INTRODUCTION

On 11 March 2020, coronavirus disease 2019 (COVID-19) was declared a pandemic by the World Health Organization. Even as nations worldwide initiated lockdowns to flatten the curves, the pandemic has brought unprecedented challenges to healthcare workers (HCWs) in hospitals treating COVID-19 patients. Initial studies reported nurses (compared to doctors) to be at higher risk for anxiety and depression in China\(^1\) and non-medical HCWs (compared to doctors and nurses) to be at higher risk for anxiety in Singapore.\(^2\) Frontline HCWs were also found to be at higher risk for psychological morbidity\(^1\) as compared to those who were not engaged in direct care of suspected or confirmed cases. However, less is known about how lockdowns, prior experience with infectious disease outbreaks and job-related perceptions affect HCW psychological outcomes. Understanding these factors can help shape a healthcare system’s disaster or pandemic response.

We initiated a longitudinal study to prospectively assess job-related burnout and psychological outcomes of HCWs from a large public hospital in Singapore. We present the baseline findings (i.e., one timepoint) gathered between 12 March 2020 and 21 April 2020, during which the government instituted the ‘circuit breaker’, a nationwide partial lockdown. The study was conducted in the third month after the first COVID-19 case was confirmed in Singapore . Our primary aim was to examine rates of burnout, anxiety and depression among HCWs. Our secondary aim was to examine the psychological health impact of the following factors: initiation of the circuit breaker, occupational characteristics (occupation, degree of job exposure to COVID-19, job redeployment), history of being an HCW during the 2003 severe acute respiratory syndrome (SARS) outbreak and HCW perceptions about their jobs (perceived job risk, perceived clarity of work protocols).

METHODS

Doctors, nurses, allied health professionals, and administrative and operations staff from a tertiary, COVID-19-treating public hospital with a 1,785-bed capacity were invited through work email and/or staff portals to participate in the study. Participants completed the baseline online survey in English, either through a web link or by scanning a QR code. The study was approved by the National University of Singapore institutional review board (IRB) (S-20-081) and exempted from review by the SingHealth Centralised IRB (2020/2160).

To maximise the response rates, the study utilised the following brief but validated and widely used screening measures: a one-item burnout question from the physician work life scale, where a score ≥3 indicates symptoms of burnout;\(^3\) the generalised anxiety disorder-7, where a threshold score ≥10 indicates anxiety;\(^4\) and the patient health questionnaire-2, where a threshold score ≥3 indicates depression.\(^5\) Perceived job risk was assessed using the item ‘I feel that my job puts me at great risk of exposure to COVID-19’, where responses ranged from ‘strongly agree’ to ‘strongly disagree’ on a 6-point scale, which was later recoded into a binary variable (high risk vs. low risk).\(^6\) Perceived clarity of protocols was assessed using an adapted item ‘The policies and protocols have been clear and easy to follow’, with the response options ‘yes’, ‘no’ and ‘neutral’.\(^7\) Presence of chronic health condition was assessed by the question ‘In your lifetime, have you ever been diagnosed by a physician as having a chronic disease or medical condition?’, with the response options ‘yes’, ‘no’ and ‘neutral’.

Descriptive statistics of the sample characteristics and outcomes of interest were tabulated. Our sample profile (i.e. age, gender, ethnicity, occupation) was similar to that of the hospital, except that the nurses were overrepresented and other HCWs underrepresented. Consequently, analyses that involved all occupations were weighted by occupation to represent the hospital profile. To

Figure 1: Graph shows the survey period in relation to the COVID-19 pandemic in Singapore. [Graph is generated through Our World In Data (https://ourworldindata.org/), with raw data sourced from the European Centre for Disease Prevention and Control].

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examine the risk factors, multivariable logistic regression analyses were conducted adjusting for age, gender, ethnicity and chronic health condition. The variable ‘initiation of the circuit breaker’ was derived by coding participants into binary groups according to when they completed the survey: pre-circuit breaker versus during circuit breaker. Data analysis was done using Stata version 15.0 (StataCorp LP, College Station, TX, USA).

RESULTS
A total of 1,410 HCWs (15% doctors, 58% nurses, 27% others) completed the survey. It was estimated that 23%, 13% and 10% of the study population experienced symptoms of burnout, anxiety and depression, respectively. Nurses reported the highest burnout, anxiety and depression rates, followed by other HCWs and doctors [Table 1]. Compared to HCWs who found that work policies and protocols were clear, HCWs who found them to be unclear reported higher rates of burnout (odds ratio [OR] 4.86, 95% confidence interval [CI] 2.57–9.21), anxiety (OR 3.75, 95% CI 1.89–7.43) and depression (OR 4.06, 95% CI 1.99–8.29). Compared to doctors, nurses reported higher rates of burnout (OR 1.96, 95% CI 1.19–3.21) and depression (OR 2.08, 95% CI 1.00–4.29). HCWs who worked during the SARS outbreak (OR 2.09, 95% CI 1.18–3.70) or perceived their job to be at high risk (OR 1.68, 95% CI 1.08–2.62) reported higher rates of anxiety than HCWs who did not. Initiation of the circuit breaker, degree of job exposure to suspected or confirmed COVID-19 cases and being redeployed were not associated with burnout, anxiety or depression (\( P > 0.05 \)) [Table 2].

### Table 1. Healthcare worker characteristics, psychological morbidity and perceptions.

| Variable                                      | Mean±SD/\(n\) (%) | Doctors (\(n = 204\)) | Nurses (\(n = 822\)) | Others\(^a\) (\(n = 384\)) | Total\(^b\) (\(n = 1,410\)) |
|-----------------------------------------------|--------------------|------------------------|-----------------------|----------------------------|-----------------------------|
| Age (yr)                                      | 37.1±9.9           | 34.6±10.3              | 37.5±11.6             | 35.8±10.6                  |
| Gender                                        |                    |                        |                       |                            |
| Female                                        | 97 (48)            | 702 (85)               | 280 (73)              | 1079 (77)                  |
| Ethnicity                                     |                    |                        |                       |                            |
| Chinese                                       | 174 (85)           | 400 (49)               | 286 (75)              | 860 (61)                   |
| Indian                                        | 19 (9)             | 85 (10)                | 27 (7)                | 131 (9)                    |
| Malay                                         | 1 (0)              | 194 (24)               | 36 (9)                | 231 (16)                   |
| Others\(^a\)                                  | 10 (5)             | 143 (17)               | 35 (9)                | 188 (13)                   |
| Chronic health condition(s)                   |                    |                        |                       |                            |
| Daily                                         | 38 (19)            | 217 (26)               | 43 (11)               | 298 (21)                   |
| Occasionally                                  | 129 (63)           | 397 (48)               | 94 (24)               | 620 (44)                   |
| Not at all                                    | 37 (18)            | 208 (25)               | 247 (64)              | 492 (35)                   |
| Job redeployment due to COVID-19              | 23 (11)            | 65 (8)                 | 47 (12)               | 135 (10)                   |
| Responded before circuit breaker              | 189 (93)           | 574 (70)               | 193 (50)              | 956 (68)                   |
| Burnout\(^c\)                                 | 1.99±0.69          | 2.19±0.82              | 2.19±0.82             | 2.12±0.80                  |
| Anxiety\(^d\)                                 | 4.56±4.22          | 4.99±4.58              | 4.99±4.58             | 4.88±4.48                  |
| Depression\(^e\)                              | 0.84±1.16          | 1.09±1.31              | 0.98±1.28             | 1.02±1.29                  |
| Perceived job risk                            |                    |                        |                       |                            |
| High                                          | 148 (73)           | 648 (79)               | 202 (53)              | 929 (66)                   |
| Low                                           | 56 (27)            | 174 (21)               | 182 (47)              | 481 (34)                   |
| Perceived clarity of work protocols           |                    |                        |                       |                            |
| Clear                                         | 121 (59)           | 540 (66)               | 261 (68)              | 930 (66)                   |
| Neutral                                       | 68 (33)            | 257 (31)               | 104 (27)              | 417 (30)                   |
| Not clear                                     | 15 (7)             | 25 (3)                 | 19 (5)                | 63 (4)                     |

Percentages may not add up to 100% due to rounding. \(^a\)Includes allied health professionals, pharmacists, administrative staff and operations staff. \(^b\)Weighted total for burnout, anxiety, depression, perceived job risk and perceived clarity of work protocols. \(^c\)Assessed using the one burnout item in the physician work life scale, where a score ≥3 indicates burnout. \(^d\)Assessed using the generalised anxiety disorder-7 scale, where a score ≥10 indicates moderate anxiety. \(^e\)Assessed using the patient health questionnaire-2, where a score ≥3 indicates symptoms of depression. SARS: severe acute respiratory syndrome, SD: standard deviation.
TABLE 2. Predictors of burnout, anxiety and depression (N=1,140).

| Variable                                      | Burnout | Anxiety | Depression |
|-----------------------------------------------|---------|---------|------------|
| **Initiation of CB (ref: pre-CB)**            |         |         |            |
| During CB                                    | 0.98 (0.70–1.36) | 1.17 (0.78–1.75) | 1.05 (0.66–1.66) |
| **Occupational characteristic**              |         |         |            |
| Occupation (ref: doctor)                     |         |         |            |
| Nurse                                        | 1.96 (1.19–3.21)† | 1.11 (0.61–2.00) | 2.08 (1.00–4.29)* |
| Others                                       | 1.63 (0.96–2.79) | 1.29 (0.69–2.44) | 2.08 (0.93–4.64) |
| Job exposure (ref: none)                     |         |         |            |
| Daily                                        | 1.26 (0.82–1.92) | 1.01 (0.59–1.72) | 1.23 (0.66–2.29) |
| Occasionally                                 | 1.07 (0.76–1.50) | 0.98 (0.64–1.48) | 1.14 (0.72–1.83) |
| Job redeployment                             | 1.11 (0.69–1.79) | 1.31 (0.74–2.32) | 1.06 (0.56–2.02) |
| Healthcare worker during SARS                | 1.06 (0.65–1.74) | 2.09 (1.18–3.70)* | 1.55 (0.73–3.29) |
| **Healthcare worker perception**             |         |         |            |
| Perceive job to be risky                     | 1.05 (0.75–1.46) | 1.68 (1.08–2.62)* | 1.23 (0.78–1.95) |
| Clarity of work protocols (ref: clear)       |         |         |            |
| Not clear                                    | 4.86 (2.57–9.21)† | 3.75 (1.89–7.43)† | 4.06 (1.99–8.29)† |
| Neutral                                      | 2.12 (1.57–2.87)† | 1.63 (1.12–2.37)* | 1.91 (1.26–2.89)† |

Analyses were weighted by occupation and adjusted for age, gender, ethnicity and chronic health condition. *P<0.05. †P<0.01. CB: circuit breaker, CI: confidence interval, Ref: reference group, SARS: severe acute respiratory syndrome

**DISCUSSION**

Psychological morbidity rates of Singapore HCWs were comparable to published samples from China and Singapore during the early stages of the COVID-19 pandemic. For instance, the rates of anxiety using the same measure indicated less than 2% difference for doctors (our sample 10% vs. Lai et al. 11.6%) and nurses (our sample 14% vs. Lai et al. 12.7%). Rates of job burnout, anxiety and depression in our sample also remained stable after initiation of the circuit breaker. Nevertheless, it is important to interpret our findings in the context of a defined HCW population and timing of the study. For instance, our prevalence rates of anxiety are lower compared to those of a local study using the same anxiety measure, but conducted specifically with laboratory HCWs who were exposed to blood samples that included confirmed or suspected severe acute respiratory syndrome coronavirus 2 and who were surveyed towards the end of the circuit breaker period (our sample 10% vs. Teo et al. 24.3%). Taken together, it will be important to continue monitoring these psychological outcomes, as the long-term nature of the pandemic and vigilance towards subsequent wave outbreaks may take its toll on HCWs. In turn, the quality of patient care delivery and safety may be affected.

Being a nurse, having worked as an HCW during the 2003 SARS outbreak and perceiving high job risk were associated with poorer mental health. Nurses have previously been shown to report higher psychological morbidity as compared to doctors, potentially because of their close, frequent contact with patients and less experience in dealing with infectious diseases. The SARS outbreak in 2003 had left a deep impression on HCWs and the healthcare system in Singapore, and this is evidenced by reports of higher anxiety among HCWs who had experienced SARS. It was noted that perception of job risk, rather than more objective job characteristics (i.e. job redeployment, exposure to suspected/confirmed cases), was associated with anxiety. This finding underscores that healthcare systems that are keen on addressing HCW anxiety first need to understand their staff’s perspectives and perception of risks.

The percentage of HCWs who found the work policies and protocols to be unclear is small in our sample; however, it is striking that the lack of clarity is associated with close to five-fold the rate of burnout and four-fold the rates of anxiety and depression. Dissemination of new work protocols during a time of crisis can be challenging, especially when they are frequently modified due to rapidly changing pandemic conditions and evolving knowledge of the disease. Our findings suggest that clear communication of new/changed work protocols to HCWs (and/or assessing whether they are well understood) can potentially reduce some of the negative outcomes experienced.

There are limitations to the study. Our hospital system is large, and the response rate (16%) may not reflect the majority of our HCW population; we dealt with this by using weighted analyses. Our cross-sectional examination of the baseline data also makes it difficult to draw causal conclusions. Although our measurement tools are validated, they are short to facilitate assessment over time and mitigate survey fatigue; for instance, we used a one-item burnout question. However, we believe our findings offer information that is useful for healthcare systems to consider in shaping their disaster and pandemic response and supporting their healthcare workforce during this extraordinary time.
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Conflicts of interest

There are no conflicts of interest.

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