A longitudinal study of the psychological impact of the COVID-19 pandemic on frontline perioperative healthcare staff in an Australian tertiary public hospital

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Abstract

Objective: This longitudinal study examined changes in psychological outcomes of perioperative frontline healthcare workers at one of Australia's most COVID-19 affected hospitals, following the surge and decline of a pandemic wave.
Method: A single-centred longitudinal online survey was conducted between 26 May and 17 November 2020. Recruitment was via poster advertisement and email invitation. The survey was sent out every 4 weeks, resulting in seven time-points.
Results: In total, 385 survey results were analysed from 193 staff (about 64% response rate), 72 (37%) of whom completed the survey more than once. The prevalence of moderate-to-severe anxiety and depressive symptoms peaked at 27% and 25%, respectively, during the pandemic surge. Up to 35% displayed post-traumatic stress disorder (PTSD) symptoms. Although not statistically significant, the trend of depressive and PTSD symptoms worsened over time, especially among females and anaesthetic/surgical trainees, despite subsidence of the pandemic curve. Technicians and anaesthetic/scrub nurses were the at-risk groups with worst psychological outcomes.
Conclusion: We found persistent mental health impacts on frontline perioperative HCWs despite subsidence of the pandemic wave. Further research is needed to determine the extent and trajectory of such impacts with larger sample sizes to determine generalisability to frontline HCWs in general.

Keywords: Longitudinal survey, psychological impact, perioperative frontline healthcare workers, COVID-19 pandemic

A compelling body of evidence illustrates a high degree of mental health vulnerability among healthcare workers (HCWs) during the COVID-19 pandemic. Notably, several studies demonstrated an

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increased incidence of depression, anxiety, insomnia and distress among HCWs.[1–6] Simply being a HCW was identified as an independent predictor of psychological distress;[1–4] being a frontline HCW was associated with worst outcomes.[7,8]

At 18 October 2021, Victoria was the most affected Australian state,[9] and experienced the longest lockdown globally.[10] The Royal Melbourne Hospital (RMH) remains the epicentre of COVID cases in Victoria.[11] Perioperative staff at RMH face many workplace stressors. There are constant concerns about aerosol transmission of COVID-19, because aerosol-generating procedures are regularly performed in operating theatres,[12] and frequently on patients with unknown COVID-19 status (e.g. trauma or unconscious patients requiring urgent surgery and/or intubation). They also experience frequent changes of personal protective equipment (PPE) requirements, theatre workflow and workload.

While much evidence illuminates psychological concerns among HCWs, most research was cross-sectional. Given the dynamic nature of mental health in relation to environmental changes, understanding longitudinal trajectories is critical. Our longitudinal study evaluated the psychological impact of the COVID-19 pandemic on RMH perioperative staff, examining changes over time. We investigated whether baseline characteristics influenced changes and associations between key characteristics and psychological outcomes.

Methods

This single-centre longitudinal online survey was conducted between 26 May and 17 November 2020; coinciding with the 'second wave' of COVID-19 in Victoria, Australia. Hosted by REDCap10.5.2 (Vanderbilt University, Nashville, Tennessee, USA), outcome assessment was undertaken 4-weekly, providing seven time-points in total. Melbourne Health Human Research Ethics Committee approved this study (HREC/63609/MH-2020).

Recruitment was via poster advertisement and emails sent to all RMH perioperative staff every 4 weeks. The survey was open for 1 week at each time-point. The study population consisted of approximately 300 members, including anaesthetic or surgical consultants and trainees, anaesthetic or scrub nurses and theatre technicians. Participation was voluntary, participants could join at any time-point, and consent was implied upon survey completion.

Demographic and COVID-19 exposure details were recorded (Supplemental Appendix 1). To maintain confidentiality, two additional items (favourite drink and first pet name) were included to facilitate participant matching across time-points, in conjunction with other characteristics (e.g. age group, gender, professional group and years worked).

Primary outcomes were anxiety, depression and post-traumatic stress disorder (PTSD) symptomatology measured using the Generalised Anxiety Disorder scale (GAD-7; range 0–21), Patient Health Questionnaire (PHQ-9; range 0–27) and Primary Care-Post-Traumatic Stress Disorder (PC-PTSD-5) questionnaire, respectively. On the seventh survey, the PC-PTSD-5 questionnaire was replaced by the Impact Event Scale–revised (IES-R-22; range 0–88) and Abbreviated Maslach Burnout Inventory (A-MBI-9; range 0–18).

Linear mixed models with random intercepts were fitted to examine differences in psychological health (GAD-7, PHQ-9 and PC-PTSD-5 scores) over time with and without adjustment for age group, gender, profession, years worked, pre-existing mental illness and number of COVID-19 patients and related-deaths encountered.

Interactions between time and (1) gender, (2) profession and (3) pre-existing mental illness were considered in linear mixed models, as were associations between number of (1) COVID-patients and (2) COVID-deaths encountered and (3) professional group, for each psychological outcome. Analyses were conducted using Stata 13.0 (Statacorp, College Station, Texas, USA).

Results

In total, 406 surveys were completed across seven time-points. Twenty-one entries containing repeat (within same time-point) or no data were excluded. This left 385 entries from 193 participants (about 64% response rate) for analysis; 72 (37%) completed the survey more than once, 10% had five or more time-points.

Demographic and COVID-exposure data are shown in Table 1. Immediately after the second pandemic wave peaked, 27% and 25% of the participants experienced moderate-to-severe anxiety and depressive symptoms, respectively (Figure 1 and Table 2). Further, 35% of the participants experienced PTSD symptoms towards the end of the pandemic wave.

Results indicated GAD-7 decreased on average by 0.15 per 4-week period (95% CI: −0.33, 0.04), whereas PHQ-9 (0.08, 95% CI: −0.07, 0.23) and PC-PTSD-5 (0.04, 95% CI: −0.03, 0.11) increased (Table 3). All psychological outcomes were worse for females than males (Figure 2); and worst among technicians and best among surgical consultants across all time-points (Figure 3). They were worse initially for those with pre-existing mental illness (Figure 4). PHQ and PTSD scores were increasing (i.e. worsening) over time for females and anaesthetic/surgical trainees.

Both technicians and anaesthetic/scrub nurses had significantly worse psychological outcomes, whereas surgeons had significantly less anxiety and depression relative to anaesthetic consultants (Table 4).

Discussion

This study demonstrated a significant psychological impact of COVID-19 on frontline perioperative HCWs at one

Table 1. Participating perioperative staff demographic characteristics at entry to the study[a] and overall COVID-exposure details

	N = 193
Age group (years), *n* (%)	
>20–30	28 (15)
>30–40	66 (34)
>40–50	53 (28)
>50–60	34 (17)
>60–70	10 (5)
>70	2 (1)
Sex, *n* (%)	
Female	116 (60)
Male	74 (38)
Other	3 (2)
Living with a child <16 years old, *n* (%)	61 (32)
Living with an adult >65 years old, *n* (%)	15 (8)
Profession, *n* (%)	
Anaesthetic consultant	41 (21)
Anaesthetic nurse	36 (19)
Anaesthetic trainee	18 (9)
Scrub nurse	21 (11)
Surgical consultant	29 (15)
Surgical trainee	8 (4)
Technician	13 (7)
Other	27 (14)
Average hours worked per week, mean (SD), min–max	37.5 (10.9), 1–70
Number of years worked at current role, mean (SD), min–max	10.8 (9.8), 0–43
Working location[b], *n* (%)	
Operating theatre	149 (77)
Intensive care unit	2 (1)
Recovery area	29 (15)
Emergency department	10 (5)
Dedicated COVID ward	1 (1)
Non-COVID ward	13 (7)
Other	35 (18)
Pre-existing baseline mental health issues, including anxiety, depression or post-traumatic stress disorder, *n* (%)	36 (19)
Number of COVID-19 patients encountered every 4 weeks, mean (SD), min–max	4 (15), 0–240
Total number of participants who encountered COVID-related deaths, *n*(%)	6 (3)
Total number of participants tested positive, *n* (%)	17 (9)
Total number of participants who had been quarantined, *n* (%)	17 (9)
Total number of participants with close friends or relatives tested positive with COVID-19, *n* (%)	23 (12)
Total number of participants with close friends or relatives died from COVID-19, *n* (%)	3 (2)

[a]Staff could enter the study at any point during the seven survey rounds.

[b]Staff could indicate multiple working locations.

of Australia's most affected hospitals over a 6-month period. The prevalence of moderate-to-severe anxiety, depressive and PTSD symptoms reached 27%, 25% and 35%, respectively, during the second pandemic wave. While the findings are comparable to global systematic reviews,[1,3,5,7] divergence is evident at a local level.

Notably, our findings reflect worse outcomes than Dobson and colleague's cross-sectional study.[13] The different survey time may account for differing results.[14] This highlights the dynamic nature of HCWs' emotional responses, hence importance of a longitudinal study.
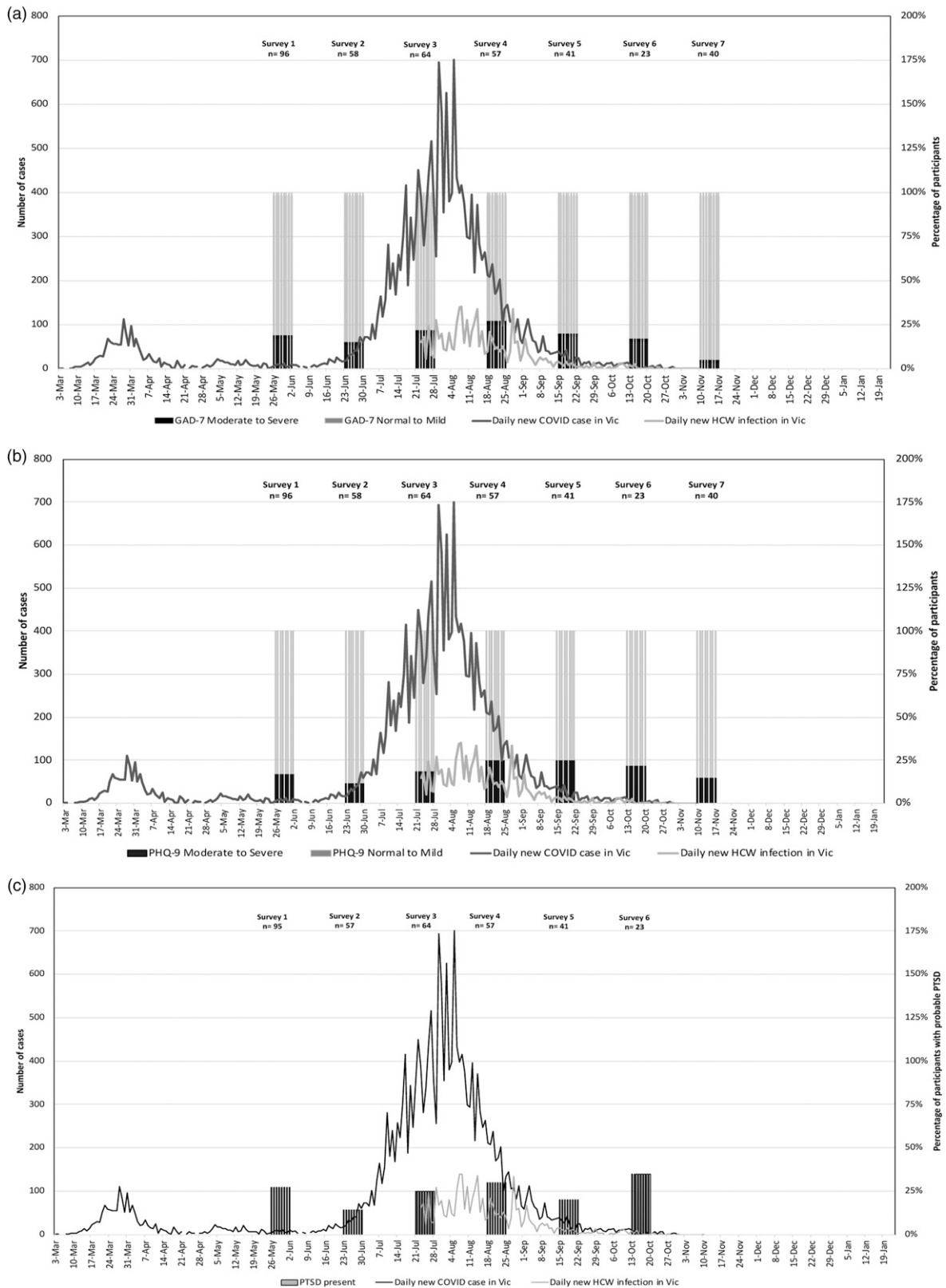
Figure 1. Daily new COVID-19 case and healthcare worker infection in Victoria (Vic), Australia in 2020; overlaid with categorised psychological health outcomes. Note. A = anxiety outcomes; B = depression outcomes; C = PTSD outcomes; GAD = generalised anxiety score; PHQ = patient health questionnaire; PTSD = post-traumatic stress score.

Table 2. Severity categories of anxiety and depression; and presence of post-traumatic stress disorder in each round of the survey

	Survey round 1 (26/5/20–2/6/20)	Survey round 2 (23/6/20–30/6/20)	Survey round 3 (21/7/20–28/7/20)	Survey round 4 (18/8/20–25/8/20)	Survey round 5 (15/9/20–22/9/20)	Survey round 6 (13/10/20–20/10/20)	Survey round 7 (10/11/20–17/11/20)
GAD-7, anxiety symptoms (score)	N = 96	N = 58	N = 64	N = 57	N = 41	N = 23	N = 40
Normal (0–4)	51 (53%)	38 (66%)	27 (42%)	27 (47%)	22 (53%)	14 (61%)	28 (70%)
Mild (5-9)	27 (28%)	11 (19%)	23 (36%)	15 (26%)	11 (27%)	5 (22%)	10 (25%)
Moderate (10-14)	13 (14%)	6 (10%)	9 (14%)	9 (16%)	6 (15%)	1 (4%)	1 (2.5%)
Severe (15–21)	5 (5%)	3 (5%)	5 (8%)	6 (11%)	2 (5%)	3 (13%)	1 (2.5%)
PHQ-9, depressive symptoms (score)	N = 96	N = 58	N = 64	N = 57	N = 41	N = 23	N = 40
Normal (0–4)	57 (60%)	35 (60%)	34 (53%)	28 (49%)	21 (51%)	10 (43%)	24 (60%)
Mild (5–9)	22 (23%)	16 (28%)	18 (28%)	15 (26%)	10 (24%)	8 (35%)	10 (25%)
Moderate (10–14)	13 (14%)	3 (5%)	7 (11%)	8 (14%)	5 (12%)	2 (9%)	5 (12.5%)
Moderate severe (15–19)	3 (3%)	1 (2%)	5 (8%)	5 (9%)	4 (10%)	1 (4%)	1 (2.5%)
Severe (20–27)	1 (1%)	3 (5%)	0 (0%)	1 (2%)	1 (3%)	2 (9%)	0 (0%)
PTSD, post-traumatic stress disorder (score)	N = 95	N = 57	N = 64	N = 57	N = 41	N = 23	N = 38
Present (≥3)	26 (27%)	8 (14%)	16 (25%)	17 (30%)	8 (20%)	8 (35%)	N/A
IES-R, distress symptoms (score)	N/A	N/A	N/A	N/A	N/A	N/A	N = 38
Normal (0–23)							18 (47%)
Mild (24–32)							18 (47%)
Moderate (33–36)							1 (3%)
Severe (≥37)							1 (3%)
AMBI, burnout symptoms (scale 0-18)	N/A	N/A	N/A	N/A	N/A	N/A	N = 38
Emotional exhaustion							10 (5–12[1–17])
Depersonalisation							2 (1–6[0–16])
Personal accomplishment							13.5 (12–16[6–18])

Note. GAD-7 = Generalised Anxiety Disorder inventory; PHQ-9 = Patient Health Questionnaire; PC-PTSD-5 = Primary Care - Post-Traumatic Stress Disorder questionnaire.

Values are presented as number (percentage) or median[IQR[range]).

Table 3. Unadjusted and adjusted estimates of the change in primary outcome summary scores over time from linear mixed models

	Unadjusted			Adjusted[a]		
	Coef	95% CI	p-value	Coef	95% CI	p-value
GAD-7 (n = 182[b]) Time[c]	−0.04	(−0.24, 0.15)	.661	−0.15	(−0.33, 0.04)	.121
PHQ-9 (n = 182[b]) Time[c]	0.12	(−0.04, 0.28)	.137	0.08	(−0.07, 0.23)	.308
PC-PTSD-5 (n = 171[b]) Time[c]	0.05	(−0.02, 0.12)	.183	0.04	(−0.03, 0.11)	.309

Note. GAD-7 = Generalised Anxiety Disorder inventory; PHQ-9 = Patient Health Questionnaire; PC-PTSD-5 = Primary Care - Post-Traumatic Stress Disorder questionnaire; CI = confidence interval; Coef = coefficient.

[a]Linear mixed models with random intercepts adjusted for participant age, gender, professional group, years worked, pre-existing mental health issues, number of COVID related deaths encountered and number of COVID patients encountered.

[b]The number of unique participants included in the model with the outcome measured on at least one survey wave. There were 359 unique observations for GAD-7 and PHQ-9 for these 182 participants with the number of observations per participant ranging from 1 to 7. There were 321 unique observations for PC-PTSD-5 PTSD with the number of observations per participant ranging from 1 to 6. The residual intraclass correlation from adjusted models was estimated to be 0.55 (95% CI 0.44–0.66), 0.73 (95% CI 0.65–0.80) for PHQ-9, 0.63 (95% CI 0.52–0.72) for PC-PTSD-5 PTSD.

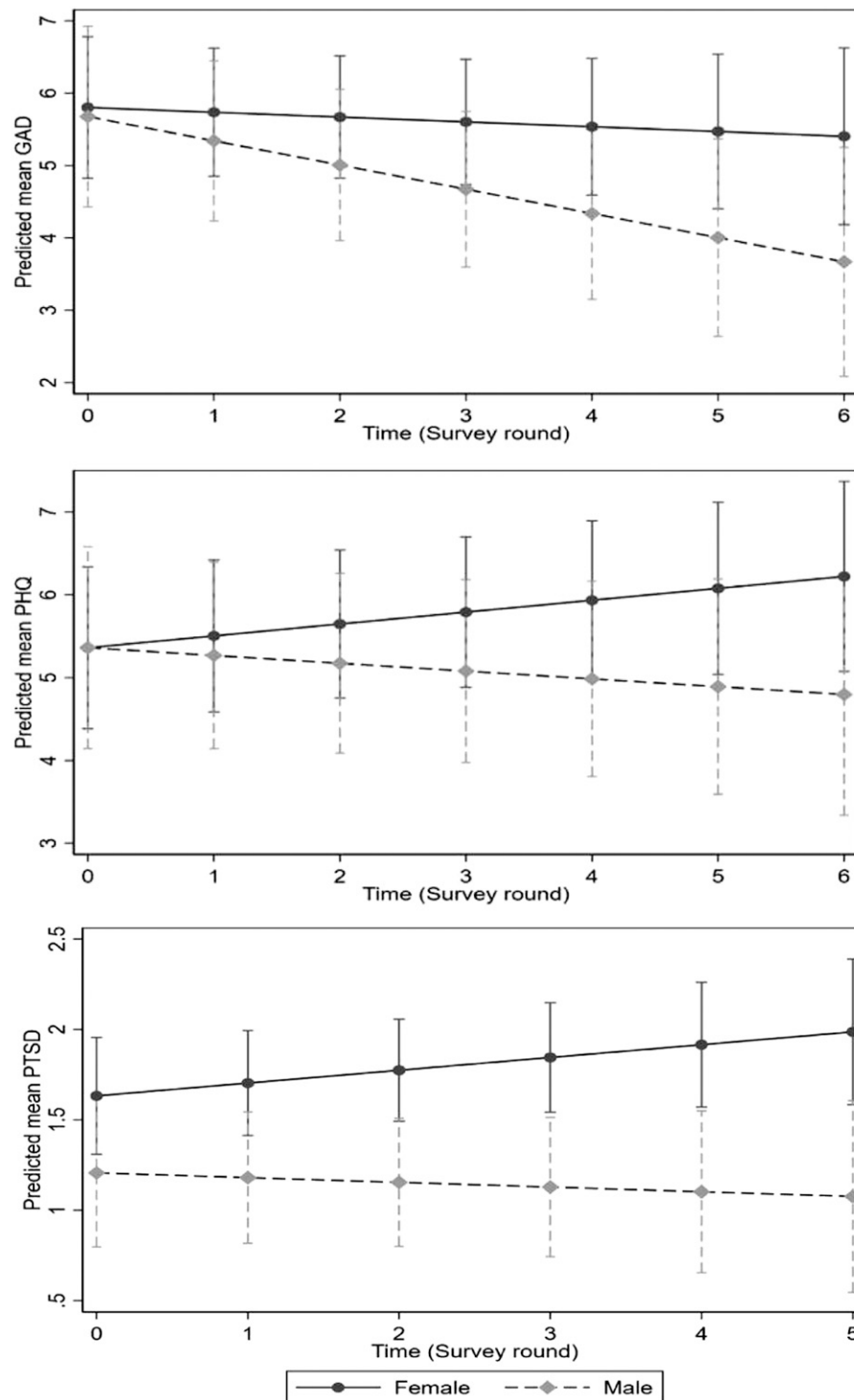[c]Time represents the mean difference in outcome per survey round (i.e. per 4-week period).

Figure 2. Estimated average mean scores and 95% confidence intervals over time (survey round) by gender identity from linear mixed models with an interaction between gender and time. Note. GAD = generalised anxiety score; PHQ = patient health questionnaire; PTSD = post-traumatic stress score.

Longitudinally, although not statistically significant, anxiety appeared to decrease over time. Previous research showed that being clinically unprepared was associated with worse anxiety,[15] whereas systemic support and adequate knowledge protected HCWs against adverse psychological outcomes.[16] During the early stage of this study, there was minimal knowledge about the virus and PPE requirement. As the pandemic evolved,
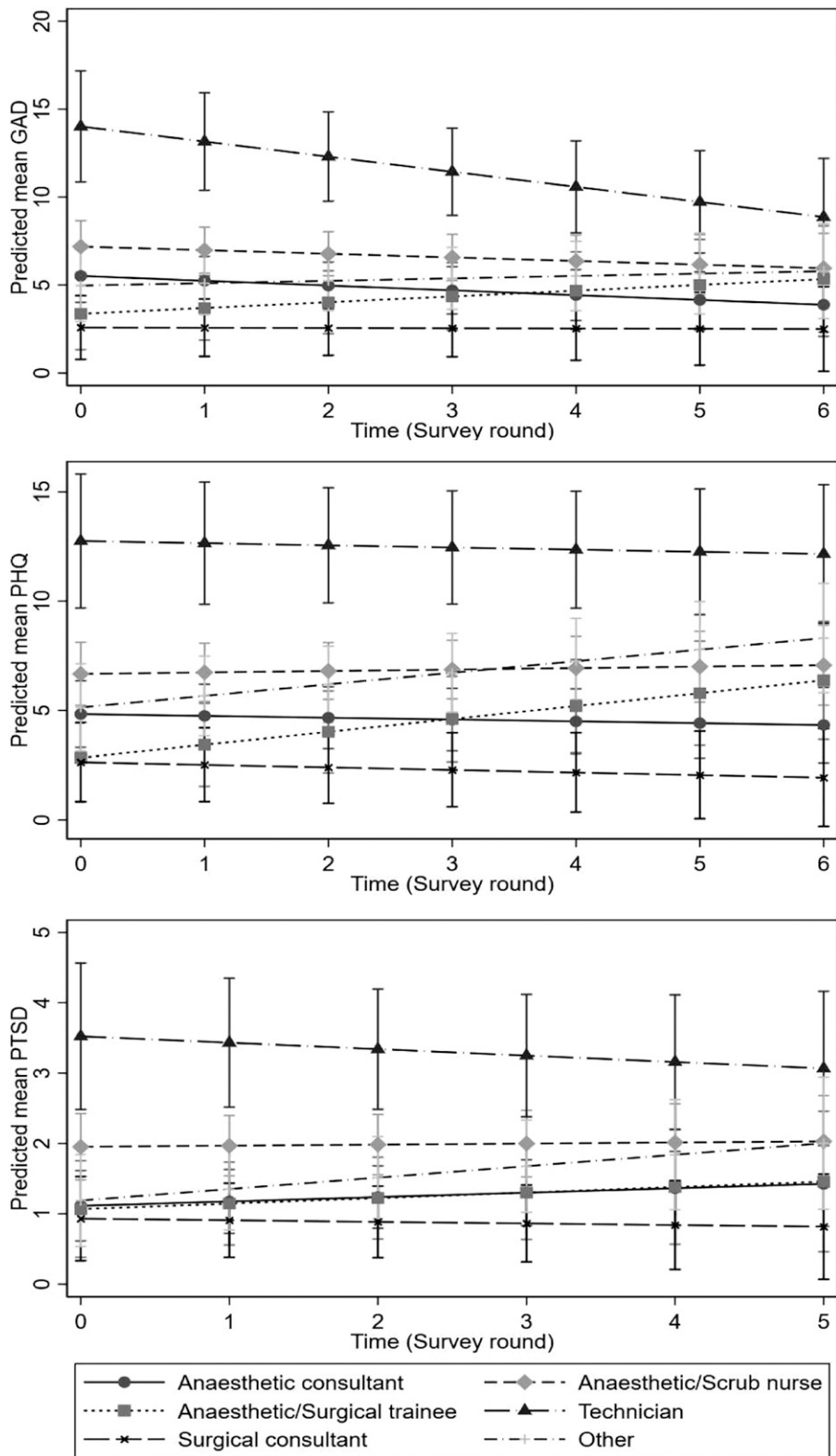
Figure 3. Estimated average mean scores and 95% confidence intervals by time (survey round) by profession. Note. GAD = generalised anxiety score; PHQ = patient health questionnaire; PTSD = post-traumatic stress score.
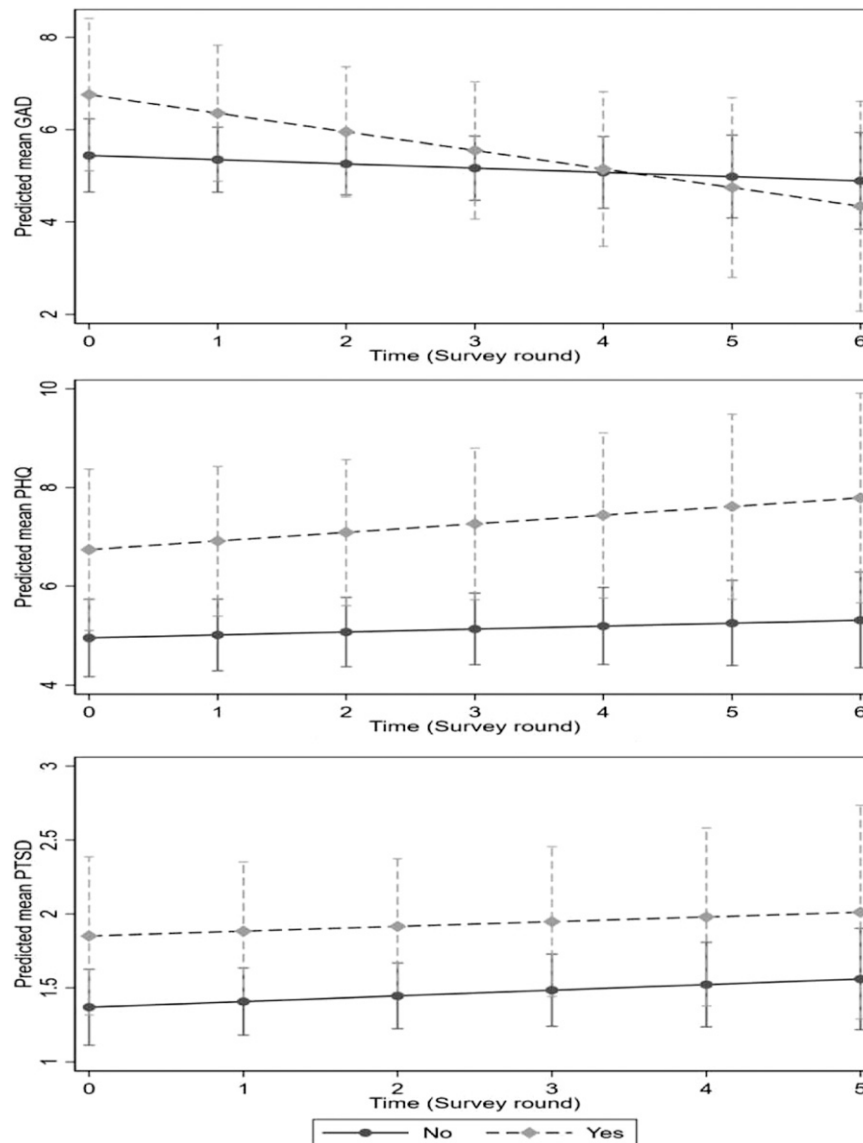
Figure 4. Estimated average mean scores and 95% confidence intervals over time (survey round) by whether participants have pre-existing baseline mental health issues including anxiety, depression and post-traumatic stress symptoms. Note. GAD = generalised anxiety score; PHQ = patient health questionnaire; PTSD = post-traumatic stress score.

organisational support was strengthened, with provision of procedural guidelines,[17] team communications and training.[11]

In contrast, depressive and PTSD symptoms worsened over time, although not statistically significant, during the study period, particularly among females and anaesthetic or surgical trainees. Our findings align with emerging literature highlighting poor psychological outcomes for women[5,6,16] and junior doctors[18,19] during the pandemic. Elevated levels of psychological distress

found in this cohort during non-pandemic times,[20] may confer increased risk during a crisis.

Technicians and anaesthetic or scrub nurses exhibited poor psychological outcomes. Both groups lacked control in their workflow and were frequently deployed to high-risk duties. Moreover, technicians as a group tend to be overlooked, because of their small workforce. They mostly worked solo, which might reduce support and communication to and within the group. Contrarily, surgeons demonstrated favourable psychological outcomes, possibly

Table 4. Unadjusted estimates from linear mixed models of associations between each of profession, number of COVID patients encountered and number of COVID related deaths encountered and each psychological health outcomes

	GAD			PHQ			PTSD		
	Coef	95% CI	*p*-value	Coef	95% CI	*p*-value	Coef	95% CI	*p*-value
COVID patients (*n* = 186)	0.02	(−0.01, 0.05)	.107	0.03	(0.00, 0.06)	.039[a]	0.00	(−0.01, 0.02)	.675
COVID deaths (*n* = 187)	0.12	(−0.78, 1.03)	.787	0.05	(−0.75, 0.84)	.911	−0.05	(−0.31, 0.22)	.716
Profession (*n* = 187)									
Anaesthetic consultant	Ref			Ref			Ref		
Anaesthetic/Scrub nurse	2.80	(1.14, 4.46)	.001[a]	3.25	(1.55, 4.95)	<.001[a]	1.20	(0.65, 1.76)	<.001[a]
Anaesthetic/Surgical trainee	0.24	(−1.79, 2.27)	.814	0.69	(−1.39, 2.77)	.515	0.34	(−0.32, 1.01)	.316
Technician	7.54	(5.00, 10.09)	<.001[a]	8.92	(6.31, 11.52)	<.001[a]	2.13	(1.28, 2.98)	<.001[a]
Surgical consultant	−2.27	(−4.21, −0.34)	0.021[a]	−2.40	(−4.39, −0.42)	.018[a]	−0.41	(−1.04, 0.23)	.209
Other	1.47	(−0.56, 3.51)	.157	3.09	(1.01, 5.17)	.004[a]	0.56	(−0.13, 1.26)	.114

Note. GAD = generalised anxiety score; PHQ = patient health questionnaire; PTSD = post-traumatic stress score; CI = confidence interval; Coef. = coefficient.

[a]Statistically significant.

because of their autonomy in decision making, and the reduction in direct patient contact, due to cutback in elective cases and options of telehealth consultation.

This study is not without limitation. Although our sample size was modest, we had a reasonable response rate of 64% and representation across a range of HCW roles. However, there was high attrition across time, only 37% of 193 participants had longitudinal data, limiting the ability to assess within-individual change. Although efforts were made to verify repeated observations using multiple questionnaire items, the possibility of misclassification remained. Furthermore, the small sample size and co-variate adjustment required reduced power to detect significant differences.

In conclusion, this study gives a partial longitudinal view of the psychological health of frontline perioperative HCWs, working at one of Australia's most COVID-19 affected hospitals during a pandemic wave. It highlighted the persistent psychological impact despite subsidence of the pandemic wave. Further research is needed to determine the extent and trajectory of such impacts with larger sample sizes to determine generalisability to frontline HCWs.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Supplemental material

Supplemental material for this article is available online.

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