	Non-Bruneian (non-local)	69 (13.5)
Marital Status	Married	371 (72.6)
	Single	122 (24.0)
	Divorced/Separated/Widowed	18 (3.5)
Living with		
	Family/Friend	435 (85.1)
	Alone	76 (14.9)
HCW occupational group		
	Doctor	87 (17.0)
	Nurse	327 (64.0)
	Allied health professional	40 (7.8)
	Other	57 (11.2)
Workplace		
	Hospital	338 (66.1)
	Health centre/clinic	107 (21.0)
	Flu clinic	12 (2.3)
	National Isolation Centre	20 (3.9)
	Other	34 (6.7)
Work sector		
	Government	494 (96.7)
	Private	17 (3.3)
Work characteristic		
Exposure to COVID-19 cases		
	Yes	376 (73.6)
	No	87 (17.0)
	Not Sure	48 (9.4)

Socio-demographic characteristic	Number (%) (N=511)
Frequency of exposure to COVID-19 cases	
Daily	168 (44.7)
Few times a week	71 (18.9)
Once a week	20 (5.3)
Rarely	117 (31.1)
No exposure	135 (26.4%)
Involvement in aerosol generating procedure	
Yes	253 (49.5)
No	258 (50.5)

[1]SD: standard deviation.

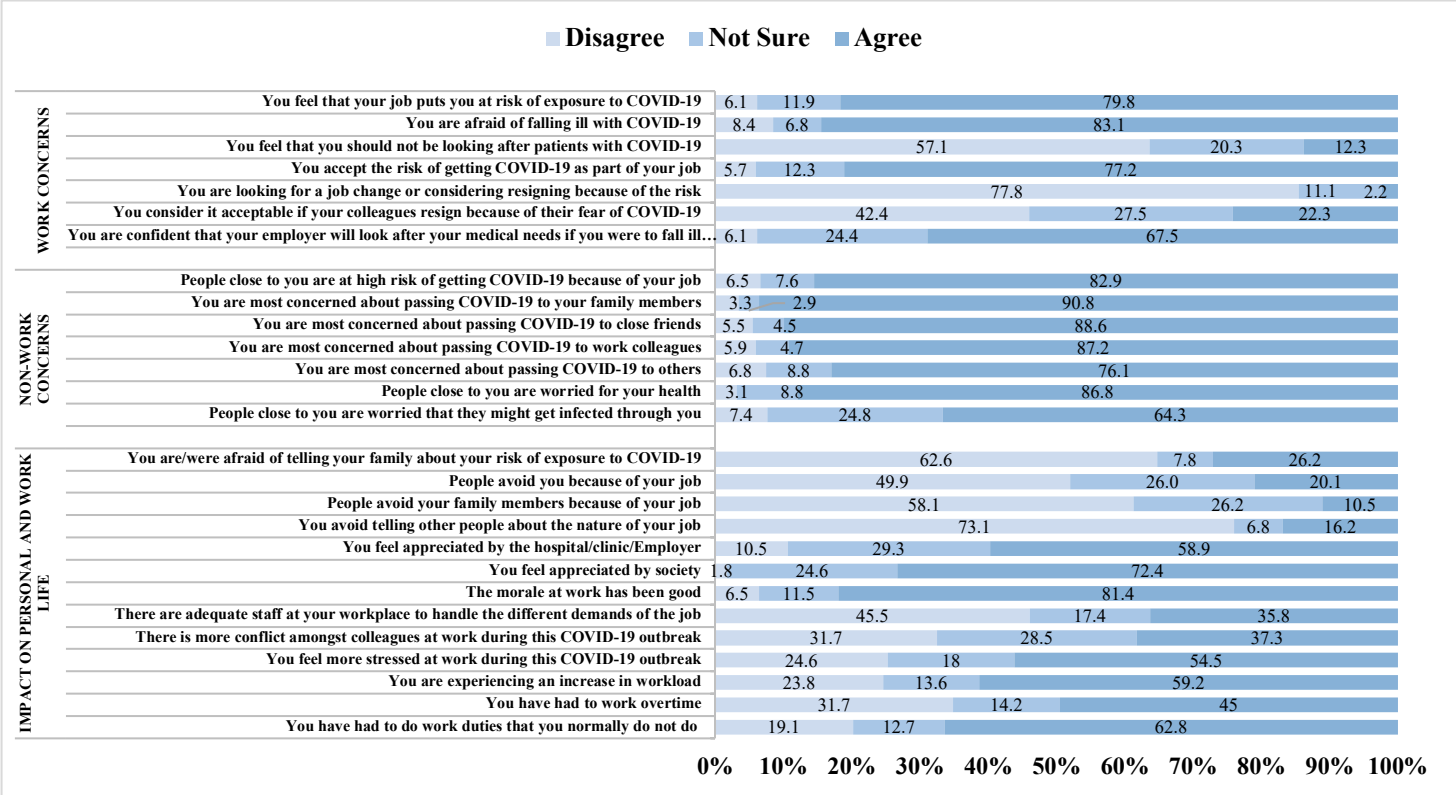


Figure 1. Perceived work and non-work concerns and impact of COVID-19 outbreak among HCWs, Brunei Darussalam

As shown in Figure 1, workplace exposure to COVID-19 cases and acquiring COVID-19 infection were the main work concerns reported by 79.8% and 83.1% of HCWs, respectively. Approximately 77.2% accepted that they were at risk of disease transmission because of their job, and 67.5% were confident that their employer would assume responsibility for their medical needs if they contracted COVID-19. A small percentage of HCWs (12.3%) were unwilling to care for COVID-19 cases, and only 2.2% would consider a job change or resignation due to occupational risk. Transmitting the infection to family members (90.8%), friends (88.6%), and colleagues (87.2%) were the main non-work concerns reported by HCWs. These findings address the primary objective of the study and reveal that transmission-related concerns dominated the work and non-work domains, reflecting the interconnected nature of work and non-work stressors among HCWs. When asked

about their perceived personal impact, 72.4% felt appreciated by society, while 20.1% felt they were being avoided. From a work perspective, 45.5% reported manpower shortages in their workplace due to increased and additional work demands as a result of the pandemic; 62.8% reported involvement in different job roles other than their regular role; 59.2% experienced increased workload; 45% had to work overtime; and 54.5% reported feeling stressed at work due to COVID-19.

Regarding stigma and discrimination related to COVID-19, 76 (14.9%) HCWs experienced this, with a further breakdown showing that 44 (57.9%) encountered it in the community while 20 (26.3%) experienced it in their workplace. Allied health professionals (17.5%) and nurses (17.4%), and HCWs working at the National Isolation Centre (25%) experienced this most among the total HCWs in that category or working at that workplace respectively (Fig. 2A). Thematic analysis of responses to open-ended questions on the type of discrimination encountered showed that 29% felt isolated or avoided, 11.8% felt they were viewed as the source of infection, 10.5% experienced refusal by food service delivery companies, and 5.3% felt insulted or experienced rude treatment (Fig. 2B). Figure 2C presents feedback from HCWs on the types of discrimination faced.

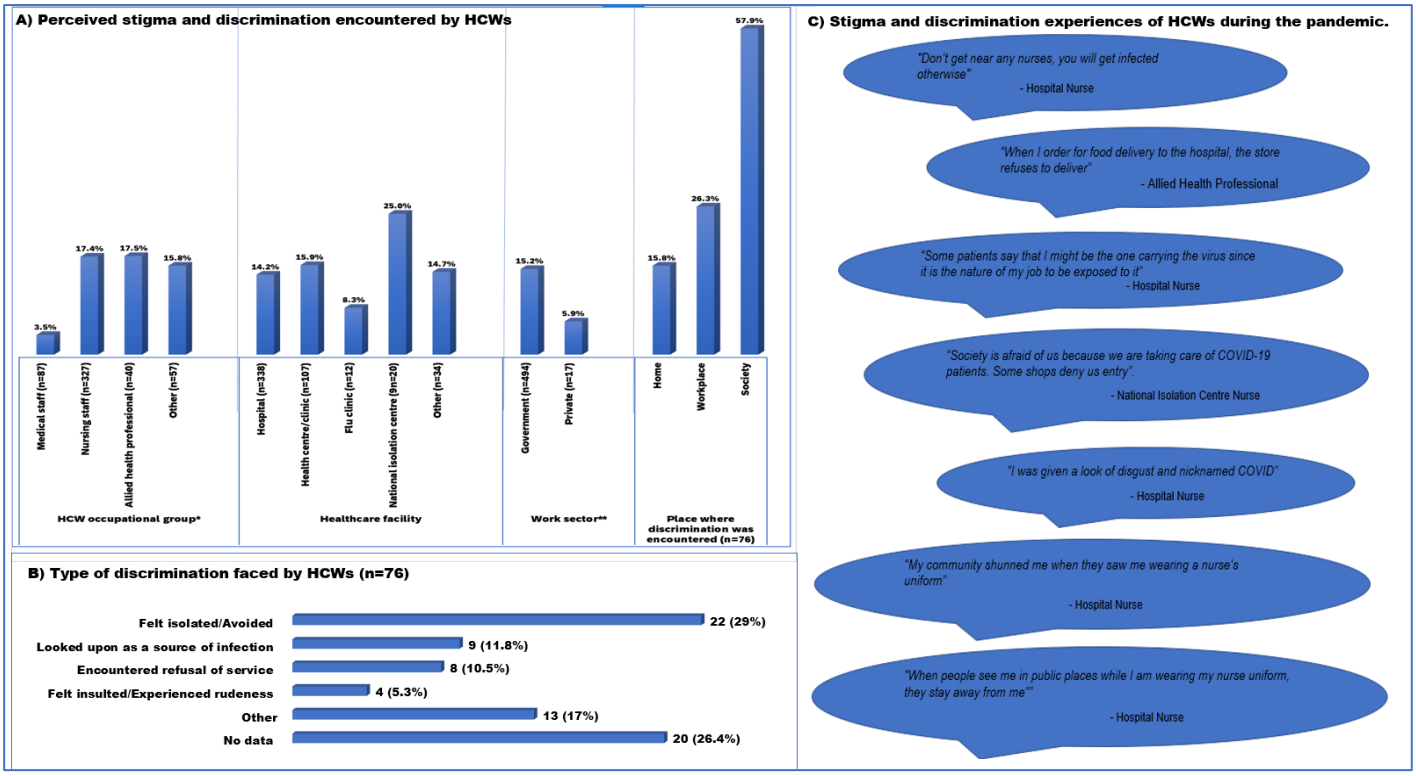


Figure 2. Perceived stigma and discrimination faced by health-care workers by workers' category, types of stigma and discrimination faced and some personal experiences during the COVID-19 pandemic, Brunei Darussalam

Bivariate analysis showed several statistically significant findings related to COVID-19 exposure. Higher-risk HCWs (doctors, nurses) and those working in higher-risk areas (isolation centres), involved in performing aerosol generating procedures (AGPs), working in the government sector, and living with family

or friends showed statistically significant work and non-work concerns as well as perceived impact (p<0.05). HCWs who faced stigma and discrimination due to COVID-19 had statistically significantly higher non-work concerns and perceived impact (p<0.01) (Fig. 3).

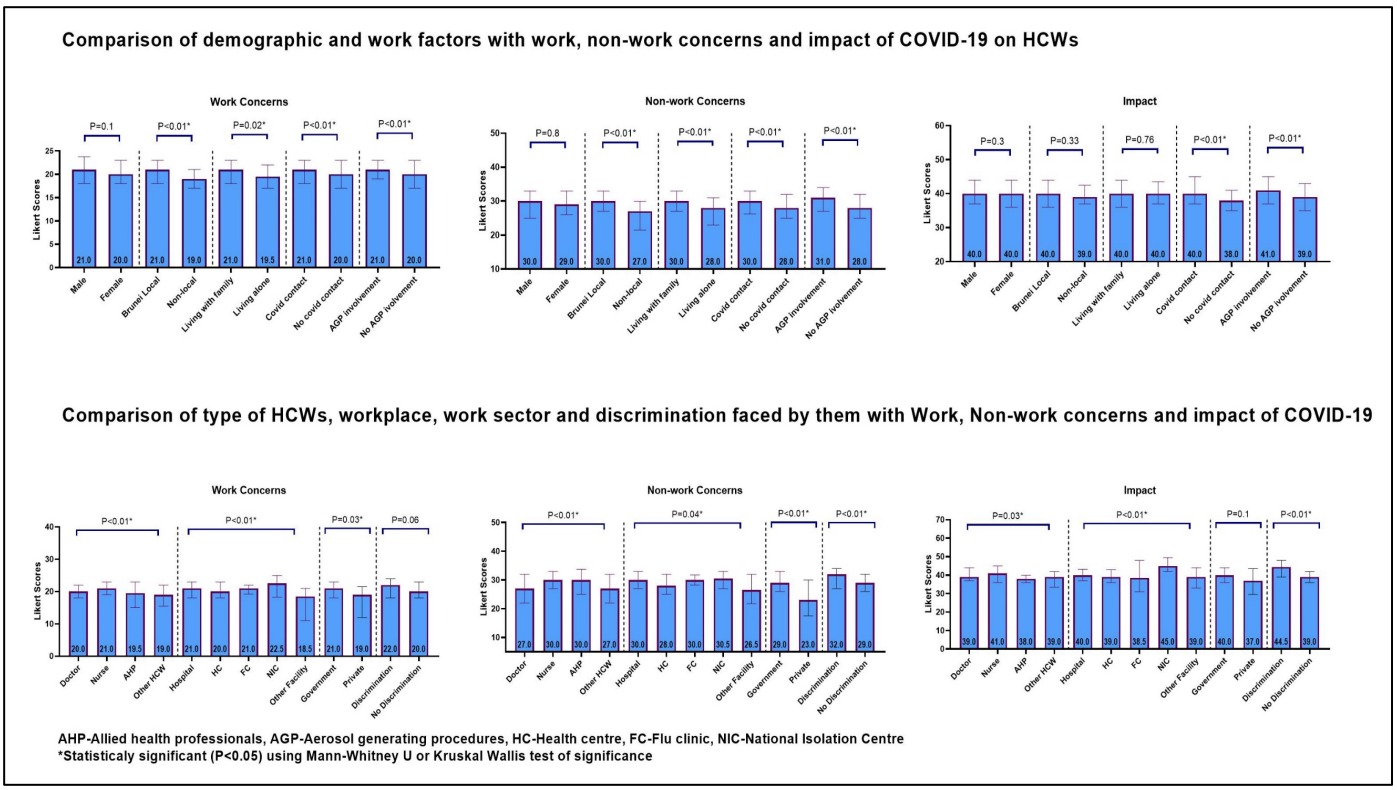


Figure 3. Comparison of Likert scores (median with IQR) of work and non-work concerns and impact with health-care workers' demographic and work factors, Brunei Darussalam

On multivariate analysis, the study findings showed that the odds of having perceived work concerns were statistically significantly higher among locals (OR: 2.75, p<0.001) and females (OR: 1.87, p=0.002), and in particular doctors (OR: 2.29, p=0.02) and nurses (OR: 2.47, p=0.003) who were working in either a hospital (OR: 3.22, p=0.002), health centre/clinic (OR: 3.82, p=0.001), or the National Isolation Centre (OR: 6.16, p=0.002), whereas the odds of having perceived non-work concerns were statistically significantly higher among local HCWs (OR: 2.14, p=0.007) who were living with family or friends (OR: 1.85, p=0.005), conducting AGPs (OR: 1.98, p<0.001), and those who had experienced discrimination (OR: 1.74, p=0.019). Perceived impact was higher among HCWs based at the isolation centre (OR: 4.44, p=0.006), those exposed to COVID-19 cases (OR: 1.86, p=0.001), and those who faced discrimination (OR: 4.57, p<0.001) (Table 2).

Table 2. Multivariate analysis of the impact of demographic and work factors, and stigma and discrimination on the work, non-work concerns and perceived impact of HCWs.

	Work Concerns		Non-Work Concerns		Perceived Impact	
	OR[1] (95% CI[2])	**P-value**	**OR[1] (95% CI[2])**	**P-value**	**OR[1] (95% CI[2])**	**P-value**
Age	0.99 (0.98 – 1.01)	0.659	0.99 (0.97 – 1.00)	0.806	0.98 (0.97 – 1.00)	0.078
Gender						
Female	1.87 (1.26 – 2.78)	0.002**	1.27 (0.87 – 1.87)	0.210	1.404 (0.96 – 2.04)	0.076
Male[#]						
Nationality						
Local	2.75 (1.61 – 4.70)	<0.001***	2.14 (1.23 – 3.72)	0.007**	1.17 (0.68 – 2.01)	0.563
Non-local[#]						
Living With						
Family/Friend	1.33 (0.83 – 2.12)	0.22	1.85 (1.20 – 2.85)	0.005*	0.92 (0.60 – 1.42)	0.722
Alone[#]						
Type of HCW						
Doctor	2.29 (1.14 – 4.61)	0.02*	0.60 (0.29 – 1.23)	0.168	1.17 (0.58 – 2.34)	0.647
Nurse	2.47 (1.37 – 4.48)	0.003**	1.70 (0.95 – 3.06)	0.07	1.49 (0.85 – 2.64)	0.149
AHP[3]	1.21 (0.57 – 2.59)	0.610	1.80(0.84 – 3.82)	0.12	0.89 (0.43 – 1.81)	0.756
Other[#]						
Workplace						
Hospital	3.22 (1.54 – 6.73)	0.002**	1.89 (0.94 – 3.82)	0.073	0.94 (0.46 – 1.94)	0.887
Health centre/clinic	3.82 (1.78 - 8.18)	0.001**	1.87 (0.91 – 3.86)	0.087	0.80 (0.38 – 1.67)	0.801
Flu clinic	2.92 (0.89 – 9.58)	0.076	1.42 (0.46 – 4.32)	0.533	0.43 (0.11 – 1.70)	0.234
N.Isolation Centre	6.16 (1.97 – 19.2)	0.002**	1.70 (0.57 – 5.03)	0.334	4.44 (1.53 – 12.8)	0.006*
Other[#]						
Work Sector						
Government	1.76 (0.69 – 4.47)	0.233	2.35 (0.85 – 6.50)	0.096	1.93 (0.73 – 5.07)	0.183
Private[#]						

	Work Concerns		Non-Work Concerns		Perceived Impact	
	OR[1] (95% CI[2])	**P-value**	**OR[1] (95% CI[2])**	**P-value**	**OR[1] (95% CI[2])**	**P-value**
Workplace exposure to COVID-19 cases						
Yes	1.25 (0.85-1.83)	0.245	1.22 (0.84-1.79)	0.289	1.86 (1.29-2.69)	0.001**
No[#]						
Involved in AGP						
Yes	1.21 (0.86 – 1.71)	0.260	1.98 (1.39 – 2.82)	<0.001***	1.05 (0.74 – 1.49)	0.752
No[#]						
Discrimination faced						
Yes	1.53 (0.95 – 2.48)	0.079	1.74 (1.09 – 2.79)	0.019*	4.57 (2.82 – 7.46)	<0.001***
No[#]						

*P<0.05, **P<0.01, ***P<0.001; [#]Reference; [1]OR=Odds ratio; [2]CI=Confidence interval; [3]AHP=Allied health professionals

DISCUSSION

This study provides critical evidence that HCWs in Brunei Darussalam during the first pandemic wave experienced high levels of both work-related (83.1% feared infection and 79.8% perceived their job as a risk for disease transmission) and non-work concerns (90.8% feared family transmission), with a significant impact on workload and mental well-being. On comparing these findings with other similar studies during the early pandemic, 69.5% of physicians in Italy reported that their job put them at risk of COVID-19 transmission, and 52.4% were concerned about getting infected, while in Egypt, 83.1% of HCWs reported fear of getting infected, and 89.2% considered their job put them at higher risk.[15,30] These findings indicate that even in low-burden settings, transmission-related pandemic stressors can substantially affect HCWs' occupational functioning and personal lives. Qualitative studies during the same period also highlighted that the fear of transmission and uncertainties of the evolving pandemic were major stressors among HCWSs.[31,32] Despite these concerns, only 12.3% reported unwillingness to care for COVID-19 cases and 2.2% considered leaving their job due to the risk. By comparison, studies from India and Pakistan which were carried out during their first wave of the pandemic in April 2020 and March–June 2020 respectively, showed that there was a higher proportion of HCWs who expressed unwillingness to care for COVID-19 cases (32.5% in India, and 99% in Pakistan) and a higher proportion considered leaving their job (9.2% in India, and 14.4% in Pakistan).[33,34] The relatively lower unwillingness to work (12.3%) and intention to leave (2.2%) in Brunei compared to India and Pakistan may reflect not only lower case burden but also Brunei's unique socio-cultural factors, including strong collectivist orientation, trust in government health systems, and adequate preparedness measures.[24,35,36] These findings suggest that the pandemic's impact on HCWs is mediated by both epidemiological burden and contextual sociocultural factors, highlighting that support strategies must be culturally specific rather than universally applied. The main non-work concerns reported by HCWs were transmission of infection to their family members (90.8%), friends (88.6%) and colleagues (87.2%), which showed similarity to a study from India, whereby HCWs were most concerned with transmission of infection to family (92.5%), friends (88.3%), and colleagues (89.2%).[33]

In our study, 45.5% of participating HCWs reported experiencing the brunt of staff shortages at their workplace, which was lower compared to that reported in a study in the United States during their Omicron variant wave in early 2022, whereby up to 64.7% of staff reported shortages in some of the states.[37] This may be due to the lower overall COVID-19 case burden in Brunei Darussalam compared to those of other countries.[25] Other issues faced by HCWs in this study, specifically higher workload (reported by 59.2%), having to work overtime (reported by 45%), and having to perform job roles other than their routine duties (reported by 62.8%), were comparable to a similar study among physicians in Italy, where 44.3% felt work overload and 40.9% had to perform tasks that they were not accustomed to doing otherwise.[15] A similar work overload was reported by HCWs in clinical roles (47.4%) in a study conducted in the United States. However, the intention to leave the job in that study was higher (32.1%) compared to 2.2% reported in our study.[38] Additionally, the perceived lack of societal appreciation was another key factor influencing HCWs' morale and mental health during the COVID-19 pandemic. In our study, 72.4% of HCWs reported feeling

appreciated by society, which was lower than that reported by HCWs in an Australian study (86.5%), which also reported that doctors and nurses felt less appreciated compared to other HCWs.[39]

Our findings showed that 14.9% of HCWs reported encountering stigma or discrimination, which was higher than those from a similar study carried out in Japan whereby 8.4% of participating HCWs faced some level of discrimination,[40] but lower than that reported in a study from India where more than 50% of participating HCWs from Anaesthesia and Critical Care departments of a tertiary care hospital faced mild to severe levels of stigma, this being likely due to their high-risk job roles and greater risk of exposure compared to other HCW occupational categories.[41]

In our study, HCWs who had occupational exposure to COVID-19, those working at the National Isolation Centre, and those involved in AGPs, reported greater work and non-work concerns, all of which can be attributed to the high risk of infection transmission when working in a facility that was treating confirmed cases of COVID-19, and the higher risk of virus aerosolization when performing AGPs.[42,43] The majority of HCWs (85.1%) in our study were living with family and/or friends, and therefore had increased work and non-work concerns due to perceived threat of transmission of infection to those residing with them. Multivariate analysis indicated that doctors, nurses, HCWs working in hospitals, health centres, and the National Isolation Centre had significantly higher odds of work concerns compared to other HCWs. Two systematic reviews by Cabarkapa et al. in 2020,[11] and Balai et al. in 2022 [44] also reported a greater psychological impact on nursing HCWs, specifically on fear of transmitting infection to family members, perceived stigma, increased work demands resulting in early fatigue, and the anxiety of acquiring the infection by having to work in close contact with COVID-19 cases. Beyond the exposure risk, early pandemic preparedness measures such as organisational restructuring, staff redeployment, evolving infection prevention and control (IPC) protocols and PPE uncertainties may have amplified the work-related concerns among frontline HCWs. Qualitative evidence from other studies has highlighted that these organisational measures contributed to anxiety and psychological burden among HCWs. Integrating timely risk communication, resource allocation, training, and structured psychological support into pandemic preparedness beyond the containment measures can help to mitigate such impacts.[32,45]

Multivariate analysis also indicated that stigma/discrimination was the strongest predictor of perceived impact (OR=4.57, $p<0.001$), suggesting that stigmatisation may have more harmful effects than occupational exposures themselves and warrants particular attention. The identified sources of discrimination (57.9% community, 26.3% workplace) indicate that interventions must target both public awareness campaigns and organisational culture. The qualitative responses of HCWs, such as “viewed as a source of infection” and “isolated,” demonstrate the profound social exclusion experienced, which likely compounds workplace stress and may ultimately affect workforce retention.

These findings have important implications for pandemic preparedness policies. First, frontline HCWs, especially doctors and nurses from high-risk settings such as hospitals, health centres, and isolation centres, should be prioritised for targeted organisational and psychological support. These include enhanced infection prevention and control measures, accessible psychological and peer support, consistent availability of personal protective equipment (PPE), timely communication, regular training and periodic physical and mental health

screening to improve preparedness and confidence. Second, adequate staffing must address the perceived staff shortages reported by 45.5% of HCWs to ensure fair workload distribution. Third, anti-stigma campaigns are essential to address the community discrimination experienced by 14.9% of HCWs.

STUDY LIMITATIONS

Several limitations warrant consideration. First, convenience sampling of HCWs presenting for screening introduces selection bias, potentially overestimating concerns among higher-risk groups; random sampling would improve generalizability. Additionally, the response rate of 51.7% is similar to typical online survey participation levels but may cause non-response bias, with a potential lower participation of HCWs who were overwhelmed by increased workloads and stress or those who were less affected and therefore less motivated to respond, which may have led to underestimation or overestimation of the reported concerns and impact and this needs to be considered while interpreting the findings. Second, the cross-sectional design prevents causal inference about relationships between variables. Third, the study questionnaire was adapted from an instrument used in comparable pandemic studies in a regional country and was pilot tested and checked for internal consistency using Cronbach's alpha; however, content validation and construct validity were not assessed. Fourth, low private sector participation (3.3%) limits representativeness. Fifth, data collection during the first wave with a low caseload (337 cases) means findings may not capture experiences during subsequent waves with a higher burden. Future longitudinal studies across all pandemic phases with probability sampling would yield more reliable evidence.

CONCLUSION

This study examines perceived work and non-work concerns as well as the impacts on HCWs during the first wave of COVID-19 in Brunei Darussalam. A high proportion of HCWs (79.8%) believed that their job placed them at high risk of disease transmission; however, this perception did not prevent them from fulfilling their duties as HCWs, with only 12.3% reporting feelings of unwillingness to manage COVID-19 cases, and 2.2% having considered leaving their job because of that risk. Non-work concerns focused mainly on fear of disease transmission to family members, friends, and colleagues. Front-line HCWs, such as medical and nursing staff working in hospitals and health centres, showed predominantly higher odds for work concerns, while HCWs working in the COVID-19 isolation facility exhibited higher odds of work concerns and impact, likely due to their greater occupational exposure risk. Regarding the pandemic's direct impact on themselves, 45.5% of HCWs experienced staff shortages, 59.2% reported an increased workload, 62.8% reported undertaking additional job roles, and 54.5% reported feeling stressed because of the clinical demands of the pandemic. The findings obtained highlight the need to provide continuous support, preparedness, and training for HCWs to protect their wellbeing in the workplace and to ensure resilience during such public health emergencies.

AUTHOR CONTRIBUTIONS

AT: Conceptualisation, Formal data analysis, Visualisation and Writing - original draft. AL: Conceptualisation, Project administration, Supervision and Writing - review and editing. MF: Data curation and Writing - review and editing. NI: Data curation and Writing - review and

editing. RT: Writing - review and editing. RS: Writing - review and editing. KNW: Writing - review and editing

ETHICAL CONSIDERATION

The study was approved by the Medical and Health Research and Ethics Committee, Ministry of Health [Ref. No. MHREC/MOH/2020/7(1) dated 30 June 2020].

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

REFERENCES

1. World Health Organization. Statement on the fifteenth meeting of the IHR (2005) Emergency Committee on the COVID-19 pandemic [Internet]. [Cited 2024 Oct 25]. Available from: https://www.who.int/news/item/05-05-2023-statement-on-the-fifteenth-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-coronavirus-disease-(covid-19)-pandemic
2. World Health Organization. COVID-19 weekly epidemiological update, edition 147, 15 June 2023 [Internet]. [cited 2024 Oct 25]. Available from: https://iris.who.int/handle/10665/369375
3. Occupational Safety and Health Administration. Pandemic influenza preparedness and response guidance for healthcare workers and healthcare employers [Internet]. [Cited 2024 Sep 20]. Available from: https://www.osha.gov/sites/default/files/publications/OSHA_pandemic_health.pdf
4. Voo TC, Capps B. Influenza pandemic and the duties of healthcare professionals. Singapore Med J 2010;51(4):275-81. PMID:20505904
5. World Health Organization. COVID-19: occupational health and safety for health workers: interim guidance, 2 February 2021 [Internet]. [Cited 2024 Sep 20]. Available from: https://iris.who.int/handle/10665/339151
6. Shaukat N, Ali DM, Razzak J. Physical and mental health impacts of COVID-19 on healthcare workers: a scoping review. Int J Emerg Med 2020;13(1):40. https://doi.org/10.1186/s12245-020-00299-5.
7. World Health Organization. The impact of COVID-19 on health and care workers: a closer look at deaths [Internet]. [Cited 2024 Oct 18]. Available from: https://iris.who.int/handle/10665/345300
8. Oksanen L, Sanmark E, Oksanen S, Anttila V, Paterno J, Lappalainen M, et al. Sources of healthcare workers' COVID-19 infections and related safety guidelines. Int J Occup Med Environ Health 2021;34(2):239-49. https://doi.org/10.13075/ijomeh.1896.01741
9. Burrer SL, De Perio MA, Hughes MM, Kuhar DT, Luckhaupt SE, McDaniel CJ, et al. Characteristics of health care personnel with COVID-19 — United States, February 12–April 9, 2020. MMWR Morb Mortal Wkly Rep 2020;69(15):477-81. https://doi.org/10.15585/mmwr.mm6915e6 PMID:32298331
10. Sorokin MY, Kasyanov ED, Rukavishnikov GV, Makarevich OV, Neznanov NG, Morozov PV, et al. Stress and stigmatization in health-care workers during the COVID-19 pandemic. Indian J Psychiatry 2020;62(9):445.

https://doi.org/10.4103/psychiatry.indianjpsychiatry_870_20
11. Cabarkapa S, Nadjidai SE, Murgier J, Ng CH. The psychological impact of COVID-19 and other viral epidemics on frontline healthcare workers and ways to address it: a rapid systematic review. Brain Behav Immun Health 2020;8:100144. https://doi.org/10.1016/j.bbih.2020.100144
12. Cheong SK, Wong TY, Lee HY, Fong YT, Tan BY, Koh GC, et al. Concerns and preparedness for an avian influenza pandemic: a comparison between community hospital and tertiary hospital healthcare workers. Ind Health 2007;45(5):653-61. https://doi.org/10.2486/indhealth.45.653
13. Ives JCS, Greenfield S, Parry JM, Draper H, Gratus C, Petts JI, et al. Healthcare workers' attitudes to working during pandemic influenza: a qualitative study. BMC Public Health 2009;9(1):56. https://doi.org/10.1186/1471-2458-9-56
14. Al-Hunaishi W, Hoe VC, Chinna K. Factors associated with healthcare workers' willingness to participate in disasters: a cross-sectional study in Sana'a, Yemen. BMJ Open 2019;9(10):e030547. https://doi.org/10.1136/bmjopen-2019-030547
15. Portoghese I, Meloni F, Galletta M, Piras I, D'Aloja E, Finco G, et al. Concerns, perceived impact, preparedness in coronavirus disease (COVID-19) pandemic and health outcomes among Italian physicians: a cross-sectional study. J Prim Care Community Health 2021;12:215013272110002. https://doi.org/10.1177/21501327211000245
16. Sahashi Y, Endo H, Sugimoto T, Nabeta T, Nishizaki K, Kikuchi A, et al. Worries and concerns among healthcare workers during the coronavirus 2019 pandemic: a web-based cross-sectional survey. Humanit Soc Sci Commun 2021;8:41. https://doi.org/10.1057/s41599-021-00716-x
17. Billings J, Ching BCF, Gkofa V, Greene T, Bloomfield M. Experiences of frontline healthcare workers and their views about support during COVID-19 and previous pandemics: a systematic review and qualitative meta-synthesis. BMC Health Serv Res 2021;21(1):547. https://doi.org/10.1186/s12913-021-06917-z
18. Department of Economic Planning and Statistics, Ministry of Finance and Economy. Report of the mid-year population estimates. Bandar Seri Begawan: Ministry of Finance and Economy; 2019 [Internet]. [cited 2024 Oct 15]. Available from: http://www.deps.gov.bn/DEPD%20Documents%20Library/DOS/POP/2019/Rep_MidYr_2019.pdf
19. Ministry of Health, Brunei Darussalam. Health information booklet [Internet]. [cited 2024 Oct 17]. Available from: https://web.archive.org/web/20191114162358/http://www.moh.gov.bn/Downloadables/Health%20Information%20Bookler%202017%20(revised%20as%20of%20January%202019).pdf
20. Ministry of Health, Brunei Darussalam. Press release on the current situation of the COVID-19 infection in Brunei Darussalam [Internet]. [cited 2024 Oct 15]. Available from: https://web.archive.org/web/20210801193310/http://www.moh.gov.bn/Lists/Latest%20news/NewDispForm.aspx?ID=970
21. Ministry of Health, Brunei Darussalam. Media statement on the current situation of the COVID-19 in Brunei Darussalam [Internet]. [cited 2024 Oct 15]. Available from: https://web.archive.org/web/20220203141635/http://www.moh.gov.bn/Lists/Latest%20news/NewDispForm.aspx?ID=1157

22. Ministry of Health, Brunei Darussalam. Media statement on the current situation of the COVID-19 in Brunei Darussalam [Internet]. [cited 2024 Oct 15]. Available from: https://web.archive.org/web/20220620234119/https://www.moh.gov.bn/Lists/Latest%20news/NewDispForm.aspx?ID=1277
23. World Health Organization. WHO COVID-19 dashboard: Brunei Darussalam [Internet]. [cited 2024 Oct 17]. Available from: https://data.who.int/dashboards/covid19/cases?m49=096&n=c
24. Trivedi A, Fontelera M, Ishak N, Lai A, Win KN, Ismail K, et al. Healthcare workers' preparedness and response during COVID-19 pandemic. Proc Singapore Healthc 2021;31:201010582110507. https://doi.org/10.1177/20101058211050752
25. Trivedi A, Fontelera M, Lai A. SARS-COV-2 screening of health care workers in Brunei Darussalam. Workplace Health Saf 2022;70(10):452-8. https://doi.org/10.1177/21650799211062802
26. Morgantini LA, Naha U, Wang H, Francavilla S, Acar Ö, Flores JM, et al. Factors contributing to healthcare professional burnout during the COVID-19 pandemic: A rapid turnaround global survey. PLoS One 2020;15(9):e0238217. https://doi.org/10.1371/journal.pone.0238217
27. Xiao H, Zhang Y, Kong D, Li S, Yang N. 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 2020;26:e923549. https://doi.org/10.12659/MSM.923549
28. Guilbert JJ, editor. Chapter 1: Health workers: a global profile. In: The World Health Report 2006: working together for health. Geneva: World Health Organization; 2006:1-17 [cited 2024 Oct 16]. Available from: https://iris.who.int/bitstream/handle/10665/43432/9241563176_eng.pdf
29. Koh D, Lim MK, Chia SE, Ko SM, Qian F, Ng V, et al. Risk perception and impact of severe acute respiratory syndrome (SARS) on work and personal lives of healthcare workers in Singapore. Med Care 2005;43(7):676-82. https://doi.org/10.1097/01.mlr.0000167181.36730.cc
30. Abdel Wahed WY, Hefzy EM, Ahmed MI, Hamed NS. Assessment of knowledge, attitudes, and perception of health care workers regarding COVID-19: a cross-sectional study from Egypt. J Community Health 2020;45(6):1242-51. https://doi.org/10.1007/s10900-020- 008 82-0
31. Rango-Martinez G, Sarmiento LB, Forero IC, Carreno LC, Cadena-Camargo Y. Fear of the unknown: experience of frontline healthcare workers with coping strategies used to face the COVID-19 pandemic. PLOS Glob Public Health 2024;4(8):e0003373. https://doi.org/10.1371/journal.pgph.0003373
32. Rücker F, Hårdstedt M, Rücker SCM, Aspelin E, Smirnoff A, Lindblom A, Gustavsson C. From chaos to control – experiences of healthcare workers during the early phase of the COVID-19 pandemic: a focus group study. BMC Health Serv Res 2021;21(1):1219. https://doi.org/10.1186/s12913-021-07248-9
33. Ranjan S, Saurabh K. Preparedness, perceived impact and concerns of health care workers in a teaching hospital during coronavirus disease 2019 (COVID-19). J Family Med Prim Care 2020;9(8):4247. https://doi.org/10.4103/jfmpc.jfmpc_799_20
34. Chaudhary FA, Ahmad B, Ahmad P, Khalid MD, Butt DQ, Khan SQ. Concerns, perceived impact, and preparedness of oral healthcare workers in their working environment during COVID-19 pandemic. J Occup Health

2020;62(1):e12168. https://doi.org/10.1002/1348-9585.12168
35. Wong J, Koh WC, Alikhan MF, Abdul Aziz ABZ, Naing L. Responding to COVID-19 in Brunei Darussalam: Lessons for small countries. J Glob Health 2020;10(1):010363. https://doi.org/10.7189/jogh.10.010363
36. Tarip I, Ashari Z. Whole-of-Nation moral learning by spiritual hearts: A case of Brunei's transformation to tackle the COVID-19 pandemic. J Relig Health 2023;62:1431–1448. https://doi.org/10.1007/s10943-023-01758-y
37. Chervoni-Knapp T. The staffing shortage pandemic. J Radiol Nurs 2022; 41(2):74-5. https://doi.org/10.1016/j.jradnu.2022.02.007
38. Rotenstein LS, Brown R, Sinsky C, Linzer M. The association of work overload with burnout and intent to leave the job across the healthcare workforce during COVID-19. J Gen Intern Med 2023;38(8):1920-7. https://doi.org/10.1007/s11606-023-08153-z
39. Smallwood N, Pascoe A, Karimi L, Willis K. Moral distress and perceived community views are associated with mental health symptoms in frontline health workers during the COVID-19 pandemic. Int J Environ Res Public Health 2021;18(16):8723. https://doi.org/10.3390/ijerph18168723
40. Shrestha RM, Inoue Y, Yamamoto S, Fukunaga A, Sampei M, Okubo R, et al. The association between experience of COVID-19-related discrimination and psychological distress among healthcare workers for six national medical research centers in Japan. Soc Psychiatry Psychiatr Epidemiol 2023; 58(9):1421-9. https://doi.org/10.1007/s00127-023-02460-w
41. Jain S, Das AK, Talwar V, Kishore J, Heena, Ganapathy U. Social stigma of COVID-19 experienced by frontline healthcare workers of Department of Anaesthesia and Critical Care of a tertiary healthcare institution in Delhi. Indian J Crit Care Med 2021;25(11): 1241-6. https://doi.org/10.5005/jp-journals-10071-24008
42. Leal J, Farkas B, Mastikhina L, Flanagan J, Skidmore B, Salmon C, et al. Risk of transmission of respiratory viruses during aerosol-generating medical procedures (AGMPs) revisited in the COVID-19 pandemic: a systematic review. Antimicrob Resist Infect Control 2022;11(1). https://doi.org/10.1186/s13756-022-01133-8
43. Vythilingam S, Quint M, Newsom R, Hicks A. The use of aerosol generating procedures (AGPs) during the COVID-19 pandemic in the diagnosis of lung cancer: a narrative review. Mediastinum 2021;5:29. https://doi.org/10.21037/med-21-16
44. Balai MK, Avasthi RD, Va R, Jonwal A. Psychological impacts among health care personnel during COVID-19 pandemic: a systematic review. J Caring Sci 2022;11(2):118-25. https://doi.org/10.34172/jcs.2022.14
45. Orhierhor M, Pringle W, Halperin D, et al. Lessons learned from the experiences and perspectives of frontline healthcare workers on the COVID-19 response: a qualitative descriptive study. BMC Health Serv Res 2023;23:1074. https://doi.org/10.1186/s12913-023-10062-0