

# Psychological impact of repeated epidemic exposure on healthcare workers: findings from an online survey of a healthcare workforce exposed to both SARS (severe acute respiratory syndrome) and COVID-19

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# BMJ Open Psychological impact of repeated epidemic exposure on healthcare workers: findings from an online survey of a healthcare workforce exposed to both SARS (severe acute respiratory syndrome) and COVID-19

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## ABSTRACT

**Objective** To measure the psychological well-being of healthcare workers (HCWs) during this COVID-19 pandemic and examine the experiences of the subgroup of participants who were also HCWs during the 2003 SARS epidemic.

**Design** Anonymous online survey adapted from a similar study conducted during the SARS epidemic, disseminated from July 2020 to August 2020.

**Setting** Nine healthcare institutions across Singapore ranging from primary care, community care, tertiary care and specialised referral centres.

**Participants** Employees working in the participating healthcare institutions.

**Results** Of 3828 survey returns, 3616 had at least one completed item on the questionnaire. Majority were female (74.7%), nurses (51.7%), foreign-born (53.2%) and not working in the tertiary care setting (52.1%). The median score on the Impact of Events Scale (IES) was 15 (IQR 23) and 28.2% of the sample scored in the moderate/severe range. 22.7% of the participants were also HCWs during SARS and more than half of them felt safer and better equipped in the current pandemic. 25.2% of SARS HCWs and 25.9% of non-SARS HCWs had moderate/severe IES scores ( $p=0.904$ ). After adjusting for age, marital status, parity and length of work experience, racial minority groups and living apart from family were independent predictors of high IES regardless of prior SARS epidemic experience. Daily exposure to confirmed or suspect COVID-19 cases increased the odds of high IES for non-SARS HCWs only.

**Conclusions and relevance** Overall, while 28% of HCWs in our study suffered from significant trauma-related psychological symptoms regardless of prior experience with the SARS epidemic, those with prior experience reported feeling safer and better equipped, finding the workload easier to manage, as well as having more confidence in their healthcare leaders. We recommend for more trauma-informed support strategies for our HCWs

## Strengths and limitations of this study

- A strength of this study is its novelty and the future applications of the findings to aid the mental resilience and wellness of healthcare workers exposed to multiple healthcare crises.
- Another strength of the study is its large and diverse cohort spanning nine healthcare institutes ranging from primary to tertiary care in Singapore, which allows for good external validity within the country's healthcare system.
- Additionally, the questionnaire was directly developed from a previous study on healthcare workers in Singapore during the SARS epidemic, allowing for direct comparison of the two healthcare crises.
- One limitation of study was that the Impact of Events Scale-Revised scale and other scales that measured depression/anxiety levels, personality and resilience factors were not used, reducing the comparability of the results with those from other studies.

especially those from racial minority groups, who are foreign-born and isolated from their families.

## INTRODUCTION

A major healthcare challenge of our time is undoubtedly emerging infectious disease epidemics and pandemics. Healthcare workers (HCWs) are indispensable in the response to such crises and are hence placed in a position of medical and psychological risks. Protecting HCWs from such risks and enhancing their resilience is vital in keeping healthcare systems robust and intact for effective crisis response.



Singapore is no stranger to such crises. One of the most well documented is that of the 2003 SARS epidemic that lasted from 12 March to 4 June, resulting in 238 cases (42% of which were HCWs) and 33 deaths, of which five were HCWs. Towards the end of that epidemic, Koh *et al* studied risk perception and impact on personal and work lives of 15 000 HCWs from nine healthcare institutions in Singapore, and found that a majority perceived great personal risk of falling ill but accepted it, and that more than half experienced increased anxiety, work stress, workload, and social stigmatisation.<sup>1</sup> Another single-site local study by Chan and Huak found that 27% of HCWs surveyed had significant emotional distress with 20% reporting the possible presence of post-traumatic stress disorder.<sup>2</sup> A similar study in Hong Kong repeated psychological measures among HCWs 1 year after the peak of the epidemic and found that HCWs from high-risk areas had higher and sustained levels of perceived stress that was associated with higher levels of depression, anxiety and post-traumatic stress as compared with HCWs from low-risk areas.<sup>3</sup> This and several other studies from localities similarly affected by SARS<sup>4-7</sup> identified risk factors such as job stress, social isolation and maladaptive coping; and protective factors such as strong social support, perceived adequacy of training and positive coping styles, which led to the development of staff training and psychological wellness plans for outbreak preparedness.

All hospitals implemented mandatory structured training for all front-line HCWs in the use of personal protective equipment (PPE) with documentation of N95 mask fitting in employee records. Peer support programmes which included crisis hotlines for staff and access to early intervention were also implemented in each hospital. Post-SARS, Singapore had also purposefully built a National Centre for Infectious Diseases (NCID) to strengthen the country's capabilities in infectious disease management and prevention that became operational in May 2019. All these were put to the test during the current COVID-19 pandemic. A systematic review and meta-analysis of studies reporting psychological symptoms among HCWs at the front line of this pandemic published up to April 2020 showed that almost a quarter of HCWs surveyed exhibited depressive and anxious symptoms, and insomnia was prevalent in almost 40%.<sup>8</sup>

Healthcare in Singapore relies heavily on foreign HCW with about a third of the nurses being foreign nationals who hold temporary worker status. This study aimed to examine the psychological well-being and risk perception of the local HCW population during the COVID-19 pandemic. It was adapted from Koh *et al*'s survey done in 2003 to enable a general comparison between the two survey cohorts.<sup>1</sup> This study also aimed to examine the experiences of the COVID-19 pandemic as compared with the SARS epidemic among a subgroup of respondents who were also working in healthcare during the 2003 SARS epidemic, hypothesising that HCWs who had experienced the SARS outbreak would be more resilient. We believe that this is the first study with such an aim and methodology. We hope to identify characteristics

of both distressed and non-distressed HCWs who were also involved in Singapore's response to the SARS epidemic; this may help to inform strategies to boost the resilience of HCWs and prevent burnout and other psychological and psychiatric morbidity.

## METHODS

Nine major healthcare institutions spanning from primary care, intermediate and long-term care (ILTC) to tertiary care participated in the anonymous, online survey that was disseminated by email blasts, recruitment posters with QR codes linked to the survey, and secure workplace messaging systems from mid-July to mid-August 2020. This was about 6 months after the first confirmed case in Singapore and about 1 month after the gradual cessation of the nationwide 'Circuit Breaker' lockdown period.<sup>9</sup> These included Tan Tock Seng Hospital (which includes the colocated NCID that bore the brunt of the nation's COVID-19 adult patient load), Khoo Teck Puat Hospital, Institute of Mental Health, Ng Teng Fong General Hospital, Woodlands Health Campus (a new hospital that had not begun operating and whose staff were nested in other institutions), National Skin Centre, Dover Park Hospice, Community Care partners supported by the Agency for Integrated Care, National Healthcare Group Polyclinics and their general practitioner partners. Significant differences from participants of the 2003 study were the participation of the country's only psychiatric institution, more ILTC institutions and Woodlands Health Campus. Dental clinics that were part of the survey sample in 2003 were not included in this study.

Similar to the 2003 survey, our survey comprised three parts: (1) individual characteristics; (2) questions pertaining to the perception of exposure to COVID-19, perceived risk of infection and impact of the outbreak on personal and work life; and (3) Impact of Events Scale (IES) which measures subjective distress in response to stressful events (online supplemental files 1 and 2). There were several differences in the current survey for contextual accuracy. In the first section, we included questions asking respondents on their sites of deployment and scope of work because the rapid siting of cases in temporary community facilities staffed by deployed manpower was a major part of the pandemic response. In a novel section specific to those who were HCWs during the SARS epidemic, we surveyed participants' job titles, scope of work and exposure then, and measured their sense of safety, stress, preparedness, workload, and confidence in leadership now as compared with 2003 on a 7-point Likert scale. In the second section, we included new questions eliciting level of agreement on a 7-point Likert scale with measures specific to the current pandemic such as safe distancing, mandatory twice-daily logging of temperature, and use of a national contact tracing mobile application (TraceTogether). Under the section of impact on personal lives, we included questions about excessive searching of the internet for information and the impact of social media posts, and whether they or their personal contacts had been suspected of having or were confirmed to have COVID-19. Additionally, we sought their

levels of agreement with other implemented public health measures. For the IES, we computed the mean and median scores, and the proportion of respondents who scored in the moderate/severe score range (>25).<sup>10</sup>

Next, we compared the subgroups of those who had also been HCWs during the SARS epidemic (SARS HCW) against the group of HCWs who had not (non-SARS HCW) on various measures, using  $\chi^2$  tests for categorical variables and Student's t-test for quantitative variables. Univariate logistic regression was used to determine predictors of high IES scores, followed by multivariate logistic regression to adjust for confounders.

We analysed the data using STATA V.11.0 (released 2009) (online supplemental file 3).

### Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

### RESULTS

Out of 3828 returns of the survey, 3616 had completed at least 1 item (online supplemental file 4). **Table 1** shows the demographic characteristics of the entire study sample. Majority of the respondents were female (74.5%), aged 31–50 years (57.5%), nurses (51.7%) with 10 or fewer years of working experience (56.1%) and foreign-born (53.2%). Most were married (52.9%) with no children

**Table 1** Demographic characteristics of study sample

Characteristic (N=3616)	n	%	Characteristic (N=3616)	n	%
Gender			Staying with		
Male	916	25.3	Family	2183	60.4
Female	2700	74.7	Alone	214	5.9
Age group			Hostel	128	3.5
21–30	1038	28.7	Rented room	1080	29.9
31–40	1344	37.2	Length of work experience		
41–50	735	20.3	0–10 years	2029	56.1
51–60	344	9.5	11–20 years	1050	29.0
>60	150	4.2	21–30 years	294	8.1
Ethnic group			>30 years	210	5.8
Chinese	1656	45.8	Job title		
Malay	327	9.0	Doctor	305	8.4
Indian	553	15.3	Nurse	1870	51.7
Filipino	627	17.3	Allied health	677	18.7
Others	453	12.5	Administrative etc	739	20.4
Birth country			Site of work/deployment		
Singapore	1694	46.9	Acute/tertiary hospital	1733	47.9
Malaysia	387	10.7	Dormitory/screening centre	366	10.1
Philippines	627	17.3	Community care facility	102	2.8
China	154	4.3	Primary care	334	9.2
India	286	7.9	Intermediate/long-term care	827	22.9
Myanmar and others	468	12.9	None of the above	474	13.1
Marital status			Daily exposure to confirmed or suspect COVID-19 patients	404	11.2
Single	1564	43.3	Was a HCW during SARS		
Married	1911	52.9	Yes	789	21.8
Divorced/widowed	130	3.6	No	2690	74.4
No of children			IES score		
0	1959	54.2	Mean	17.74	(SD 14.7)
1–2	1256	34.7	Median	15	(IQR 23)
Three or more	390	10.8	Moderate/severe range	896	28.2

(N=3616).

HCW, healthcare worker; IES, Impact of Events Scale.

(54.2%) and living with their families (60.4%). Slightly more than 10% reported daily exposure to confirmed or suspect COVID-19 cases in their work. About a fifth (21.8%) were also HCWs during the SARS outbreak. The overall mean IES score for the sample was 17.7 (SD 14.7) and the median score was subclinical (15, IQR 23), but

more than a quarter (28.2%) scored in the moderate/severe range (total score >25).

Comparing the SARS HCWs and the non-SARS HCWs (table 2), the SARS-experienced group was significantly more likely to be older, to be local-born, married with children and staying with family, with longer working

**Table 2** Comparison of respondents who did (SARS) and did not experience SARS (non-SARS) as a HCW in 2003

Characteristic (N=3479)	SARS, n=789 (%)	Non-SARS, n=2690 (%)	P value	Characteristic (N=3479)	SARS, n=789 (%)	Non-SARS, n=2690 (%)	P value
Gender				Staying with			
Male	25.9	25.5	0.841	Family	69.3	57.8	<0.001
Female	74.1	74.5		Alone	8.1	5.2	
Age group				Hostel	2.2	3.9	
21–30	3.8	35.7	<0.001	Rented room	20.4	33.1	
31–40	12.9	44.5		Length of work experience			
41–50	44.7	13.4		0–10 years	8.5	70.1	<0.001
51–60	24.8	4.9		11–20 years	38.3	27.1	
>60	13.7	1.4		21–30 years	29.4	2.1	
Ethnic group				>30 years	23.5	0.5	
Chinese	45.5	45.1	<0.001	Job title			<0.001
Malay	8.0	9.6		Doctor	13.2	7.3	
Indian	16.1	15.2		Nurse	59.7	50.3	
Filipino	14.2	18.5		Allied health	15.5	19.8	
Others	16.2	11.6		Administrative etc	11.7	22.6	
Birth country				Site of work/deployment			
Singapore	51.2	45.1	<0.001	Acute/tertiary hospital	52.7	48.6	0.694
Malaysia	7.2	11.6		Dormitory/screening centre	9.5	10.7	
Philippines	14.6	18.4		Community care facility	2.9	2.9	
China	4.1	4.3		Primary care	10.0	9.8	
India	6.5	8.6		Intermediate/long-term care	24.0	23.5	
Myanmar and others	16.5	12.1		None of the above	11.5	13.9	
Marital status				Daily exposure to confirmed or suspect COVID-19 patients	14.8	10.7	0.001
Single	24.6	48.5	<0.001				
Married	70.0	48.6					
Divorced/widowed	5.5	2.9					
No of children				IES score			
0	36.0	59.4	<0.001	Mean	16.7 (SD 14.7)	18.0 (SD 14.8)	0.032
1–2	47.3	31.4		Median	13 (IQR 23)	15 (IQR 22)	0.016
Three or more	16.7	9.2		Moderate/severe range (%)	25.2	25.9	0.904

HCW, healthcare worker; IES, Impact of Events Scale.



experience. This is likely because many of the foreign HCWs during SARS would have left the country in the interim due to non-renewal of the work passes. There were significantly more respondents who were doctors in the SARS group. There was no difference in the proportion of respondents in both groups who had clinically significant IES scores (total >25) (25.2% vs 25.9%,  $p=0.904$ ). Their mean and median IES scores were not significantly different and did not reach clinical threshold.

Furthermore, more than half of the SARS HCWs rated that they felt safer (54.8%), better equipped (72.1%) with better managed workload (58.9%) in the current pandemic as compared with during the SARS epidemic. Seventy-seven per cent felt that the authorities and health-care leaders were doing a better job now as compared with before. However, only slightly less than half (47.3%) felt less stressed now as compared with their past SARS experience (table 3).

### Regarding personal risk perception

Both SARS HCWs and non-SARS HCWs did not differ in that approximately half of each group felt that their job put them at great risk of contracting COVID-19 and about 63% of both groups were afraid of contracting the disease (table 3). Despite this fear, both groups also did not differ in that only a small proportion felt that they should not be looking after COVID-19 patients (14.0% vs 13.2%,  $p=0.572$ ) or were thinking of leaving their jobs (5.4% vs 5.0%,  $p=0.685$ ). However, significantly more non-SARS HCWs felt that they had little control over whether they would get infected (36.0% vs 46.2%,  $p<0.001$ ).

### Regarding the usefulness of protective measures

SARS HCWs showed higher rates of disagreement with the protectiveness of standard PPE (9.8% vs 6.5%,  $p=0.003$ ) and the powered air-purifying respirator (22.8% vs 16.1%,  $p<0.001$ ), though the majority of both groups disagreed that the current PPE they were provided with was inadequate (71.0% vs 68.9%,  $p=0.28$ ) (table 3). However, the SARS HCWs also showed lower rates of disagreement with the use of the TraceTogether (20.0% vs 25.5%,  $p=0.003$ ). Non-SARS HCWs showed lower rates of disagreement with the items: being satisfied with the explanations for the various protective measures (10.8% vs 14.9%,  $p=0.005$ ), having someone to turn to when they have a problem using PPE (10.2% vs 16.3%,  $p<0.001$ ), that emotional support was available (15.1% vs 20.4%,  $p=0.001$ ), and that clear policies and protocols were instituted (10.8% vs 15.0%,  $p=0.004$ ). Significantly more of the SARS HCWs also disagreed with the statement that they still found it difficult to follow the policies and protocols despite the help provided (77.5% vs 72.5%,  $p=0.007$ ).

### Regarding impact on personal life and work

With respect to stigma, SARS HCWs showed higher rates of agreement with feeling appreciated by their employing institution (74.7% vs 67.0%,  $p<0.001$ ) and feeling appreciated by society (70.5% vs 62.5%,  $p<0.001$ )

(table 3). More of this group also agreed that there were adequate staff at work to handle the demands (62.8% vs 55.3%,  $p<0.001$ ). There were relatively high numbers from both groups who reported: more conflict among work colleagues (~25%), feeling more stressed at work (~45%), having an increased workload (~58%), having to work overtime (~35%), having to do what they normally do not (~60%), spending more time on the internet searching for COVID-19 information (~43%), and that too much COVID-19 news on social media has affected them (~36%), with no significant difference on these items.

The comparison of SARS and non-SARS HCWs who scored in the moderate/severe range of the IES is shown in table 4. Variables that showed statistically significant differences between both groups were entered into univariate logistic regression, followed by multivariable logistic regression.

Table 5 shows the identified predictor variables for clinically significant IES scores in the different exposure groups.

For SARS HCWs, multivariate logistic regression showed that those who were non-Chinese (Indian, adjusted OR 2.33, SE 0.73, 95% CI 1.26 to 4.32,  $p=0.012$ ) and currently not living with family (Rented room, adjusted OR 2.45, SE 0.69, 95% CI 1.41 to 4.26,  $p=0.003$ ) were more than twice as likely to be significantly stressed by the current pandemic (Likelihood Ratio  $\chi^2=64.74$ ,  $df$  21,  $p=0.00$ ). For the non-SARS HCWs, those living apart from family (Rented room, adjusted OR 2.01, SE 0.30, 95% CI 1.50 to 2.70,  $p<0.001$ ) were two times more likely to be significantly stressed (Likelihood ratio  $\chi^2=103.7$ ,  $df$  21,  $p=0.00$ ). Additionally, those coming into daily exposure of confirmed/suspect COVID-19 cases were also 1.5 times more likely to experience significant stress (adjusted OR 1.53, 95% CI 1.16 to 2.02,  $p=0.002$ ). Foreign-born participants were just as likely to be significantly stressed as compared with the local Singaporeans in either group.

## DISCUSSION

We found that 28% of HCWs regardless of prior experience of the SARS epidemic had clinically significant IES scores that indicated significant post-traumatic symptoms. For SARS HCWs, this was higher than the 20% reported from a local non-designated SARS hospital during the SARS epidemic in 2003.<sup>2</sup> Additionally, this proportion was not lower than the non-SARS HCWs group as we expected. One reason for this could be the larger scale impact and longer duration of COVID-19 compared with SARS. This could also indicate potential cumulative effects of repeated exposure to front-line trauma stemming from an epidemic/pandemic response in increasing the risk of developing clinically significant psychological symptoms instead of increasing one's resilience and protection from such effects.<sup>11</sup> Another possible reason for this result could be that SARS HCWs were already experiencing persistent symptoms post-SARS and these effects

**Table 3** Comparison of personal risk perception and impact on personal and work lives between SARS and non-SARS HCWs

Statement	SARS HCW (n=748)	Non-SARS HCW (n=2591)	P value	Effect size $\phi$
Comparison with SARS experience	% agree			
I feel safer now compared with SARS	54.8			
I feel less stressed now compared with SARS	47.3			
I feel better equipped now compared with SARS	72.1			
I feel the authorities and healthcare leaders are doing a better job now compared with SARS	77.1			
I feel my workload now is better managed compared with during SARS	58.9			
Personal risk perception	% agree			
I feel that my job puts me at great risk of contracting COVID-19	50.9	47.8	0.128	
I am afraid of falling ill with COVID-19	63.4	63.7	0.86	
I have little control over whether I get infected or not*	36.0	46.2	<0.001*	0.086
I feel that I shouldn't be looking after patients with COVID-19	14.0	13.2	0.572	
I am thinking of leaving my job because of the risk that I face	5.4	5.0	0.685	
My family is asking me to leave my job because of the risk that I face	7.4	10.1	0.023	
I am confident my employer will look after my medical needs if I were to fall ill to COVID-19	81.2	78.3	0.093	
I worry that those closest to me are at high-risk of getting COVID-19 because of my job	53.3	55.0	0.403	
Those closest to me are worried that they may get infected through me	41.8	44.0	0.273	
Regarding protective measures	% disagree			
Surgical mask is protective	4.5	5.0	0.577	
Standard PPE is protective*	9.8	6.5	0.003*	0.052
PAPR is protective*	22.8	16.1	<0.001*	0.074
Hand hygiene is protective	1.9	2.3	0.541	
Special room/area to isolate COVID-19 patients is protective	1.9	2.9	0.125	
Swabbing staff with ARI for COVID-19 is necessary	6.8	6.3	0.645	
Twice daily logging of temperature is necessary	19.5	23.4	0.025	0.039
Use of TraceTogether App is necessary*	20.0	25.5	0.003*	0.053
I am satisfied with the explanation for the use of various measures*	10.8	14.9	0.005*	0.049
I have someone to turn to when I have a problem in using PPE*	10.2	16.3	<0.001*	0.071
Emotional support (eg, counselling) is available to those who need help*	15.1	20.4	0.001*	0.056
Clear policies and protocols were instituted for everyone to follow*	10.8	15.0	0.004*	0.051
I still find it difficult to follow them despite the help provided*	77.5	72.5	0.007*	0.047
I feel that I deserve a higher level of PPE than currently provided	71.0	68.9	0.28	
Impact on personal life and work	% agree			
I have been afraid of telling my family about the risk I am exposed*	21.9	27.2	0.004*	0.051
People avoid me because of my job	27.2	28.6	0.124	
People avoid my family members because of my job	16.4	14.7	0.267	
I feel appreciated by the hospital/clinic/my employer*	74.7	67.0	<0.001*	0.069
I feel appreciated by society*	70.5	62.5	<0.001*	0.069
The morale at work has been good	70.5	65.9	0.024	

Continued

Table 3 Continued

Statement	SARS HCW (n=748)	Non-SARS HCW (n=2591)	P value	Effect size $\phi$
There are adequate staff at my workplace to handle the different demands*	62.8	55.3	<0.001*	0.063
There is more conflict among colleagues at work	24.0	24.5	0.747	
I feel more stressed at work	44.3	44.8	0.805	
I have an increased workload	59.0	57.6	0.512	
I have to work overtime	36.8	35.9	0.662	
I have to do what I normally don't do	60.4	59.2	0.575	
I spend a lot more time on the internet searching for information on COVID-19	43.3	42.7	0.78	
Too much news about COVID-19 on social media has affected me	35.9	38.1	0.272	

\*Denotes  $p < 0.01$ .

ARI, Acute Respiratory Infection; HCWs, healthcare workers; PAPR, Powered Air Purifying Respirator; PPE, personal protective equipment.

were exacerbated by new-onset symptoms triggered by COVID-19,<sup>12</sup> thus giving rise to a higher proportion than expected. Of note, this rate is still higher than that of 20% of HCWs as reported by Salehi *et al* in a recent systematic review and meta-analysis.<sup>13</sup> Hence, the long intervening time between SARS and COVID-19 and prior experience as a SARS HCW do not appear to be protective.

Most SARS HCW respondents felt safer, better equipped, more confident about their healthcare leaders, and that their workload was being better managed. More of them also agreed with the various infection control/contact tracing measures and policies as well as being satisfied with official communications, likely due to a general perception of how things have generally improved from the SARS episode. However, at least half still reported fears of falling ill with COVID-19 and felt that their jobs put them at risk. More of them also doubted the effectiveness of protective equipment as compared with the non-SARS group. Memories of 42% of the local SARS patient population being HCWs and of losing one esteemed doctor colleague were likely still fresh.<sup>14</sup> Like the SARS study,<sup>1</sup> the large majority would continue their present jobs looking after infected patients; this was the same for the non-SARS HCWs. While it reflects an admirable work ethos from our HCWs, this could also reflect HCWs suppressing personal fears and emotions in a sacrificial attempt to provide patient care. This may be indicative of a trajectory towards the depletion of emotional resources and eventually fatigue and burnout,<sup>15</sup> which are outcomes not measured by our study. Nevertheless, a possible target for intervention is to address the locus of control, since a sizeable proportion of both groups (more so for non-SARS HCWs) endorsed having little control over whether they get infected, and possession of an external locus of control has been identified as a vulnerability factor to psychological distress.<sup>16</sup> It is possible that post-SARS strategies successfully addressed this or post-traumatic growth had spontaneously occurred in a number of SARS HCWs.

Various staff support systems were put in place after the SARS epidemic, and most participants were aware these resources were available to them. However, as the COVID-19 pandemic is more long-drawn and has more widespread impact across the healthcare system, we believe it is imperative to identify at-risk HCWs for targeted psychological outreach. Furthermore, despite the consensus of good morale at work, having adequate manpower, and adequate levels of PPE, high numbers still reported increased workplace conflict, more work stress and increased workload. Results of our logistic regression analyses showed that being more socially isolated (not living with family) was the most significant predictive factor for both SARS and non-SARS HCWs. This finding may be explained by the large numbers of foreign HCWs who were affected by the travel bans and prevented from being with their families in their countries of origin, as well as having to be housed in temporary accommodation due to distancing requirements placed on those living in communal housing. Even though these phenomena were only present during the current pandemic, we believe that these risk factors are not unique or specific to locale or pathogen-type and should be considered in future outbreak situations. Being exposed to confirmed/suspect cases daily was predictive of significant distress for non-SARS HCWs but not for SARS HCWs. This could reflect either a true protective effect of prior experience or a symptom of emotional numbing for SARS HCWs.

Considering that a quarter of the respondents experienced clinically significant trauma-related symptoms despite the existence of active HCW psychological support resources, we advocate for (1) the examination of current resources and their limitations in the current pandemic, (2) the modification of existing programmes to be more specifically trauma-informed in approach and (3) for more targeted and focused trauma-informed care for HCWs who have experienced repeated exposure. This calls for a resolve to acknowledge the presence and



**Table 4** Comparison of SARS and non-SARS HCWs who had IES scores in the moderate/severe range

Characteristic (N=896)	SARS, n=199 (%)	Non-SARS, n=697 (%)	P value	Characteristic (N=896)	SARS, n=199 (%)	Non-SARS, n=697 (%)	P value
Gender				Staying with			
Male	29.7	26.3	0.34	Family	54.3	44.8	<0.001*
Female	70.4	73.7		Alone	10.6	5.9	V=0.129
Age group				Hostel	3.5	6.2	
21–30	6.0	38.7	<0.001*	Rented room	31.7	43.2	
31–40	13.1	44.2	V=0.583	Length of work experience			
41–50	45.7	10.8		0–10 years	11.6	73.9	<0.001*
51–60	26.6	4.2		11–20 years	35.7	23.2	V=0.659
>60	8.5	1.6		21–30 years	32.2	1.9	
Ethnic group				>30 years	19.6	0.7	
Chinese	31.7	34.2	0.02	Job title			
Malay	9.6	10.2		Doctor	9.1	6.2	0.027
Indian	18.1	17.1		Nurse	62.8	55.5	
Filipino	19.1	25.8		Allied health	17.1	19.7	
Others	18.6	12.8		Administrative etc	11.1	18.7	
Birth country				Site of work/deployment			
Singapore	42.2	37.6	0.052	Acute/tertiary hospital	48.7	43.3	0.22
Malaysia	7.5	10.8		Dormitory/screening centre	7.5	13.1	
Philippines	19.1	25.8		Community care facility†	4.0	3.2	
China	1.0	3.7		Primary care	8.5	10.0	
India	6.5	10.0		Intermediate/long-term care	32.2	31.6	
Myanmar and others	23.7	12.1		None of the above	13.1	11.2	
Marital status				Daily exposure to confirmed or suspect COVID-19 patients	17.1	13.8	0.24
Single	29.7	50.9	<0.001*				
Married	64.8	46.5	V=0.182				
Divorced/widowed	5.5	2.6					
No of children			<0.001*				
0	41.2	63.6	V=0.196				
1–2	41.2	28.1					
3 or more	17.6	8.3					

\*Denotes  $p < 0.01$ .

†Community care facility- medically supervised care facilities for recovering COVID-19 patients till the completion of their infectious period. HCWs, healthcare workers; IES, Impact of Events Scale.

effects of vicarious trauma at the organisational level,<sup>17 18</sup> and to transform the workplace climate so that HCWs feel safe, supported and well-supervised by a coach/mentor who has been trained in trauma-related care.<sup>19</sup> This makes possible widespread training and education and

the nomination of ‘trauma-informed care champions’ in different units who will be champions for the execution of informal networks for debrief and support. Additionally, suitable HCWs who have experienced SARS and identified to be coping well can be trained to leverage

**Table 5** Univariate logistic regression for predictors of moderate/severe IES score for SARS and non-SARS HCWs

Predictive factor	SARS HCW			Non-SARS HCW		
	OR	95% CI	P value	OR	95% CI	P value
<b>Age group</b>						
21–30	1			1		
31–40	0.38	0.15 to 0.97	0.042	0.85	0.70 to 1.04	0.114
41–50	0.36	0.15 to 0.84	0.018	0.66	0.49 to 0.89	0.006*
51–60	0.39	0.16 to 0.94	0.037	0.71	0.46 to 1.10	0.128
>60	0.19	0.07 to 0.51	0.001*	1.06	0.51 to 2.22	0.867
<b>Ethnic group<sup>09†</sup></b>						
Chinese	1			1		
Malay	2.06	1.11 to 3.82	0.021*	1.50	1.10 to 2.05	0.011
Indian	1.90	1.18 to 3.08	0.009*	1.61	1.24 to 2.09	<0.001*
Filipino	2.53	1.55 to 4.12	<0.001*	2.12	1.68 to 2.69	<0.001*
Others	2.43	1.52 to 3.88	<0.001*	1.56	1.04 to 2.56	0.003*
<b>Birth country</b>						
Singapore	1			1		
Malaysia	1.47	0.76 to 2.83	0.248	1.08	0.81 to 1.46	0.595
Philippines	1.95	1.22 to 3.11	0.005*	1.89	1.50 to 2.39	<0.001*
China	0.28	0.06 to 1.20	0.086	1.00	0.63 to 1.59	0.993
India	1.14	0.58 to 2.24	0.703	1.56	1.13 to 2.15	0.006*
Myanmar	2.00	1.26 to 3.19	0.004*	1.20	0.86 to 1.67	0.275
Others	5.33	1.70 to 16.73	0.004*	1.22	0.75 to 2.01	0.413
<b>Marital status</b>						
Single	1			1		
Married	0.65	0.45 to 0.95	0.024	0.90	0.76 to 1.08	0.267
Divorced/widowed	1.51	0.57 to 4.05	0.404	0.93	0.52 to 1.65	0.806
<b>No of children</b>						
0	1			1		
1–2	0.66	0.46 to 0.95	0.027	0.79	0.65 to 0.96	0.018
3 or more	0.85	0.53 to 1.37	0.513	0.81	0.59 to 1.11	0.195
<b>Staying with<sup>†‡</sup></b>						
Family	1			1		
Alone	1.88	1.06 to 3.32	0.030	1.54	1.04 to 2.27	0.03
In hostel	2.78	1.01 to 7.64	0.047	3.06	2.00 to 4.70	<0.001*
In rented room/apartment	2.96	1.99 to 4.40	<0.001*	1.95	1.61 to 2.36	<0.001*
<b>Length of work experience</b>						
0–10 years	1			1		
11–20 years	0.41	0.22 to 0.76	0.005*	0.73	0.59 to 0.89	0.002*
21–30 years	0.53	0.29 to 1.00	0.049	0.72	0.38 to 1.35	0.307
>30 years	0.37	0.19 to 0.72	0.003*	1.45	0.47 to 4.47	0.513
<b>Daily exposure to confirmed/suspect cases<sup>‡</sup></b>						
No	1			1		
Yes	1.28	0.82 to 1.20	0.283	1.48	1.14 to 1.94	0.004*

\*Denotes  $p < 0.01$ .

†Denotes variable remains significant after multivariate logistic regression for non-SARS HCW group.

‡Denotes variable remains significant after multivariate logistic regression for SARS HCW group.

HCW, healthcare worker; IMS, Impact of Events Scale.

on their experience to provide trauma-informed care to affected colleagues. Nevertheless, the real challenge is in the actualisation of protocols that require interpersonal interactions in the face of adhering to infection control guidelines and manpower conservation measures such as the freezing of vacation days.

We acknowledge that a major limitation of our study is that we chose not to use the IES-Revised (IES-R) scale or other scales that measured depression/anxiety levels, personality and resilience factors, and that reduces the comparability of our results with those from other studies.<sup>20</sup> In view of the unique nature of our healthcare workforce having experienced the similar SARS crisis, we intentionally adapted our questionnaire from a similar one used in 2003 during the SARS epidemic to glean insight and make general comparisons between it and the current pandemic. We believed that performing a cross-sectional measurement using general psychiatric measures would not add novel value beyond existing studies on the mental health of HCWs; hence, we avoided this approach. Another limitation of this online survey methodology is that it may not have reached those who did not have institutional email addresses or who were not adequately IT-savvy, thus introducing sample bias and affecting the generalisability of the results. We had proposed having study team members to conduct in-person outreach to departments such as portering, housekeeping, catering and security, however, it was vetoed as it contravened infection control policies. Hence, we were also not able to report the response/non-response rate and examine the characteristics of those who did not respond to the survey. As the survey was anonymous, we were also unable to reidentify respondents in order to clarify unclear responses. Respondents also did not have opportunity to clarify the items they did not understand and thus causing opportunities for erroneous responses. The final sample size may also have been limited by the lack of incentive for completing the survey due to lack of funding. Regrettably, we were unable to reach a similar sample size to the 2003 SARS study.

We designed our questionnaire to include novel open-ended questions for survey respondents to upload photos, videos, journal entries or free-text responses on how they have been coping during the pandemic. These data are being analysed qualitatively and will be reported elsewhere. Each site-principal investigator was also provided with the site-specific dataset of both the quantitative and qualitative data for use in their own sites. It was beyond the scope of this paper to report and discuss results by site or healthcare setting. The study team hopes to eventually combine the results from the quantitative and qualitative sections and make useful recommendations to our healthcare leadership for the ongoing psychological protection of our healthcare workforce. Future directions should focus on the effectiveness of such strategies and the longitudinal follow-up of the well-being of HCWs considering the protracted nature of the current pandemic which was still unknown at the time the study was conceptualised and conducted.

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