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Safety attitudes, burnout and wellbeing among healthcare workers during the COVID-19 pandemic: an Indo-Pacific regional cross-sectional study

Abhiram Kanneganti[1*], MBBS, MRCOG, Benjamin YQ Tan[2*], MBBS, MRCP, Nik Hisamuddin Nik Ab Rahman[3,4], PhD, MMed, Aloysius ST Leow[2], MBBS, Max Denning[5], BM BCh, MRCS, Ee Teng Goh[5], MBBS, MRCS, Lucas JH Lim[6], MBBS, MRCPsych, Ching-Hui Sia[2,7], MBBS, MRCP, Ying Xian Chua[8], MMed, MPH, James Kinross[5], PhD, FRCS, Melanie Tan[9], MBBS, MRCP, Li Feng Tan[10], MBBS, MRCP, Yi Min Wan[11], MB BCh BAO, MRCPsych, Arvind K Sharma[12], MD, Rivan Danuaji[13], DM, RN Komal Kumar[14], DM, Chew Keng Sheng[15], PhD, MMed, Cheah Phee Kheng[16], MMed, MD, Sarah Shaikh Abdul Karim[17], MBBS, MMed, Mohd Najib Abdul Ghani[18], MMed, MBBS, Suhaimi Mahmud[19], MMed, MD, Yiong Huak Chan[20], PhD, Vijay K Sharma[2], MD, Kang Sim[21,22,†], MBBS, MMed, Shirley BS Ooi[23,24,†], MBBS, FRCSEd(A&E)

[1]Department of Obstetrics and Gynaecology, National University Hospital, [2]Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore [3]Hospital Universiti Sains Malaysia, [4]Department of Emergency Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kota Bharu, Malaysia, [5]Department of Surgery and Cancer, Imperial College London, UK, [6]Early Psychosis Intervention Program, Institute of Mental Health, [7]Department of Cardiology, National University Heart Centre Singapore, [8]National University Polyclinics – Pioneer, National University Health System, [9]Department of Geriatric Medicine, Ng Teng Fong General Hospital, [10]Division of Healthy Ageing, Alexandra Hospital, [11]Department of Psychiatry, Ng Teng Fong General Hospital, Singapore, [12]Department of Neurology, Zydus Hospitals and BJ Medical College, Ahmedabad, India, [13]Department of Neurology, Dr Moewardi Hospital, Kota Surakarta, Jawa Tengah, Indonesia, [14]Yashoda Hospital, Secunderabad, India, [15]Universiti Malaysia Sarawak, Kota Samarahan, Sarawak, [16]Emergency and Trauma Department, Sabah Women and Children's Hospital, Kota Kinabalu, Sabah, [17]Emergency and Trauma Department, Hospital Sungai Buloh, Sungai Buloh, Selangor, [18]Emergency and Trauma Department, Hospital Raja Perempuan Zainab (II), Bandar Kota Bharu, Kelantan, [19]Emergency and Trauma Department, Hospital Tuanku Jaafar, Seremban, Negeri Sembilan, Malaysia, [20]Biostatistics Unit, Yong Loo Lin School of Medicine, National University of Singapore, [21]West Region, Institute of Mental Health,

Singapore, [22]Department of Psychological Medicine, Yong Loo Lin School of Medicine, National University of Singapore, [23]Emergency Medicine Department, National University Hospital, [24]Department of Surgery, Yong Loo Lin School of Medicine, National University Singapore, Singapore
[*]*These authors contributed equally as* [*]*first authors and* [†]*last authors of this work.*

Correspondence: Dr Kanneganti Abhiram, Senior Resident, Department of Obstetrics and Gynaecology, National University Hospital, 5 Lower Kent Ridge Rd, Singapore 119074. abhiram_kanneganti@nuhs.edu.sg

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ABSTRACT

Introduction: The COVID-19 pandemic has had an unprecedented impact in Asia and has placed significant burden on already stretched healthcare systems. We examined the impact of COVID-19 on safety attitudes among healthcare workers (HCWs) as well as their associated demographic and occupational factors, and measures of burnout, depression and anxiety.

Methods: A cross-sectional survey study utilising snowball sampling was performed involving doctors, nurses and allied health professions from 23 hospitals in Singapore, Malaysia, India and Indonesia between 29 May 2020 and 13 July 2020. This survey collated demographic data and workplace conditions and included three validated questionnaires: Safety Attitudes Questionnaire (SAQ); Oldenburg Burnout Inventory; and Hospital and Anxiety Depression Scale. We performed multivariate mixed model regression to assess for independent associations with the SAQ Total Percentage Agree Rates (PAR).

Results: We obtained 3,163 responses. A SAQ Total PAR of 35.7%, 15.0%, 51.0% and 3.3% was calculated among respondents from Singapore, Malaysia, India and Indonesia, respectively. Burnout scores were highest among respondents from Indonesia and lowest in respondents from India at 70.9%–85.4% versus 56.3%–63.6%, respectively. Multivariate analyses revealed that meeting burnout and depression thresholds, and shifts lasting ≥ 12 hours were significantly associated with lower SAQ Total PAR.

Conclusion: Addressing factors contributing to high burnout and depression, and placing strict limits on work hours per shift may contribute significantly towards improving safety culture among HCWs and should remain priorities as this pandemic continues.

Keywords: *burnout, COVID-19, pandemic, safety attitudes, safety culture*

INTRODUCTION

Accessible air travel, high trade volumes and geographical proximity contributed to the rapid spread of Coronavirus Disease 2019 (COVID-19) throughout Asia in late-January 2020. By end-March 2020, several countries had implemented travel restrictions and various levels of "lock-down" comprising restrictions on unnecessary social movement.[1-4] Despite the development of effective vaccines, lack of availability or acceptance[5-7] and the emergence of virulent variants such as the delta variant[8] has caused several countries to repeatedly re-enter varying degrees of "lock-down". Differences in pre-pandemic healthcare systems (Table I), critical care capacity[9] and governmental responses have created different operating environments for healthcare workers (HCWs) in South-East Asia and India. As the pandemic approaches its third year, it is important to address the long-term sustenance of effective healthcare services.

Similar to the Severe Acute Respiratory Syndrome (SARS) outbreak of 2003,[10,11] emotional distress among HCWs has been a significant concern despite recommendations to prioritise frontline HCW safety[12] with recurring reports of global shortages in personal protective equipment (PPE), inadequate workplace protection for HCWs and overwork.[13,14] Additionally, HCWs have often been redeployed to other departments within their hospitals and externally to community screening and isolation facilities,[15,16] often under unfamiliar work environments. Several studies have demonstrated increased burnout[17-21] amongst HCWs, with some citing a prevalence as high as 80%,[22] as well as high levels of depressive symptoms emotional distress.[23,24] One large study during the early stages of the pandemic[25] reported a prevalence of depressive symptoms of 34% although a meta-analysis[26] showed a reduction within the first 12 months from 20.2% to 8.7%. The usage of different assessment tools and unvalidated questionnaires, however, greatly limits comparison between different studies and cohorts.

While emotional distress amongst HCWs during this pandemic has been well-documented, the impacts on safety culture has been poorly understood.[27] Safety culture in healthcare is a key pillar in patient safety[28,29] and has been adopted from other industries such as the aviation industry.[30] The European Network for Patient Safety (EUNetPaS) defines patient safety culture as "an integrated pattern of individual and organizational behaviour, based upon shared beliefs and values that continuously seek to minimize patient harm, and which may result from the processes of care delivery".[31] While there are significant variations in definition of safety culture, several studies define a positive safety culture as one "characterised by communications founded on mutual trust, shared perceptions of the importance of safety and confidence in the efficacy of preventive measures"[32] with poor safety culture being linked to adverse patient outcomes[28,33] and HCW burnout.[34,35]

The uncertainty, limited PPE, lack of good curative treatment strategies and an evolving understanding of the disease process that characterised the early phases of this pandemic were likely highly detrimental good safety culture.[27,36] The aim of our study is to understand and compare safety culture amongst HCWs from India, Indonesia, Malaysia and Singapore and assess its relationship with other work conditions such as work hours, redeployment and exposure to COVID-19 patients, as well as mental health aspects such as burnout, depression and anxiety assessed via validated wellbeing tools at this phase in this pandemic.

METHODS

We conducted a multinational, multicentre, cross-sectional survey study involving doctors, nurses and allied healthcare professionals (AHPs) across private and public hospitals in Singapore, Indonesia, Malaysia and India (See Appendix A), collectively referred to as the Indo-Pacific region for the purposes of this paper. This study was conducted about four months

after the first cases were reported in Singapore, Malaysia and India from 29th May to 13th July 2020 (Fig. 1).

An anonymous, voluntary questionnaire was circulated through a website link distributed through e-mail, posters or instant messaging means with weekly reminders. The questionnaire was administered using FormSG (GovTech, Singapore) in Singapore and Google Forms (Google, Mountain View, CA, USA) in Malaysia, India and Indonesia. This questionnaire was worded in English. The data and methodology for the Singapore cohort has been published in a study looking into factors affecting burnout among HCWs during a pandemic.[22] For India, Malaysia and Indonesia, a snowball sampling method[37] was used by the national coordinators to disseminate the survey within the various participating hospitals.

Three internationally validated questionnaires were utilised, i.e. the Safety Attitudes Questionnaire (SAQ), Oldenburg Burnout Inventory (OLBI) and the Hospital Anxiety and Depression Scale (HADS). Respondents were categorized by country, ethnicity, HCW roles, gender, redeployment status, testing status for COVID-19, type of healthcare institution, educational status, average duration of shift and average number of days of work in a week and number of COVID-19 cases in their hospital for multivariate analysis. Redeployment referred to being posted out of one's usual workplace to areas either internally within one's hospital to areas in need of more manpower or outside to areas such as community screening or isolation facilities. As each country had multi-ethnic populations, respondents were further grouped according to whether they were part of the majority ethnicity of their respective countries.

Safety Attitudes Questionnaire

The SAQ has been adapted for use in hospital settings[29] from the Flight Management Attitudes Questionnaire,[30] which was designed to assess safety attitudes amongst flight crew. Encompassing six patient safety domains, i.e. safety climate, perceptions of management,

teamwork climate, working conditions, job satisfaction, and stress recognition, it has been validated across various HCW roles, work environments and languages[35,38] and is one of the most widely used tools to assess safety attitudes. In addition to the core 30 questions that are constant in each variation of the SAQ, we selected an additional six questions that we deemed were relevant from the original bank of 60 questions (Appendix B, Supplementary Material). Each close-ended question is scaled on a 5-point Likert scale ranging from Strongly Disagree (1 point) to Strongly Agree (5 points). Higher scores refer to better safety attitudes. The Safety Culture Score for each domain was calculated by: (Mean value of item scores within a domain – 1) x 25.[35] The "Percentage Agree Rate" (PAR) is a primary metric for the SAQ[29,39,40] and refers to the proportion of respondents achieving a score of 75 or more. The Total SAQ PAR was calculated by (1) calculating the mean score for all the items for each respondent and then (2) determining the percentage of respondents with a score of 75 or more.

Oldenburg Burnout Inventory

The OLBI is a validated tool to assess burnout (Appendix C, Supplementary Material) with eight positively- and negatively-framed items for each of its two constituent dimensions of (1) Exhaustion (emptiness and need for rest) and (2) Disengagement (distancing from aspects of one's own work).[41] Each item was rated on a four-point Likert scale ranging from 'Strongly Disagree' to 'Strongly Agree' where the highest burnout response was awarded four points. A score of ≥2.25 for Exhaustion or ≥2.10 for Disengagement correlates with physical symptoms[42] and has been used to as a cut-off to define burnout.[43] The OLBI has been validated in a variety of populations and settings[44,45] and has convergent validity with the more well-known Maslach Burnout Inventory while possessing superior psychometric scale properties[41] due the inclusion of both positively- and negative-framed questions in each domain.

Hospital Anxiety and Depression Scale

The HADS[46] is a self-reported questionnaire to screen for Depression and Anxiety with seven items in each respective subscale for Depression and Anxiety (Appendix D, Supplementary Material). Each item is measured on a four-point Likert scale with scores between 0 to 3 with a higher score referring to higher levels of depression or anxiety. A score of 8 and above[46] for either subscales was deemed as being at risk for depression or anxiety.

Outcomes

Our primary outcome measure was the Total SAQ PAR. Individual SAQ domain PAR, OLBI mean scores and burnout rates, as well as percentage of respondents with HADS-Anxiety or -Depressions scores of ≥8 were secondary outcomes.

Statistics

Analyses were performed using SPSS 26.0 (IBM Corp, Armonk, New York, USA) with statistical significance set as $p < 0.05$. Confirmatory factor analysis via Root Mean Square Error of Approximation (RMSEA < 0.06), Comparative Fit Indices (CFI ≥0.90) and Standardised Root Mean Square Residual (SRMSR < 0.08)[47] demonstrated a good fit of the instruments to the data between different samples. (Appendix E). One-way analysis of variance (ANOVA) was used to evaluate for differences in SAQ, OLBI and HADS scores between each country. Univariate and multivariate logistic regression analyses were performed as mixed effects analyses using Total SAQ PAR as the outcome variable and institution as a random effect.

Ethics

Waiver of consent and ethics approval was obtained from the National Healthcare Group's Domain Specific Review Board (Reference Number 2020/00598) as well as from the relevant

institutional review boards in each country. The questionnaire's front page provided participants with information regarding the purpose of the study and assurance of anonymity.

RESULTS

We obtained a total of 3,163 valid questionnaires which had completed SAQ scoring in all six domains. Respondent characteristics are shown in Table II. Males constituted 26.3% of responses. Doctors, nurses, allied health professionals (including dental staff and healthcare students) comprised 30.8%, 52.4% and 16.7%, respectively. Public or community hospitals was the declared site of work by 96.6% of respondents with the remainder belonging to a private hospital. Among the respondents, 18.1% had been redeployed from their primary site of work to other locations, 30.6% worked more than 5 days a week, 12.0% worked 12 or more hours per shift and 18.0% stated that they had treated known COVID-19 positive patients. Amongst respondents from Singapore, Malaysia, Indonesia and India, the majority ethnicity was Chinese (53.1%), Malay (78.2%), Javanese (88.7%) and Indian (99.3%), respectively.

SAQ scores and other measures of wellbeing are reported in Table III and Fig. 2. We found statistically significant differences ($p<0.001$) in SAQ mean scores and PAR between each country in all six domains. (Table III). India had the highest overall Total SAQ PAR (49.0%), with the highest PAR for the Teamwork Climate, Safety Climate, Perceptions of Management and Working Conditions domains while Singapore had the highest PAR for Stress Recognition (53.3%) and Malaysia for Job Satisfaction (81.5%). The OLBI scores between each country were also statistically significant differences ($p<0.001$). Indonesia had the highest percentage of respondents meeting thresholds for OLBI-Disengagement (85.4%) and HADS-Anxiety (58.3%) while Malaysia did so for OLBI-Exhaustion (79.2%) and India for HADS-depression (39.5%).

Multivariate Analysis

Explanatory variables for Total SAQ PAR included HADS and OLBI scores, country, being in the majority ethnicity, healthcare role, workplace, workdays per week, work hours per shift, number of COVID-19 patients in the hospital, redeployment and having done COVID-19 testing. Variables found to be significant on univariate analysis were included in multivariate analysis. Indonesia and Malaysia had significantly lower SAQ Total PAR than Singapore (odds ratio [OR] 0.27 and 0.05 respectively, both p<0.001). Factors associated with a lower SAQ Total PAR included positive OLBI-Disengagement (OR 0.40, p<0.001), OLBI-Exhaustion (OR 0.58, p<0.001), HADS-Depression (OR 0.54, p<0.001) and working for 12 hours or more per shift (OR 0.70, p=0.019) (Table IV).

DISCUSSION

While pre-pandemic studies have been done in Asia to evaluate safety attitudes and validate assessment tools amongst HCWs,[38,48-51] few have been conducted to determine intra-regional differences[52] using the same tool and fewer still during a surge period such as this pandemic.[22]

Our study highlighted that working for 12 hours or more per shift was significantly associated with a low Total SAQ PAR. Of note, the number of workdays per week was not significantly correlated with Total SAQ PAR although it did approach statistical significance. Pre-pandemic studies have shown a similar inverse relationship between shift durations with patient safety outcomes.[53-56] During surge periods when work hours per week may need to be increased due to redeployment, segregation and increased patient loads, our study suggests the importance of proper work-rest cycles where the number of workdays per week cannot be reduced. Nevertheless, work hours per week are also correlated with poorer patient safety outcomes and off-days per week should be supported.

Safety culture scores were significantly different between each of the four countries with India having the highest Total SAQ PAR and Indonesia having the lowest with HCWs from India highlighted markedly higher SAQ scores in all parameters compared to Indonesia except for Stress Recognition (PAR 24.5% and 26.5%, respectively). This disparity was seen despite both Indonesia and India having a similarly accelerating COVID-19 case trajectory (Fig. 1), higher case fatality rate (6.03% and 2.84%, respectively) and a lower daily test rate (8.0 and 2.0 per 100,000 population, respectively; Table I) compared to Singapore and Malaysia. Furthermore, while shift work for 12 hours or more was a significant contributor to low Total SAQ PAR on multivariate analysis, a greater proportion of HCWs from India did so compared to Indonesia (27.8% vs 10.6%), indicating that other factors were in play. These may have included factors which were overall not significantly correlated with Total SAQ PAR but were markedly different between HCWs from India and Indonesia that may have affected perceptions of safety culture. More HCWs from India than Indonesia were not involved in the care of COVID-19 patients, worked in private hospitals and comprised nurses (71.3% vs 54.3%, 31.1% vs 0.0% and 43.0% vs 25.8%, respectively). More studies are needed to explore these as well as other factors.

Our study also demonstrated a relatively high level of burnout in each country with Disengagement and Exhaustion scores exceeding thresholds amongst more than 70% of respondents in each country except India which showed the lowest burnout rates at 63.6% and 56.3% for OLBI-Exhaustion and –Disengagement, respectively. While comparisons with pre-pandemic studies are challenging due to different burnout assessment tools and limited size or scope, high burnout levels have also been reported amongst the healthcare workforce in Asia. A systematic review of HCWs in India demonstrated a prevalence of burnout in 23%–27%.[57] A single-centre study in Indonesia reported a prevalence of 70%–88.3%[58] while another looking at five hospital in Sabah, Malaysia placed this at 30.4%–57.1%.[59] These studies used

the Maslach Burnout Inventory. This indicates that a significant component of burnout exists pre-pandemic and may have continued. An interval assessment with similar tools and scope would allow for meaningful comparisons. The significant correlation between lower Total SAQ PAR and meeting thresholds for OLBI-Disengagement and -Exhaustion and HADS-Depression seen in this study were consistent with the findings of several other studies[35,60,61] and reflects that wellbeing among HCWs is an important factor in ensuring good patient safety outcomes through a positive safety culture.

An additional factor that warrants further study is the role of minority ethnicity in wellbeing and perceptions safety culture. As multi-ethnic countries, HCWs of minority ethnicity from the Singapore, Malaysia and Indonesia cohorts comprised 11.3-46.9% of all respondents while in India, this was 99.3%. An inverse relationship between minority ethnicity and burnout has been seen in several studies[62-65] and has been thought to be due to increased resilience related to life experiences.[62] In our previously published study, HCWs from Singapore of Indian ethnicity had significantly lower burnout scores compared to HCWs of Chinese ethnicity.[22] While being in a majority ethnicity was found to be a significant contributor to lower Total SAQ PAR on univariate analysis, it was not found to be so on multivariate analysis after correcting for other covariates such as OLBI scores. Few studies have evaluated the unique and complex interplay between minority ethnicity amongst the healthcare workforce and its effects on emotional wellbeing[66] and none, to our knowledge, with safety attitudes.

The main limitation of our study pertains to representation of each country's health workforce. Snowball sampling, while cost-effective, is non-random. Persons embedded in larger social networks are more likely to be referred and as individuals are more likely to forward a questionnaire within their social networks.[37] This may have contributed to the markedly different proportions of the workforce captured in our study with 62% of respondents

from Singapore being nurses 25% to 45% in the other countries. Additionally, AHPs were poorly represented amongst respondents from Malaysia or Indonesia (0% and 2.4%). A large proportion of respondents were from Singapore (72.8%) and while we corrected for this in multivariate analysis, this could lead to sampling errors when comparing with the other smaller cohorts. As the hospitals selected were mainly in urban centres and not in rural regions, this study's results may have reflect working conditions amongst HCWs in larger countries with rural areas[67,68] which reported worse conditions and HCW mental wellbeing.[24,69] The multilingual natures of participating countries and the lack of validated language-specific versions of these questionnaires meant that this study may select for HCWs with good English proficiency which may in turn have selection biases for seniority, nature of work, roles and associated workload. Finally, a lack of pre-COVID studies on safety attitudes in each of these countries makes it difficult to determine the extent of change that can be attributed to changes in work conditions due to this pandemic.

Nevertheless, the comparative nature of our study across different countries in the Indo-Pacific region with different healthcare systems during a period of surge using validated tools has significant merit and would hopefully serve as a baseline for future comparative studies.

CONCLUSION

We report worryingly high burnout rates in each of these countries and demonstrate its association with lower SAQ scores during this time of unprecedented healthcare burden. Our study also shows that limiting shift hours can improve patient safety attitudes, perhaps more so than reducing workdays per week. Thus, during times when surge capacity is needed, enforcing work-rest cycles may be important for sustaining increased HCW work hours per week. Any measures to improve burnout, depression and anxiety would also improve patient safety attitudes. These includes training in mental resilience,[35,70] availability of dedicated mental

health professionals and providing workplace training and protection[71] for continuing healthcare services under pandemic conditions.[72] As the SARS-CoV-2 pandemic draws on, it would be useful to re-evaluate safety attitudes in the context of the improved vaccine, PPE and test availability for HCWs and better understanding of COVID-19. With COVID-19 increasingly likely to be endemic, a good safety culture will be vital for the sustenance of effective healthcare services even during surge periods.[36]

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Table I: Background of demographic, health systems and COVID-19 pandemic data in participating countries i.e. Singapore, Indonesia, Malaysia and India

	Singapore	Indonesia	Malaysia	India
Demographic and Healthcare Systems				
GDP per capita	60913.75	3837.65	10254.23	1981.65
World Bank Income level	High	Upper middle	Upper middle	Lower middle
Universal Health Coverage Service Coverage Index	86	57	73	55
Human Development Index#	0.935	0.707	0.804	0.647
Total Population	5,612,253	264,645,886	31,105,028	1,338,658,835
Gross healthcare expenditure (per capita)	2618.71	114.97	384.07	69.29
Population density per km^2	7915.73	146.09	94.67	450.24
Physicians per 1,000 population	2.29§	0.38	1.54‡	0.78
Nurse & midwife per 1,000 population	6.24	2.05	3.47	2.11
Hospital bed per 1,000 population	2.4‡	1.2‡	1.9‡	0.7†
All data is from the World Bank Data Bank 2017 except for; *†Obtained from 2011 ‡Obtained from 2015 §Obtained from 2016 #Obtained from United Nations Development Programme 2018*				
Status during pandemic at start of study i.e. 29 May 2020				
Number of cases	33,294	25,216	7,629	165,799
Cases per 10,000 population	59.32	0.95	2.45	1.24
Deaths	23	1,520	115	4,706
Case fatality rate i.e. ratio between confirmed deaths & cases	0.07%	6.03%	1.51%	2.84%
Daily Tests for 100,000 population	92	8.0	20	2.0
Critical care beds per 100,000 population$^{\Delta}$	11.4	2.7	3.4	2.3
All data obtained from Roser M et al, 2020 except for; *$^{\Delta}$ Obtained from Phua J et al, 2020*				

Table II: Demographic data and baseline measures of welfare

Variables	Valid n	Total	Singapore	Malaysia	India	Indonesia
Age (years), mean (SD)	1072	33.3 (8.2)	36.2 (10.4)	32.4 (6.3)	29.3 (6.8)	33.7 (7.5)
Male gender, *n* (%)	2772	713 (26.3)	430 (21.9)	167 (37.4)	60 (40.0)	56 (37.6)
Country, *n* (%)	2772	N/A	2019 (72.8)	451 (16.3)	151 (5.4)	151 (5.4)
Ethnicity, *n* (%)	2638					
Chinese		1053 (39.9)	1006 (53.1)	45 (10.2)	0 (0.0)	2 (1.3)
Malay		557 (21.1)	203 (10.7)	344 (78.2)	0 (0.0)	10 (6.6)
Indian		466 (17.7)	266 (14.0)	50 (11.4)	150 (99.3)	0 (0.0)
Filipino		322 (12.2)	322 (17.0)	0 (0.0)	0 (0.0)	0 (0.0)
Javanese		135 (5.1)	0 (0.0)	0 (0.0)	1 (0.7)	134 (88.7)
Others (e.g. Arab, Burmese, Caucasian, Vietnamese)		105 (4.0)	99 (5.2)	1 (0.2)	0 (0.0)	5 (3.3)
Majority ethnicity, *n* (%)*	2638	1634 (61.9)	1006 (53.1)	344 (78.2)	150 (99.3)	134 (88.7)
Role, *n* (%)	2772					
Doctor		878 (31.7)	371 (18.4)	326 (72.3)	69 (45.7)	112 (74.2)
Nurse		1470 (53.0)	1252 (62.0)	114 (25.3)	65 (43.0)	39 (25.8)
AHP and others		424 (15.3)	396 (19.6)	11 (2.4)	17 (11.3)	0 (0.0)
Current workplace, *n* (%)	2772					
Public or community hospital		2679 (96.6)	1982 (98.2)	442 (98.0)	104 (68.9)	151 (100.0)
Private hospital		93 (3.4)	37 (1.8)	9 (2.0)	47 (31.1)	0 (0.0)
Redeployment, *n* (%)	2772	501 (18.1)	376 (18.6)	54 (12.0)	59 (39.1)	12 (7.9)
Working days in a week, *n* (%)	2772					
Less than 5 days		533 (19.2)	434 (21.5)	50 (11.1)	27 (17.9)	22 (14.6)
5 days		1390 (50.1)	1186 (58.7)	151 (33.5)	15 (9.9)	38 (25.2)
More than 5 days		849 (30.6)	399 (19.8)	250 (55.4)	109 (72.2)	91 (60.3)
Average duration of shift, *n* (%)	2772					
Less than 8 hours		288 (10.4)	149 (7.4)	99 (22.0)	26 (17.2)	14 (9.3)
8 to less than 12 hours		2150 (77.6)	1658 (82.1)	288 (63.9)	83 (55.0)	121 (80.1)
12 or more hours		334 (12.0)	212 (10.5)	64 (14.2)	42 (27.8)	16 (10.6)
COVID-19 testing done for self, *n* (%)	2772	474 (17.1)	258 (12.8)	107 (23.7)	32 (21.2)	77 (51.0)
Treating COVID-19 patients, *n* (%)	2618					
Unknown		178 (6.8)	86 (4.6)	61 (13.9)	9 (6.3)	22 (14.6)
No		1969 (75.2)	1445 (76.6)	340 (77.6)	102 (71.3)	82 (54.3)
Yes		471 (18.0)	355 (18.8)	37 (8.4)	32 (22.4)	47 (31.1)
Number of COVID-19 patients, *n* (%)	2692					
25 or fewer		1144 (42.5)	554 (27.5)	301 (80.3)	138 (92.0)	151 (100.0)
More than 25		1548 (57.5)	1462 (72.5)	74 (19.7)	12 (8.0)	0 (0.0)

*Majority ethnicity in different countries: Singapore (Chinese), Malaysia (Malay), India (Indian), Indonesia (Javanese)
AHP: Allied Healthcare Professional

Table III: Safety attitudes questionnaire percentage agree rates[a] (PAR) and other baseline measures of well-being

Variables	Valid n	Singapore	Malaysia	India	Indonesia	*p* value
Safety Attitudes Questionnaire (SAQ)						
Teamwork, mean (SD)	2741	70.3 (13.9)	70.4 (8.0)	73.0 (16.6)	64.1 (9.1)	**<0.001**
PAR, *n* (%)		1023 (49.0)	180 (41.3)	88 (58.7)	18 (11.9)	**<0.001**
Safety climate, mean (SD)	2745	69.4 (14.4)	67.8 (8.9)	76.8 (15.8)	63.3 (9.7)	**<0.001**
PAR, *n* (%)		876 (43.6)	118 (27.1)	103 (68.7)	21 (13.9)	**<0.001**
Stress recognition, mean (SD)	2743	69.3 (25.6)	65.4 (22.5)	50.3 (31.2)	56.9 (20.0)	**<0.001**
PAR, *n* (%)		1056 (52.5)	232 (53.5)	36 (24.5)	40 (26.5)	**<0.001**
Job satisfaction, mean (SD)	2750	73.7 (22.4)	75.9 (14.9)	85.0 (19.3)	73.5 (15.3)	**<0.001**
PAR, *n* (%)		1147 (57.0)	341 (78.4)	120 (80.0)	88 (58.3)	**<0.001**
Perception of management, mean (SD)	2746	63.4 (20.2)	62.9 (13.9)	72.7 (18.8)	57.0 (9.9)	**<0.001**
PAR, *n* (%)		684 (34.0)	143 (32.9)	80 (53.3)	8 (5.3)	**<0.001**
Working conditions, mean (SD)	2748	65.5 (21.2)	64.8 (15.1)	76.5 (19.3)	62.8 (13.7)	**<0.001**
PAR, *n* (%)		828 (41.2)	206 (47.4)	90 (60.0)	54 (35.8)	**<0.001**
Total score, mean (SD)	2732	69.0 (12.8)	68.5 (7.3)	73.7 (13.5)	63.3 (7.6)	**<0.001**
PAR, *n* (%)		713 (35.7)	65 (15.0)	75 (51.0)	5 (3.3)	**<0.001**
Oldenburg Burnout Inventory (OLBI)						
OLBI-Disengagement, mean (SD)	2772	2.40 (0.46)	2.36 (0.32)	2.15 (0.32)	2.31 (0.26)	**<0.001**
Positive[b], *n* (%)		1625 (80.5)	386 (85.6)	96 (63.6)	129 (85.4)	**<0.001**
OLBI-Exhaustion, mean (SD)	2772	2.52 (0.48)	2.46 (0.36)	2.24 (0.42)	2.34 (0.32)	**<0.001**
Positive, *n* (%)		1553 (76.9)	358 (79.4)	85 (56.3)	107 (70.9)	**<0.001**
Both OLBI-Disengangement and -Exhaustion positive, *n* (%)	2772	1423 (70.5)	328 (72.7)	77 (51.0)	98 (64.9)	**<0.001**
Hospital Anxiety and Depression Scale (HADS)						
HADS-Anxiety, mean (SD)	2772	7.00 (3.99)	7.03 (3.51)	6.77 (3.66)	8.31 (4.13)	**0.001**
Positive[c], *n* (%)		855 (42.3)	200 (44.3)	65 (43.0)	88 (58.3)	**0.002**
HADS-Depression, mean (SD)	2772	5.65 (3.88)	5.45 (3.37)	6.13 (3.54)	5.52 (3.51)	0.286
Positive, *n* (%)		636 (31.5)	133 (29.5)	59 (39.1)	47 (31.1)	0.183
Both HADS-Anxiety and -Depression positive, *n* (%)	2772	492 (24.4)	101 (22.4)	38 (25.2)	39 (25.8)	0.771

[a] Percentage Agree Rate (PAR) refers to the proportion of respondents who scored ≥75% for the Safety Culture Score in each domain
[b] Thresholds for deeming burnout for 1) OLBI-Disengagement ≥ 2.10 and 2) OLBI-Exhaustion ≥ 2.25
[c] Thresholds for deeming risk of anxiety or depression for HADS was ≥8 in either subscale

Table IV: Multivariate analysis – total safety attitudes questionnaire percentage agree rate

Variables	Univariate		Multivariate	
	OR (95% CI)	*p* value	OR (95% CI)	*p* value
Country				
Singapore	(ref)		(ref)	
Malaysia	**0.31 (0.24 – 0.42)**	**<0.001**	**0.27 (0.19 – 0.38)**	**<0.001**
India	**1.88 (1.34 – 2.63)**	**<0.001**	1.40 (0.91 – 2.13)	0.125
Indonesia	**0.06 (0.03 – 0.15)**	**<0.001**	**0.05 (0.02 - 0.11)**	**<0.001**
Being in the majority ethnicity	**0.80 (0.68 - 0.95)**	**0.009**	1.03 (0.85 - 1.25)	0.789
Healthcare role				
Doctor	(ref)			
Nurse	1.01 (0.84 – 1.21)	0.953		
AHP and others	1.14 (0.89 – 1.47)	0.298		
Workplace				
Public hospital	(ref)			
Private hospital	1.38 (0.90 – 2.12)	0.142		
Workdays per week				
<5 days	(ref)		(ref)	
5 days	0.86 (0.69 – 1.06)	0.151		
>5 days	**0.74 (0.59 – 0.94)**	**0.012**	1.23 (0.98 - 1.55)	0.068
Work hours per shift				
<8 hours	(ref)		(ref)	
8 to 12 hours	0.94 (0.72 – 1.21)	0.612		
≥12 hours	**0.67 (0.47 – 0.95)**	**0.024**	**0.70 (0.52 - 0.94)**	**0.019**
Number of COVID-19 patients				
25 or less	(ref)		(ref)	
More than 25	**1.20 (1.02 - 1.42)**	**0.030**	0.92 (0.75 - 1.14)	0.456
Redeployment	0.99 (0.80 – 1.22)	0.908		
COVID-19 testing done for self	0.87 (0.70 – 1.08)	0.198		
Other baseline measures of well-being i.e. Oldenburg Burnout Inventory (OLBI) and Hospital Anxiety and Depression Scale (HADS)				
OLBI-Disengagement positive	0.25 (0.20 – 0.30)	<0.001	**0.40 (0.32 – 0.52)**	**<0.001**
OLBI-Exhaustion positive	0.31 (0.26 – 0.38)	<0.001	**0.58 (0.45 - 0.73)**	**<0.001**
HADS-Anxiety positive	0.44 (0.37 – 0.52)	<0.001	0.85 (0.69 - 1.06)	0.148
HADS-Depression positive	0.39 (0.33 – 0.48)	<0.001	**0.54 (0.42 - 0.68)**	**<0.001**

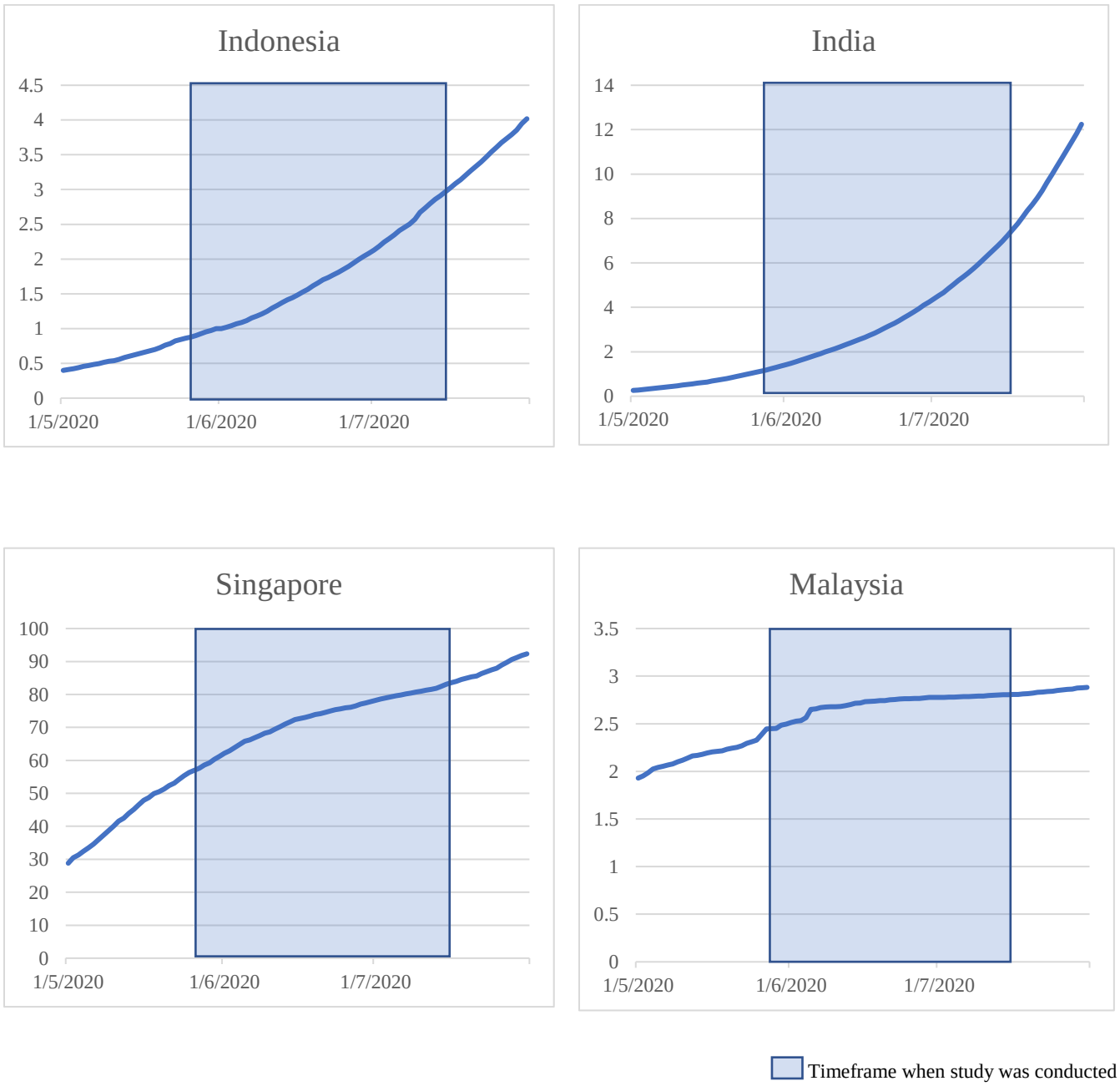

Fig. 1: Cumulative COVID-19 cases per 10,000 population
Source: WHO coronavirus disease (COVID-19) dashboard. Geneva: World Health Organization, 2020. Available online: https://covid19.who.int/ (last cited: 17th Jan 2021)

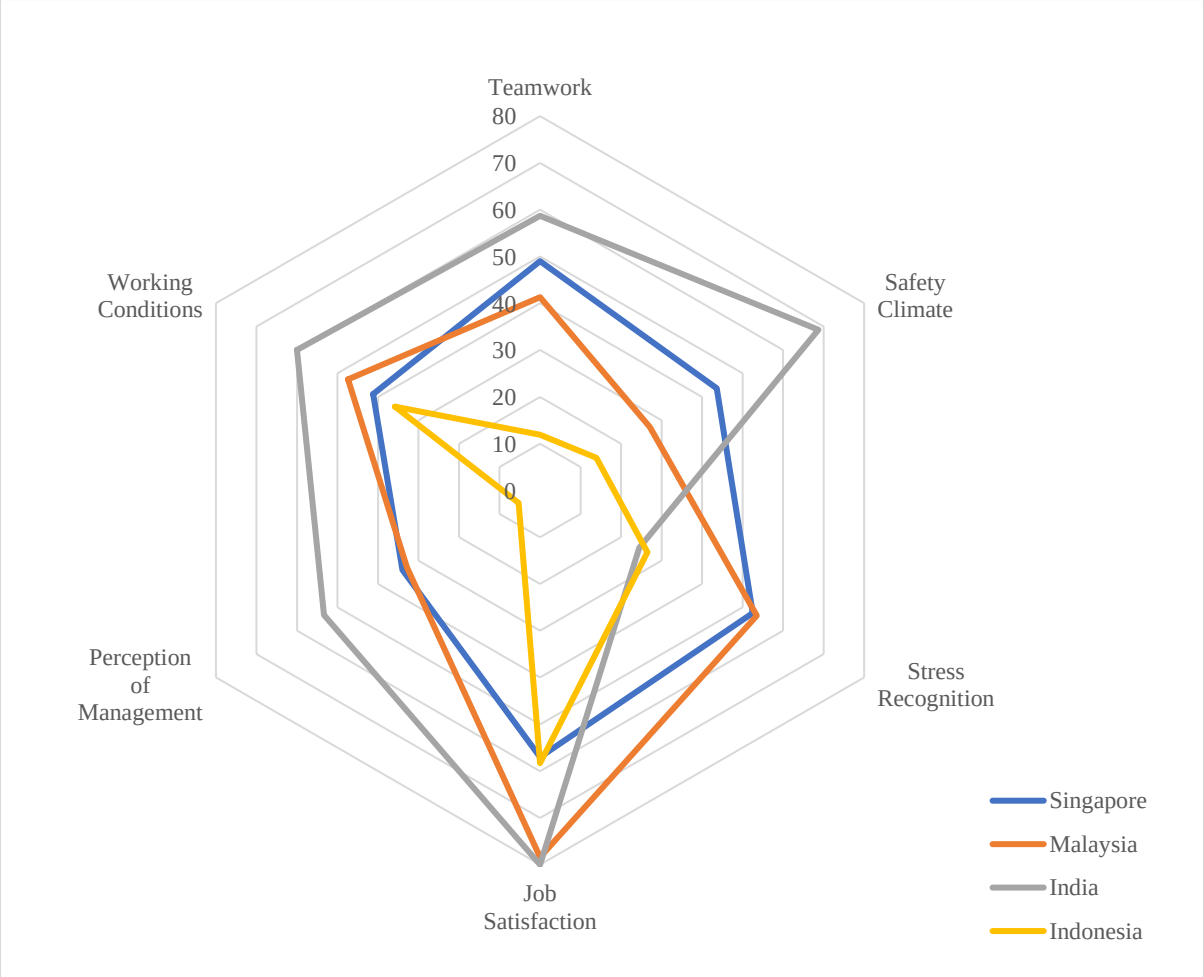

Fig. 2: Safety attitudes questionnaire (percentage agree rate) between different countries

SUPPLEMENTARY MATERIAL

Appendix A: Participating Hospitals

Name of Hospital	Valid *n*	Median Range of Number of COVID-19 Patients
Indonesia		
Moewardi Hospital	143	1-25
Malaysia		
Hospital Umum Kuching Sarawak	3	More than 100
Hospital Sungai Buloh	40	51-100
Hospital Wanita & Kanak Kanak Likas, Kota Kinabalu	9	26-50
Hospital Tengku Ampuan Afzan Kuantan	17	26-50
Hospital Queen Elizabeth I/II Kota Kinabalu	2	26-50
Hospital Bintulu	26	1-25
Hospital Tuanku Jaafar Seremban	17	1-25
Hospital Labuan	37	1-25
Hospital Raja Perempuan Zainab 2 Kota Bharu	84	1-25
Hospital Selayang	35	1-25
Hospital Tengku Ampuan Rahimah Klang	87	1-25
Pusat Perubatan UIA Kuantan	6	1-25
Hospital USM	68	0
India		
GCS Hospital	12	More than 100
Zydus Hospital	108	1-25
Yashoda Hospital	4	1-25
Max Saket Hospital	1	0
SMS Hospital	7	0
Singapore		
Ng Teng Fong General Hospital	416	51-100
National University Hospital	995	51-100
Alexandra Hospital	75	1-25
Institute of Mental Health	452	1-25

Appendix B: Safety Attitudes Questionnaire (5-point Likert Scale)

	Question	Domain	Reversed Questions
1.	Nurse input is well received in this clinical area.	TW	
2.	In this clinical area, it is difficult to speak up if I perceive a problem with patient care.		✓
3.	Disagreements in this clinical area are resolved appropriately (i.e., not who is right, but what is best for the patient).		
4.	I have the support I need from other personnel to care for patients.		
5.	It is easy for personnel here to ask questions when there is something that they do not understand.		
6.	The physicians and nurses here work together as a well-coordinated team.		
7.	I would feel safe being treated here as a patient.	SC	
8.	Medical errors are handled appropriately in this clinical area.		
9.	I know the proper channels to direct questions regarding patient safety in this clinical area.		
10.	I receive appropriate feedback about my performance.		
11.	In this clinical area, it is difficult to discuss errors.		✓
12.	I am encouraged by my colleagues to report any patient safety concerns I may have.		
13.	The culture in this clinical area makes it easy to learn from the errors of others.		
14.	I like my job.	JS	
15.	Working here is like being part of a large family.		
16.	This is a good place to work.		
17.	I am proud to work in this clinical area.		
18.	Morale in this clinical area is high.		
19.	When my workload becomes excessive, my performance is impaired.	SR	✓
20.	I am less effective at work when fatigued.		✓
21.	I am more likely to make errors in tense or hostile situations.		✓
22.	Fatigue impairs my performance during emergency situations (e.g. emergency resuscitation, seizure).		✓
23.	Management supports my daily efforts.	PM	
24.	Management doesn't knowingly compromise patient safety.		
25.	Management is doing a good job.		
26.	Problem personnel are dealt with constructively by our management.		
27.	I get adequate, timely info about events that might affect my work, from management.		
28.	The levels of staffing in this clinical area are sufficient to handle the number of patients.	WC	
29.	This hospital does a good job of training new personnel.		
30.	All the necessary information for diagnostic and therapeutic decisions is routinely available to me.		
31.	Trainees in my discipline are adequately supervised.		
32.	I experience good collaboration with nurses in this clinical area.	No domain	
33.	I experience good collaboration with staff physicians in this clinical area.		
34.	I experience good collaboration with pharmacists in this clinical area.		
35.	Communication breakdowns that lead to delays in delivery of care are common.		✓
36.	My suggestions about safety would be acted upon if I expressed them to management.		

TW: Teamwork climate, SC: Safety Climate, JS: Job Satisfaction, SR: Stress Recognition, PM: Perceptions of Management, WC: Working conditions

Appendix C: Oldenburg Burnout Inventory (4-point Likert Scale)

	Question	Domain	Reversed Questions
1.	I always find new and interesting aspects of my work.	D	✓
2.	There are days when I feel tired before I arrive at work.	E	
3.	It happens more and more often that I talk about my work in a negative way.	D	
4.	After work, I tend to need more time than in the past in order to relax and feel better	E	
5.	I can tolerate the pressure of my work very well.	E	✓
6.	Lately, I tend to think less at work and do my job almost mechanically.	D	
7.	I find my work to be a positive challenge.	D	✓
8.	During my work, I often feel emotionally drained.	E	
9.	Over time, one can become disconnected from this type of work.	D	
10.	After working, I have enough energy for my leisure activities.	E	✓
11.	Sometimes I feel sickened by my work tasks.	D	
12.	After my work, I usually feel worn out and weary.	E	
13.	This is the only type of work that I can imagine myself doing.	D	✓
14.	Usually, I can manage the amount of my work well.	E	✓
15.	I feel more and more engaged in my work.	D	✓
16.	When I work, I usually feel energized.	E	✓

D: Disengagement, E: Exhaustion

Appendix D: Hospital Anxiety and Depression Scale

	Question	Domain	Responses & Score			
1.	I feel tense or 'wound up'	A	Most of the time	A lot of the time	From time to time, occasionally	Not at all
			3	**2**	**1**	**0**
2.	I still enjoy the things I used to enjoy	D	Definitely as much	Not quite so much	Only a little	Hardly at all
			0	**1**	**2**	**3**
3.	I get a sort of frightened feeling as if something awful is about to happen	A	Very definitely and quite badly	Yes, but not too badly	A little, but it doesn't worry me	Not at all
			3	**2**	**1**	**0**
4.	I can laugh and see the funny side of things	D	As much as I always could	Not quite so much now	Definitely not so much now	Not at all
			0	**1**	**2**	**3**
5.	Worrying thoughts go through my mind	A	A great deal of the time	A lot of the time	From time to time, but not too often	Only occasionally
			3	**2**	**1**	**0**
6.	I feel cheerful	D	Not at all	Not often	Sometimes	Most of the time
			0	**1**	**2**	**3**
7.	I can sit at ease & feel relaxed	A	Definitely	Usually	Not often	Not at all
			0	**1**	**2**	**3**
8.	I feel as if I am slowed down	D	Nearly all the time	Very often	Sometimes	Not at all
			3	**2**	**1**	**0**
9.	I get a sort of frightened feeling like 'butterflies' in the stomach	A	Not at all	Occasionally	Quite often	Very often
			0	**1**	**2**	**3**
10.	I have lost interest in my appearance	D	Definitely	I don't take as much care as I should	I may not take quite as much care	I take just as much care ever
			3	**2**	**1**	**0**
11.	I feel restless as I have to be on the move	A	Very much indeed	Quite a lot	Not very much	Not at all
			3	**2**	**1**	**0**
12.	I look forward with enjoyment to things	D	As much as I ever did	Rather less than I used to	Definitely less than I used to	Hardly at all
			0	**1**	**2**	**3**
13.	I get sudden feelings of panic	A	Very often indeed	Quite often	Not very often	Not at all
			3	**2**	**1**	**0**
14.	I can enjoy a good book or radio or TV program	D	Often	Sometimes	Not often	Very seldom
			0	**1**	**2**	**3**

D: Depression, A: Anxiety

0-7: Normal, 8-10: Borderline abnormal, 11-21: Abnormal

Appendix E: Confirmatory Factor Analysis

Confirmatory Factor Analysis		OLBI	SAQ	HADS
Root mean square error of approximation	**(RMSEA)**	Not available	0.042	0.057
Comparative fit index	**(CFI)**	1.0	0.893	0.900
Standardized root mean square residual	**(SRMR)**	0.086	0.044	0.050

OLBI: Oldenburg Burnout Inventory
SAQ: Safety Attitudes Questionnaire
HADS: Hospital Anxiety and Depression Scale