


High levels of psychosocial distress among Australian frontline healthcare workers during the COVID-19 pandemic: a cross-sectional survey

Natasha Smallwood,^{1,2} Leila Karimi,^{3,4} Marie Bismark,^{5,6} Mark Putland ^{7,8} Douglas Johnson,^{9,10} Shyamali Chandrika Dharmage,¹¹ Elizabeth Barson,¹² Nicola Atkin,^{13,14} Claire Long,¹⁵ Irene Ng,^{16,17} Anne Holland,^{2,18} Jane E Munro,^{19,20} Irani Thevarajan,²¹ Cara Moore,²² Anthony McGillion,²³ Debra Sandford,²⁴ Karen Willis^{25,26}

To cite: Smallwood N, Karimi L, Bismark M, *et al*. High levels of psychosocial distress among Australian frontline healthcare workers during the COVID-19 pandemic: a cross-sectional survey. *General Psychiatry* 2021;**34**:e100577. doi:10.1136/gpsych-2021-100577

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/gpsych-2021-100577>).

Received 20 May 2021
Accepted 03 August 2021



© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Natasha Smallwood;
natasha.smallwood@monash.edu.au

ABSTRACT

Background The coronavirus disease 2019 (COVID-19) pandemic has had a profound and prolonged impact on healthcare services and healthcare workers.

Aims The Australian COVID-19 Frontline Healthcare Workers Study aimed to investigate the severity and prevalence of mental health issues, as well as the social, workplace and financial disruptions experienced by Australian healthcare workers during the COVID-19 pandemic.

Methods A nationwide, voluntary, anonymous, single timepoint, online survey was conducted between 27 August and 23 October 2020. Individuals self-identifying as frontline healthcare workers in secondary or primary care were invited to participate. Participants were recruited through health organisations, professional associations or colleges, universities, government contacts and national media. Demographics, home and work situation, health and psychological well-being data were collected.

Results A total of 9518 survey responses were received; of the 9518 participants, 7846 (82.4%) participants reported complete data. With regard to age, 4110 (52.4%) participants were younger than 40 years; 6344 (80.9%) participants were women. Participants were nurses (n=3088, 39.4%), doctors (n=2436, 31.1%), allied health staff (n=1314, 16.7%) or in other roles (n=523, 6.7%). In addition, 1250 (15.9%) participants worked in primary care. Objectively measured mental health symptoms were common: mild to severe anxiety (n=4694, 59.8%), moderate to severe burnout (n=5458, 70.9%) and mild to severe depression (n=4495, 57.3%). Participants were highly resilient (mean (SD)=3.2 (0.66)). Predictors for worse outcomes on all scales included female gender; younger age; pre-existing psychiatric condition; experiencing relationship problems; nursing, allied health or other roles; frontline area; being worried about being blamed by colleagues and working with patients with COVID-19.

Conclusions The COVID-19 pandemic is associated with significant mental health symptoms in frontline healthcare workers. Crisis preparedness together with policies and practices addressing psychological well-being are needed.

Key messages

The known

- Healthcare workers experience unique workplace demands and stressors in their day-to-day roles and therefore are at increased risk of mental illness.
- Crisis events represent an additional threat to mental health of healthcare workers.
- Poor mental health of clinicians has wider repercussions for quality of care, patient safety, workforce retention and engagement.

The new

- The impacts of the COVID-19 pandemic were associated with significant symptoms of mental illness in Australian frontline healthcare workers in primary and secondary care.
- Some healthcare worker groups were more vulnerable to psychological problems.
- Health organisations and leaders need to be better prepared for crisis events such as pandemics, given the associated impacts observed in mental health of frontline healthcare workers. Additional psychological well-being services are needed to actively support healthcare workers.

INTRODUCTION

Healthcare workers (HCWs) experience unique workplace demands and stressors, with doctors and nurses particularly experiencing poor mental health and increased rates of occupational burnout, anxiety, depression and suicide than other occupations.¹⁻⁴ Although less is known about other groups of clinicians, the findings of early studies are concerning.⁵ These issues have ramifications beyond the health of practitioners themselves, given that poor mental health of clinicians translates to adverse effects on overall

quality of care,⁶ patient safety, workforce retention and engagement.⁷

Crises, such as the current coronavirus disease 2019 (COVID-19) pandemic, represent a profound threat to mental health. HCWs, particularly those on the ‘front-line’ in hospitals and the community, have had to respond quickly to many challenges including heavy workloads, large volumes of new information, new work practices and roles, redeployment or job insecurity, social change and increased risks to their own lives and for family members. Evidence regarding the impacts of the severe acute respiratory syndrome (SARS) pandemic demonstrated that the mental health of many HCWs was adversely affected, with potentially long-lasting mental health effects.^{8,9} Studies from overseas during the current pandemic suggest high rates of anxiety, depression, stress and burnout in HCWs, with the prevalence rates of up to 57%.^{10–16} Before the onset of COVID-19, certain demographic and workplace factors have been associated with increased risk of psychosocial harm for HCWs, particularly female gender,² inexperience,¹⁷ excessive work hours,^{18,19} and certain frontline areas.^{20,21} Similarly, studies of the general public during COVID-19 reveal a disproportionate impact on women,^{22,23} young people^{22,24} and people with previous mental health diagnoses.^{24,25} It is therefore vital to comprehensively identify and act on the mental health needs of Australian frontline HCWs to minimise the far-reaching effects of crisis events. This article reports the first findings from the Australian COVID-19 Frontline Healthcare Workers Study, which was both initiated and led by frontline clinicians in partnership with academics. This study investigated the severity, prevalence and predictors of symptoms of mental illness, as well as the social, workplace and financial disruptions experienced by Australian HCWs during the COVID-19 pandemic.

METHODS

The second wave of the pandemic in Australia occurred predominantly in Melbourne, Victoria, between June and October 2020. Severe lockdown restrictions were instituted locally including (but not limited to) mandatory mask wearing; travel limited to 5 km from home; an evening curfew, 1-hour limit for outdoor exercise per day; limits on seeing extended family; working from home; home schooling; the closure of most shops, hospitality and entertainment venues; and closure of international and interstate borders.

Participants and study design

A nationwide, voluntary, anonymous, online survey was conducted between 27 August and 23 October 2020, concurrently with the second wave of the pandemic. Australian HCWs, comprising medical, nursing, allied health, medical laboratory, administrative and other support staff, who self-identified as frontline HCWs in secondary or primary and community care, were invited to participate. Participants did not need to have cared for people with COVID-19 to participate. Over 8 weeks, 9518 survey responses were received,

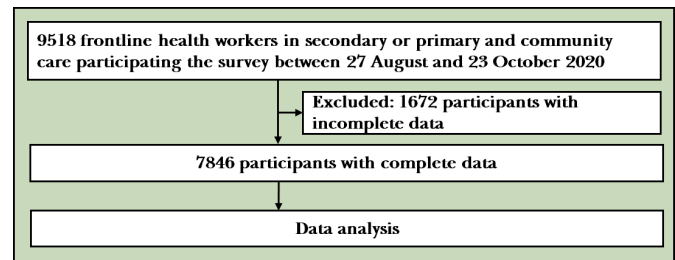


Figure 1 Flowchart of participant recruitment.

with complete data from 7846 (82.4%) participants reported in this article (figure 1).

Participants were recruited through multiple strategies. Information regarding the survey was emailed to chief executive officers and departmental directors of frontline areas (emergency medicine, critical care, respiratory medicine, general medicine, infectious diseases, palliative care and hospital aged care) of all public hospitals throughout Victoria, and to multiple hospitals around Australia. Hospital leaders were asked to share the survey information with colleagues. Thirty-six professional societies, colleges, universities, associations and government health department staff also disseminated the information about the survey across Australia. In addition, the study was promoted through 117 newspapers, 8 television and radio news items and 30 social media sites.

Data collection

Each participant completed the survey once, with no longitudinal data collected. Participants completed the online survey either directly or via a purpose-built website (<https://covid-19-frontline.com.au/>). Before commencing the survey, participants provided online consent to participate. Data were collected and managed using REDCap electronic data capture tools.²⁶

Information collected included demographics, home life details, professional background, work arrangements, the impact of the pandemic on employment and finances, organisational leadership, workplace change, exposure to COVID-19 and health and recreational habits (online supplemental file 1). Most questions were in a single-choice or multiple-choice format, with free text questions enabling more detailed answers. Five validated psychological measurement tools were completed to assess symptoms of mental illnesses: anxiety (Generalized Anxiety Disorder Scale-7 (GAD-7)),²⁷ depression (Patient Health Questionnaire-9 (PHQ-9)),²⁸ post-traumatic stress disorder (PTSD) (abbreviated Impact of Events Scale-6 (IES-6))²⁹ and burnout (abbreviated Maslach Burnout Inventory (MBI)),³⁰ with subdomains of emotional exhaustion (EE), depersonalisation (DP) and personal accomplishment (PA)). Resilience was assessed using the abbreviated two-item Connor-Davidson Resilience Scale-2.³¹ Burnout on the MBI is indicated by higher scores on the EE and DP, and lower scores on the scale of PA. Cut-off scores for validated scales were as follows: depersonalisation: 0 to 3=low, 4 to 6=moderate, 7 to 18=high; emotional exhaustion: 0 to 6=low, 7 to 10=moderate, 11 to 18=high;

personal accomplishment: 0 to 12=high, 13 to 14=moderate, 15 to 18=low³²; IES is categorised as 0 to 9=none/minimal and >9=moderate-severe²⁹; GAD-7: 0 to 4=none/minimal, 5 to 9=mild, 10 to 14=moderate, 15 to 21=severe anxiety²⁷; PHQ-9: 0 to 4=none/minimal, 5 to 9=mild, 10 to 14=moderate, 15 to 19=moderately severe, 20 to 27=severe.²⁸ In addition, participants were asked to report if they subjectively believed they had experienced anxiety, depression, PTSD, burnout or other mental health issues in order to determine their insight into their mental health. Ethics approval was provided by the Royal Melbourne Hospital Human Research Ethics Committee (HREC/67074/MH2020).

Statistical methods and data analysis

A power calculation for general linear models was computed using RStudio.³³ With an expected medium to large effect size and a power of 0.95, and significance level of 0.05, a sample of 6348 participants was required. To account for missing or incomplete data, a minimum sample size of 7000 responses was chosen. Data analysis was performed using SPSS V.26.0 statistical software (IBM). Demographic and socioeconomic characteristics were reported descriptively. Predictors of mental illness symptoms were identified through univariable logistic regression then entered into a multivariable logistic regression model. Covariates examined in univariable analyses included age; gender; state; occupation; number of working years since graduation; living situation (living alone, living with children, living with elderly); frontline area; practice location; working with patients with COVID-19; anticipating working with patients with COVID-19; having received personal protective equipment (PPE) training; worry that their role will lead to COVID-19 transmission to family; worry regarding being blamed by colleagues, close friends or relatives infected with COVID-19; changed relationships with partner or friends or family or colleagues; changed household income; concerns regarding household income and pre-existing mental health diagnoses. For each mental illness scale, outcomes were merged into dichotomous categories (no or minimal symptoms vs moderate to severe symptoms) in the regression model. Associations between mental illness symptoms and predictor variables are presented as ORs with 95% CIs. Multicollinearity of predictor variables was examined using the variance inflation factor criterion. The Spearman coefficient (r) was calculated to evaluate the correlation between self-reported and objective evidence of mental illness symptoms. For all statistical tests, significance was indicated by $p \leq 0.05$.

RESULTS

Demographic characteristics and workplace environment

More than half ($n=4110$, 52.4%) of the participants were younger than 40 years, and 6344 (80.9%) were women (table 1). Most participants were nurses ($n=3088$, 39.4%), doctors ($n=2436$, 31.0%) or allied health staff ($n=1314$, 16.7%) with 523 participants working in other health

Table 1 Participants' characteristics

Characteristic	Frequency	%
Age (years) (n=7846)		
20–30	1860	23.7
31–40	2250	28.7
41–50	1738	22.2
>50	1998	25.5
Gender (n=7846)		
Male	1458	18.6
Female	6344	80.9
Non-binary	19	0.2
Prefer not to say	25	0.3
State (n=7846)		
Victoria	6685	85.2
New South Wales	472	6.0
Queensland	209	2.7
South Australia	203	2.6
Western Australia	137	1.7
Tasmania	81	1.0
Australian Capital Territory	35	0.4
Northern Territory	24	0.3
Occupation (n=7846)		
Nursing	3088	39.4
Medical	2436	31.0
Allied health	1314	16.7
Administrative staff	485	6.2
Other roles*	523	6.7
Number of working years since graduated (n=6637)		
0–5	1592	24.0
6–10	1377	20.7
11–15	943	14.2
≥15	2725	41.1
Number of people in the household (n=7846)		
Living alone (1 person)	1087	13.9
2	2492	31.8
3–4	3181	40.5
5–6	1024	13.1
≥7	62	0.8
Number of children <16 years at home (n=7846)		
0	5102	65.0
1–2	2253	28.7
3–4	482	6.1
≥5	9	0.1
Living with ≥1 elderly person/people at home (n=7846)	697	8.9

*Other roles=pharmacists: 185; clinical laboratory scientists or technicians: 176; paramedics: 95; support staff (including cleaning, security, facilities management personnel): 43; leadership role: 9; other role: 15.

organisation roles including food services and security. The medical staff group comprised 389 general practitioners, 1221 senior medical staff, 745 junior medical staff and 81 students. More than one-quarter of participants (n=2250, 28.7%) had caring responsibilities at home, and 2133 (27.2%) participants had children who were being homeschooled.

Participants worked in primary care or community roles (n=1250, 15.9%), medical specialty areas (n=1205, 15.4%), emergency departments (n=1146, 14.6%), anaesthetics or surgical areas (n=824, 10.5%) or intensive care units (n=745, 9.5%) (table 2). More than three-quarters (n=6158, 78.5%) had been tested for COVID-19, 136 (1.7%) had been infected with COVID-19 and 77 (0.9%) had been previously quarantined because of unprotected exposure to COVID-19. Three-quarters (n=4551, 76.4%) were worried or very worried that their role could lead to them transmitting COVID-19 to their families, and almost two-thirds (n=4949, 63.1%) were worried about being blamed by colleagues for not taking adequate precautions if they contracted COVID-19.

Relationship changes and prevalence of mental illness symptoms

More than three-quarters of participants (n=5994, 76.4%) reported that the pandemic had affected their relationships with family, friends and colleagues, and nearly one-third had a close friend or relative who had been infected with COVID-19 either in Australia or overseas (table 2). Approximately one-third (n=2389, 30.4%) reported having a pre-existing mental illness diagnosed before the pandemic (table 3). Many participants subjectively believed they had experienced mental illness during the pandemic including anxiety (n=4875, 62.1%), burnout (n=4575, 58.3%) and depression (n=2175, 27.7%). Mental illness symptoms measured by objective scales demonstrated a similar or worse trend, with 4694 (59.8%) participants experiencing mild to severe anxiety, 5458 (70.9%) moderate to severe burnout (EE) and 4495 (57.3%) mild to severe depression. Participants had a high score for resilience with a mean (SD) of 3.21 (0.66) out of 4. There was correlation between subjective reporting and objective evidence of moderate to severe mental illness symptoms for anxiety ($r=0.346$, $p<0.001$), depression ($r=0.346$, $p<0.001$) and EE ($r=0.354$, $p<0.001$).

Predictors of poor mental health

In the multivariable regression model, independent, personal predictors for worse mental health on all measured outcomes (anxiety, depression, burnout and PTSD) included female gender, younger age, experiencing worsening of personal relationships and low resilience scores (table 4). In addition, independent, personal predictors for anxiety and PTSD included having previous mental health conditions, having a family member or friend infected with COVID-19 and concerns about household income. Depression was also associated with having previous mental health conditions and concerns

Table 2 Work environment and relationship changes during the pandemic

Characteristic	Frequency	%
Frontline area (n=7846)		
Primary care or community practitioner	1250	15.9
Medical specialty areas*	1205	15.4
Emergency department	1146	14.6
Anaesthetics, perioperative care or surgical areas	824	10.5
Intensive care unit	745	9.5
General medicine	644	8.2
Hospital aged care	536	6.8
Respiratory medicine	336	4.3
Palliative care	292	3.7
Infectious diseases	171	2.2
Paramedicine	99	1.3
Radiology	61	0.8
Hospital pharmacy	42	0.5
Pathology	31	0.4
Worked in multiple or other areas†	464	5.9
Location of practice (n=7846)		
Metropolitan	6373	81.2
Regional	1407	17.9
Remote	66	0.8
Currently working with people infected with COVID-19 (n=7846)		
Yes	3063	39.0
No	4783	61.0
Number of patients infected with COVID-19 cared for, mean (SD)	1.4 (0.43)	
Anticipating working with people infected with COVID-19 (n=4775)		
Yes	2891	60.5
No	1884	39.5
Received training on PPE during the pandemic (n=7846)		
Yes	5137	65.5
No	2709	34.5
Being worried that their roles will lead to them transmitting COVID-19 to family (n=5954)		
Not worried	729	12.2
Neutral	674	11.3
Worried or very worried	4551	76.4
Being worried about being blamed by colleagues if they contract COVID-19 (n=7846)		
Neutral	1275	16.3
Not worried	1622	20.7
Worried	4949	63.1
Experiencing close friends/relatives infected with COVID-19 in Australia or overseas (n=7846)		
Yes	2398	30.6

Continued

Table 2 Continued

Characteristic	Frequency	%
No	5448	69.4
Impact of COVID-19 on relationships (n=7846)		
<i>Closer or stronger relationship with</i>		
Partner	2266	28.9
Children/parents/family	2226	28.4
Friends	1054	13.4
Work colleagues	2533	32.3
<i>Worse relationship with</i>		
Partner	1000	12.7
Children/parents/family	1421	18.1
Friends	2221	28.3
Work colleagues	1116	14.2
<i>No effect on relationships</i>	1852	23.6
Change in household income due to COVID-19 (n=7846)		
Increased	820	10.5
Decreased	2415	30.8
No change	4611	58.8
Concerns or worries about household income since COVID-19 (n=7846)		
Yes	2416	30.8
No	5430	69.2

*Medical specialty areas included all medical specialties other than hospital aged care, general medicine, respiratory medicine, palliative care and infectious diseases. The latter were reported separately due to their potentially increased risk of exposure to COVID-19.

†This group included (but was not limited to) people working in leadership roles, clerical roles, support roles, food preparation, facilities maintenance, screening clinics and clinical scientists. COVID-19, coronavirus disease 2019; PPE, personal protective equipment.

about household income, whereas EE was also associated with previous mental health conditions. Independent, workplace predictors for worse mental health outcomes on all measured scales (anxiety, depression, burnout and PTSD) included having a nursing, allied health or other non-medical role, frontline area, working with patients infected with COVID-19 and being worried about being blamed by colleagues on contracting COVID-19 infection (table 5). There were no significant associations between other demographic, work environment, relationship or financial covariates and each mental illness score.

DISCUSSION

Main findings

To our knowledge, this is the largest, national, cross-sectional study examining psychosocial distress during the COVID-19 pandemic in Australia that has included all frontline healthcare occupations and areas. Despite participants receiving high scores on the validated resilience instrument, the majority experienced anxiety or

Table 3 Prevalence of mental health issues

Characteristic	Frequency	%
Pre-existing mental health condition diagnosed before the pandemic (n=7846)		
Yes	2389	30.4
No	5272	67.2
Prefer not to say	185	2.4
Self-reported mental health issues experienced since COVID-19 (n=7846)*		
Anxiety	4875	62.1
Burnout	4575	58.3
Depression	2175	27.7
PTSD	427	5.4
Other mental health issues	328	4.2
No mental health issues	1431	18.2
Mental health issues assessed by validated scales		
<i>Burnout DP (n=7688)</i>		
Low	4811	62.6
Moderate	1321	17.2
High	1556	20.2
<i>Burnout EE (n=7701)</i>		
Low	2243	29.1
Moderate	2079	27.0
High	3379	43.9
<i>Burnout PA (n=7689)</i>		
Low	2358	30.7
Moderate	1592	20.7
High	3739	48.6
<i>Anxiety—GAD-7 (n=7843)</i>		
None/minimal	3149	40.2
Mild	2478	31.6
Moderate	1293	16.5
Severe	923	11.8
<i>Depression—PHQ-9 (n=7841)</i>		
None/minimal	3321	42.5
Mild	2303	29.5
Moderate	1203	15.4
Moderately severe	620	7.9
Severe	369	4.7
<i>Impact of events/trauma—IES-6 (n=7796)</i>		
None/minimal	4641	59.5
Moderate-severe	3155	40.5
	Mean (SD)	Range
Resilience—CD-RISC2 (n=7841)	3.21 (0.66)	0–4

Burnout DP: 0 to 3=low, 4 to 6=moderate, 7 to 18=high. Burnout EE: 0 to 6=low, 7 to 10=moderate, 11 to 18=high. Burnout PA: 0 to 12=high burnout, 13 to 14=moderate burnout, 15 to 18=low burnout. IES is categorised as 0 to 9=none/minimal and >9=moderate-severe. GAD-7: 0 to 4=none/minimal, 5 to 9=mild, 10 to 14=moderate, 15 to 21=severe anxiety. PHQ-9: 0 to 4=none/minimal, 5 to 9=mild, 10 to 14=moderate, 15 to 19=moderately severe, 20 to 27=severe.

*Multiple options could be chosen.

CD-RISC2, Connor-Davidson Resilience Scale-2; COVID-19, coronavirus disease 2019; DP, depersonalisation; EE, emotional exhaustion; GAD-7, Generalized Anxiety Disorder Scale-7; IES-6, Impact of Events Scale-6; PA, personal accomplishment; PHQ-9, Patient Health Questionnaire-9; PTSD, post-traumatic stress disorder.

depressive symptoms, or EE (burnout). This indicates that the protective effects of resilience are not sufficient to prevent psychological harm during the pandemic. A

Table 4 Personal predictors of mental health outcomes (multivariable univariate analysis)

Predictor	Anxiety (GAD-7)		Depression (PHQ-9)		PTSD (IES-6)		Burnout DP		Burnout EE		Burnout PA	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Female	1.18 (1.01 to 1.38)	0.031	1.31 (1.12 to 1.55)	0.001	1.40 (1.22 to 1.60)	0.001	0.63 (0.54 to 0.72)	0.001	1.23 (1.07 to 1.41)	0.003	1.02 (0.89 to 1.16)	0.770
Age (years)												
20–30	1.93 (1.64 to 2.27)	0.001	1.55 (1.31 to 1.84)	0.001	1.72 (1.48 to 1.99)	0.001	2.72 (2.12 to 3.48)	0.001	2.29 (1.94 to 2.70)	0.001	0.82 (0.70 to 0.95)	0.012
31–40	1.31 (1.11 to 1.53)	0.001	1.12 (0.95 to 1.32)	0.163	1.19 (1.04 to 1.37)	0.010	1.69 (1.37 to 2.08)	0.001	1.39 (1.21 to 1.61)	0.001	0.76 (0.66 to 0.87)	0.001
41–50	1.21 (1.02 to 1.43)	0.028	1.23 (1.03 to 1.46)	0.019	1.03 (0.88 to 1.19)	0.680	1.36 (1.14 to 1.61)	0.001	1.32 (1.14 to 1.53)	0.001	0.90 (0.77 to 1.05)	0.183
Previous mental health condition	1.96 (1.74 to 2.20)	0.001	2.23 (1.98 to 2.50)	0.001	1.75 (1.57 to 1.95)	0.001	1.10 (0.98 to 1.24)	0.098	1.73 (1.53 to 1.96)	0.001	1.26 (1.13 to 1.41)	0.001
Experiencing family or friends infected with COVID-19	1.30 (1.15 to 1.46)	0.001	1.04 (0.92 to 1.18)	0.450	1.41 (1.26 to 1.57)	0.001	1.07 (0.96 to 1.20)	0.200	1.05 (0.93 to 1.18)	0.370	1.10 (0.98 to 1.23)	0.095
Experiencing worse relationships during the pandemic												
With partner	1.97 (1.96 to 2.29)	0.001	1.96 (1.45 to 1.98)	0.001	1.50 (1.29 to 1.74)	0.001	1.37 (1.16 to 1.60)	0.001	1.57 (1.31 to 1.89)	0.001	N/A	-
With family	1.74 (1.51 to 2.00)	0.001	1.56 (1.35 to 1.80)	0.001	1.58 (1.38 to 1.81)	0.001	1.29 (1.11 to 1.49)	0.001	1.52 (1.29 to 1.80)	0.001	N/A	-
With friends	1.38 (1.22 to 1.57)	0.001	1.32 (1.16 to 1.51)	0.001	1.51 (1.35 to 1.70)	0.001	1.36 (1.20 to 1.54)	0.001	1.74 (1.52 to 2.00)	0.001	N/A	-
With colleagues	1.77 (1.52 to 2.06)	0.001	1.45 (1.24 to 1.70)	0.001	1.50 (1.30 to 1.73)	0.001	N/A	-	N/A	-	N/A	-
Concerns about income	1.96 (1.50 to 1.89)	0.001	1.29 (1.14 to 1.45)	0.001	1.56 (1.41 to 1.74)	0.001	N/A	-	N/A	-	N/A	-
Resilience	0.62 (0.57 to 0.67)	0.001	0.76 (0.70 to 0.83)	0.001	0.76 (0.70 to 0.82)	0.001	0.74 (0.68 to 0.80)	0.001	0.63 (0.55 to 0.65)	0.001	1.82 (1.68 to 1.97)	0.001

N/A=variable not included for that mental scale in the model because no relationship was observed in the univariate model. Reference categories for each variable were as follows: gender=male; age=older than 50 years; pre-existing mental health conditions=no change; concerns about income=poor outcomes. Lower OR for personal accomplishment indicates poorer outcomes. COVID-19, coronavirus disease; DP, depersonalisation; EE, emotional exhaustion; GAD-7, Generalized Anxiety Disorder Scale-7; IES-6, Impact of Events Scale-6; PA, personal accomplishment; PHQ-9, Patient Health Questionnaire-9; PTSD, post-traumatic stress disorder.



Table 5 Workplace predictors of mental health outcomes (multivariable univariate analysis)

Predictor	Anxiety (GAD-7)		Depression (PHQ-9)		PTSD (IES-6)		Burnout DP		Burnout EE		Burnout PA	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Occupation												
Nursing	1.79 (1.55 to 2.07)	0.001	1.92 (1.65 to 2.23)	0.001	1.28 (1.12 to 1.45)	0.001	0.84 (0.74 to 0.96)	0.013	1.22 (1.07 to 1.39)	0.003	0.73 (0.64 to 0.83)	0.001
Allied health	1.25 (1.04 to 1.50)	0.013	1.48 (1.22 to 1.79)	0.001	1.20 (1.02 to 1.41)	0.022	0.57 (0.48 to 0.68)	0.001	1.16 (0.98 to 1.38)	0.081	1.13 (0.95 to 1.34)	0.150
Other roles	1.83 (1.51 to 2.22)	0.001	1.95 (1.59 to 2.38)	0.001	1.29 (1.08 to 1.53)	0.004	1.13 (0.85 to 1.49)	0.380	0.89 (0.74 to 1.07)	0.233	0.43 (0.36 to 0.51)	0.001
Frontline area												
ICU	0.87 (0.70 to 1.10)	0.260	0.73 (0.58 to 0.93)	0.010	N/A	-	0.70 (0.57 to 0.87)	0.001	0.83 (0.67 to 1.03)	0.100	1.08 (0.88 to 1.33)	0.450
Anaesthetics and surgery	1.18 (0.94 to 1.48)	0.140	0.85 (0.67 to 1.08)	0.190	N/A	-	0.73 (0.59 to 0.91)	0.005	1.14 (0.91 to 1.43)	0.220	0.85 (0.69 to 1.05)	0.140
Medical speciality areas	1.13 (0.95 to 1.35)	0.150	0.89 (0.74 to 1.06)	0.200	N/A	-	0.67 (0.57 to 0.80)	0.001	1.19 (1.00 to 1.41)	0.047	1.18 (1.00 to 1.39)	0.040
Primary care, community and residential aged care	0.96 (0.77 to 1.20)	0.760	0.82 (0.66 to 1.03)	0.580	N/A	-	0.62 (0.49 to 0.78)	0.001	1.53 (1.24 to 1.89)	0.001	1.35 (1.10 to 1.66)	0.003
Other*	1.11 (0.87 to 1.42)	0.380	0.85 (0.66 to 1.03)	0.098	N/A	-	0.64 (0.49 to 0.84)	0.001	1.31 (1.03 to 1.66)	0.027	0.89 (0.71 to 1.11)	0.300
Currently working with patients with COVID-19	1.21 (1.05 to 1.39)	0.006	1.19 (1.03 to 1.37)	0.015	1.27 (1.12 to 1.44)	0.001	1.25 (1.09 to 1.42)	0.001	1.20 (1.05 to 1.37)	0.007	0.80 (0.71 to 0.92)	0.001
Received PPE training	0.91 (0.80 to 1.05)	0.210	0.96 (0.83 to 1.10)	0.580	1.04 (0.92 to 1.17)	0.490	0.98 (0.85 to 1.12)	0.790	1.10 (0.97 to 1.25)	0.122	1.27 (1.12 to 1.43)	0.001
Being worried that colleagues will blame them	1.68 (1.42 to 1.97)	0.001	1.44 (1.22 to 1.71)	0.001	1.82 (1.58 to 2.11)	0.001	1.39 (1.19 to 1.62)	0.001	1.57 (1.36 to 1.81)	0.001	1.02 (0.89 to 1.18)	0.700

N/A=variable not included for that mental scale in the model because no relationship was observed in the univariate model. Reference categories for each variable were as follows: occupation=medical staff; frontline area=emergency department; currently working with patients with COVID-19=negative response; received PPE training=negative response; being worried about being blamed=disagreed. Resilience was a continuous variable (scores 0–4). Lower OR for personal accomplishment indicates poorer outcomes. *Other for frontline area included people working in paramedicine, radiology, pharmacy, pathology and clinical laboratories, or other areas. COVID-19, coronavirus disease 2019; DP, depersonalisation; EE, emotional exhaustion; GAD-7, Generalized Anxiety Disorder Scale-7; ICU, intensive care unit; IES-6, Impact of Events Scale-6; PA, personal accomplishment; PHQ-9, Patient Health Questionnaire-9; PPE, personal protective equipment; PTSD, post-traumatic stress disorder.

significant proportion also experienced PTSD symptoms. Although less than half of the participants worked with patients with COVID-19 and very few had been infected with COVID-19 or quarantined, many experienced disruptions to family life, altered social relationships and financial worries. Our findings are consistent with those reported in international studies: high mental health burden on frontline workers during COVID-19^{10 11 15} and SARS pandemics.³⁴ Fears of transmitting COVID-19 infection to family and of being blamed by colleagues for not taking adequate precautions if they did contract COVID-19 were extremely common. Personal, social and workplace predictors for mental illness symptoms have been identified.

Around the world, a growing number of largely country-specific, single timepoint, cross-sectional surveys have identified that mental health problems are common in HCWs during the COVID-19 pandemic. Prevalence estimates are as follows: 33% to 59% for anxiety, 30% to 62% for depression, 41% to 51% for burnout and approximately 57% for acute distress or PTSD.^{10 11 13–15 35} The upper limits of these prevalence estimates are strikingly similar to our own findings. However, moderate to severe burnout (EE) was much more prevalent in our study (70.9%), which may be explained by the later timing of our study, by which time Australian HCWs had endured many months of social and workplace disruptions, and lockdown restrictions.

By contrast, two separate, small (n=320 and n=668), single-site, single timepoint surveys of HCWs undertaken in Melbourne from April to May 2020 and from May to June 2020 both identified a lower prevalence of adverse mental health outcomes.^{36 37} Their findings may again be partly explained by the earlier timing of the studies in the first wave and the lack of power in those studies due to smaller size of the samples. Comparing our data to international data, the high prevalence of symptoms of poor mental health in our study is interesting given the comparatively low case load of COVID-19 in Australia. One explanation is that anticipation and fear of a catastrophic crisis leading to high death rates of patients and HCWs (as Australian HCWs saw occurring overseas) contributed to adverse psychological outcomes.¹⁴ This concept of psychological distress being related to anticipated, perceived risk is important and highlights the critical importance of crisis preparedness, good government and organisational leadership and consistent clear communication. In addition, the pervasive media coverage regarding COVID-19 along with the many restrictions enacted in local lockdowns may have contributed to poor mental health in Australian frontline workers.

Similar to our findings, studies from overseas have found that predictors of poor mental health in HCWs during the pandemic include female gender, less years of work experience (which in our study correlated with younger age), pre-existing psychological illnesses, working in a nursing role and working in certain frontline areas.^{10–13 15 16 35 38 39} Many of these groups are at heightened

risk of psychosocial harm during non-pandemic times, and it is possible that crises such as COVID-19 exacerbate harm in pre-existing vulnerable groups.⁴⁰ Importantly, unlike previous small local and international studies, the large sample size in our study enabled us to demonstrate that female gender and working in nursing or allied health roles are independent predictors of poor mental health. The relationship between nursing and poorer mental health may be explained by the heightened risk of COVID-19 exposure from prolonged and frequent contact with patients. Moreover, nursing and allied health professionals generally have less choice regarding their daily work environments.^{11–13 16} Reduced finances were not associated with a nursing role and therefore did not explain the association.

The relationship between gender and adverse mental illness outcomes is intriguing, given that this relationship was identified even during the SARS pandemic.³⁴ One possible explanation is that men and women have different coping styles,⁴¹ with men having greater odds of reporting DP in this study. In addition, a British study identified that women have had to bear greater responsibilities (on average, an extra 11.2 hours of unpaid work per week) than men as primary carers for dependents during the pandemic.⁴² General population data from the Australian Bureau of Statistics report similar findings, with women three times more likely than men to perform the majority of caregiving tasks and twice as likely to undertake the majority of unpaid domestic work.⁴³ In our study, having young or old dependents was not a predictor of poor mental health. However, we did not specifically enquire about the number of additional unpaid hours undertaken in the home for domestic or caregiving tasks during the pandemic. As there was no difference in resilience scores between men and women, this gender difference requires further exploration. The lack of a relationship between PPE training and poor mental health in our study may relate to the majority of frontline staff receiving training and the relatively low rates of COVID-19 infection in Australia compared with other countries.

Limitations

The large sample size in our study enabled detailed examination of independent predictors of poor mental health. Most participants in our study were women, which is consistent with data from both the Australian Institute of Health and Welfare and the Australian Health Practitioner Regulation Agency demonstrating that 75% of the Australian health workforce is female.^{44–46} Because of the very broad survey dissemination strategy, calculation of a response rate was not possible. Selection bias and response bias may have led to overestimation or underestimation of psychological distress and rates of pre-existing mental health illness. Similarly, in line with other international surveys exploring the psychosocial effects of the COVID-19 pandemic on healthcare workers, we were not able to confirm clinical diagnoses of mental illness with

the symptoms measured by the validated psychological scales. Nevertheless, these scales are validated and the only feasible option for measuring mental health symptoms in a large-scale survey such as this.

Because of the spontaneous and unexpected nature of the COVID-19 pandemic, no baseline data regarding mental health symptoms in non-pandemic times had previously been collected from a large cohort of Australian HCWs. Therefore, it is not possible to demonstrate a change in the prevalence estimates of mental health symptoms in this study. Nevertheless, the prevalence estimates in this study are much higher than those reported in earlier studies in non-pandemic times.^{2 47–49} Notably, the case load of COVID-19 in Australia at the time of survey closure was low relative to international settings, with 27 484 cases recorded.⁵⁰ The prevalence of mental health impacts arising in the Australian context is indicative of harm related to the prolonged stress of a pandemic, even with relatively few cases. Participant responses were measured at a single timepoint, not longitudinally, to avoid excessively burdening the frontline healthcare workers during the pandemic. However, given the ongoing nature of the pandemic, we believe that longitudinal research is urgently required to better understand any persisting psychosocial effects of the pandemic on HCWs and any ramifications for patient safety and workforce retention. Similar prospective studies sampling Italian HCWs during the first and second waves of COVID-19 have reported growing prevalence of mental health issues as the pandemic continues, and it is likely that similar trends exist in Australia.⁵¹ Furthermore, research is required to examine the acceptability, uptake and effectiveness of any new interventions introduced to support the well-being of HCWs.

Implications

Although many factors, including lockdown restrictions, social disconnection and media coverage, likely have contributed to the high prevalence of mental health symptoms in frontline healthcare workers in this study, occupational factors cannot be ignored. Indeed, occupational factors (related to workloads, training, PPE, organisational leadership, communication and policies) must be actively considered because they represent important opportunities to intervene and prevent mental health issues. Both better crisis preparedness and new psychological support services for HCWs are needed. Importantly, such services should not just be short-term ‘fixes’ to address the current pandemic-related issues, but instead should provide long-term support given the high prevalence of pre-existing mental health diagnoses. These supports must be accessible and acceptable to HCWs. Although resilience was identified as a protective factor in this study, the overall resilience level of HCWs was already high, and as such, approaches that aim to build resilience are likely to have limited efficacy in this cohort. Furthermore, it is vital that health leaders in the government, secondary care and the community

recognise that certain groups of HCWs are more vulnerable to mental health problems and therefore require additional targeted support interventions. Crucially important are organisational policies and practices that address burnout (and contributing factors such as information overload), given its extremely high prevalence and the risk it poses to workforce retention.⁷

The health workforce is an indispensable asset. Yet crises such as the COVID-19 pandemic are associated with significant mental health symptoms in frontline HCWs, with potentially wide repercussions for individuals, patients and the workforce. Crisis preparedness, along with long-term, evidence-based policies and practices that focus on preventing and actively addressing psychological well-being, is needed to protect, maintain and ‘future-proof’ the health workforce.

Author affiliations

¹Department of Respiratory Medicine, Alfred Hospital, Prahran, Victoria, Australia

²Department of Allergy, Immunology and Respiratory Medicine, Central Clinical School, Alfred Hospital, Monash University, Melbourne, Victoria, Australia

³School of Psychology and Public Health, La Trobe University, Melbourne, Victoria, Australia

⁴School of Medicine and Healthcare Management, Caucasus University, Tbilisi, Georgia

⁵Department of Psychiatry, The Royal Melbourne Hospital, Parkville, Victoria, Australia

⁶Department of Public Health Law, Melbourne School of Population and Global Health, The University of Melbourne, Parkville, Victoria, Australia

⁷Department of Emergency Services, The Royal Melbourne Hospital, Parkville, Victoria, Australia

⁸Department of Critical Care, Faculty of Medicine, Dentistry and Health Sciences, The University of Melbourne, Melbourne, Victoria, Australia

⁹Departments of General Medicine and Infectious Diseases, The Royal Melbourne Hospital, Parkville, Victoria, Australia

¹⁰Department of Medicine, The Royal Melbourne Hospital, The University of Melbourne, Parkville, Victoria, Australia

¹¹Allergy and Lung Health Unit, School of Population and Global Health, The University of Melbourne, Parkville, Victoria, Australia

¹²Department of Allied Health, The Royal Melbourne Hospital, Parkville, Victoria, Australia

¹³Parkville Integrated Palliative Care Service, The Royal Melbourne Hospital, Parkville, Victoria, Australia

¹⁴Sir Peter MacCallum Department of Oncology, The University of Melbourne, Parkville, Victoria, Australia

¹⁵Department of Geriatric Medicine, Western Health, Footscray, Victoria, Australia

¹⁶Department of Anaesthesia and Pain Management, The Royal Melbourne Hospital, Parkville, Victoria, Australia

¹⁷Centre for Integrated Critical Care, Melbourne Medical School, The University of Melbourne, Parkville, Victoria, Australia

¹⁸Department of Physiotherapy, Alfred Health, Melbourne, Victoria, Australia

¹⁹Rheumatology Unit, Royal Children's Hospital, Parkville, Victoria, Australia

²⁰Arthritis and Rheumatology, Murdoch Children's Research Institute, Parkville, Victoria, Australia

²¹Department of Infectious Diseases, The Royal Melbourne Hospital, Parkville, Victoria, Australia

²²Department of Intensive Care Medicine, The Royal Melbourne Hospital, Parkville, Victoria, Australia

²³School of Nursing and Midwifery, College of Science, Health and Engineering, La Trobe University, Melbourne, Victoria, Australia

²⁴Royal Adelaide Hospital, University of South Australia, Adelaide, South Australia, Australia

²⁵College of Health and Biomedicine, Victoria University, Footscray, Victoria, Australia

²⁶Division of Critical Care and Investigative Services, The Royal Melbourne Hospital, Parkville, Victoria, Australia

Acknowledgements We gratefully acknowledge and thank The Royal Melbourne Hospital Foundation and the Lord Mayor's Charitable Foundation for financial support for this study. We wish to thank the numerous health organisations, universities, professional societies, associations and colleges, and many supportive individuals who assisted in disseminating the survey. We thank The Royal Melbourne Hospital Business Intelligence Unit who provided and hosted the REDCap electronic data capture tools.

Contributors NS, KW: conceptualisation, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, supervision, writing (original and revisions). LK: conceptualisation, formal analysis, investigation, methodology, resources, supervision, writing (original and revisions). MB, MP, DJ, SCD, EB, NA, CL, IN, AH, JEM, IT, CM, AM, DS: conceptualisation, investigation, methodology, writing (original).

Funding The Royal Melbourne Hospital Foundation and the Lord Mayor's Charitable Foundation kindly provided financial support for this study.

Disclaimer Funding bodies had no role in the research activity. All authors were independent of the funders and had access to the study data.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Mark Putland <http://orcid.org/0000-0002-1994-252X>

REFERENCES

- De Cieri H, Shea T, Cooper B, et al. Effects of work-related stressors and mindfulness on mental and physical health among Australian nurses and healthcare workers. *J Nurs Scholarsh* 2019;51:580-9.
- Imo UO. Burnout and psychiatric morbidity among doctors in the UK: a systematic literature review of prevalence and associated factors. *BJPsych Bull* 2017;41:197-204.
- Milner AJ, Maheen H, Bismark MM, et al. Suicide by health professionals: a retrospective mortality study in Australia, 2001-2012. *Med J Aust* 2016;205:260-5.
- Petrie K, Crawford J, Baker STE, et al. Interventions to reduce symptoms of common mental disorders and suicidal ideation in physicians: a systematic review and meta-analysis. *Lancet Psychiatry* 2019;6:225-34.
- Courtney JA, Francis AJP, Paxton SJ. Caring for the country: fatigue, sleep and mental health in Australian rural paramedic shiftworkers. *J Community Health* 2013;38:178-86.
- Tawfik DS, Scheid A, Profit J, et al. Evidence relating health care provider burnout and quality of care: a systematic review and meta-analysis. *Ann Intern Med* 2019;171:555-67.
- Salyers MP, Flanagan ME, Firmin R, et al. Clinicians' perceptions of how burnout affects their work. *Psychiatr Serv* 2015;66:204-7.
- Bai Y, Lin C-C, Lin C-Y, et al. Survey of stress reactions among health care workers involved with the SARS outbreak. *Psychiatr Serv* 2004;55:1055-7.
- Lee AM, Wong JGWS, McAlonan GM, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. *Can J Psychiatry* 2007;52:233-40.
- Azoulay E, De Waele J, Ferrer R, et al. Symptoms of burnout in intensive care unit specialists facing the COVID-19 outbreak. *Ann Intensive Care* 2020;10:110.
- Luceño-Moreno L, Talavera-Velasco B, García-Albuérne Y, et al. Symptoms of posttraumatic stress, anxiety, depression, levels of resilience and burnout in Spanish health personnel during the COVID-19 pandemic. *Int J Environ Res Public Health* 2020;17:30.
- Matsuo T, Kobayashi D, Taki F, et al. Prevalence of health care worker burnout during the coronavirus disease 2019 (COVID-19) pandemic in Japan. *JAMA Netw Open* 2020;3:e2017271-e:e2017271.
- Shechter A, Diaz F, Moise N, et al. Psychological distress, coping behaviors, and preferences for support among New York healthcare workers during the COVID-19 pandemic. *Gen Hosp Psychiatry* 2020;66:1-8.
- Temsah M-H, Al-Sohime F, Alamro N, et al. The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country. *J Infect Public Health* 2020;13:877-82.
- WZY T, Soo YE, Yip C. The psychological impact of COVID-19 on 'hidden' frontline healthcare workers. *Int J Soc Psychiatry* 2021;67.
- Zhu Z, Xu S, Wang H, et al. COVID-19 in Wuhan: sociodemographic characteristics and hospital support measures associated with the immediate psychological impact on healthcare workers. *EClinicalMedicine* 2020;24:100443.
- Oates J, Drey N, Jones J. Associations between age, years in post, years in the profession and personal experience of mental health problems in UK mental health nurses. *Issues Ment Health Nurs* 2017;38:624-32.
- Hayes B, Prihodova L, Walsh G, et al. What's up doc? A national cross-sectional study of psychological wellbeing of hospital doctors in Ireland. *BMJ Open* 2017;7:e018023.
- Petrie K, Crawford J, LaMontagne AD, et al. Working hours, common mental disorder and suicidal ideation among junior doctors in Australia: a cross-sectional survey. *BMJ Open* 2020;10:e033525.
- Pyper Z, Paterson JL. Fatigue and mental health in Australian rural and regional ambulance personnel. *Emerg Med Australas* 2016;28:62-6.
- Colville GA, Smith JG, Brierley J, et al. Coping with staff burnout and work-related posttraumatic stress in intensive care. *Pediatr Crit Care Med* 2017;18:e267-73.
- Bu F, Steptoe A, Fancourt D. Loneliness during lockdown: trajectories and predictors during the COVID-19 pandemic in 35,712 adults in the UK. *medRxiv* 2020.
- Bu F, Steptoe A, Fancourt D. Who is lonely in lockdown? Cross-cohort analyses of predictors of loneliness before and during the COVID-19 pandemic. *medRxiv* 2020.
- Garnett C, Jackson S, Oldham M, et al. Factors associated with drinking behaviour during COVID-19 social distancing and lockdown among adults in the UK. *Drug Alcohol Depend* 2021;219:108461.
- lob E, Steptoe A, Fancourt D, Abuse FD. Abuse, self-harm and suicidal ideation in the UK during the COVID-19 pandemic. *Br J Psychiatry* 2020;217:543-6.
- Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-81.
- Spitzer RL, Kroenke K, Williams JBW, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* 2006;166:1092-7.
- Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16:606-13.
- Thoresen S, Tambs K, Hussain A, et al. Brief measure of posttraumatic stress reactions: Impact of Event Scale-6. *Soc Psychiatry Psychiatr Epidemiol* 2010;45:405-12.
- Maslach C, Jackson SE, Leiter MP. *Maslach burnout inventory: third edition. evaluating stress: a book of resources*. Lanham, MD, US: Scarecrow Education, 1997: 191-218.
- Vaishnavi S, Connor K, Davidson JRT. An abbreviated version of the Connor-Davidson Resilience Scale (CD-RISC), the CD-RISC2: psychometric properties and applications in psychopharmacological trials. *Psychiatry Res* 2007;152:293-7.
- Riley MR, Mohr DC, Waddimba AC. The reliability and validity of three-item screening measures for burnout: evidence from group-employed health care practitioners in upstate New York. *Stress Health* 2018;34:187-93.
- RStudio Team. *RStudio: integrated development environment for R*. MA: Boston, 2015. <http://www.rstudio.com/>
- Tam CWC, Pang EPF, Lam LCW, et al. Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. *Psychol Med* 2004;34:1197.
- Hu D, Kong Y, Li W, et al. Frontline nurses' burnout, anxiety, depression, and fear statuses and their associated factors during the COVID-19 outbreak in Wuhan, China: a large-scale cross-sectional study. *EClinicalMedicine* 2020;24:100424.

- 36 Dobson H, Malpas CB, Burrell AJ, *et al.* Burnout and psychological distress amongst Australian healthcare workers during the COVID-19 pandemic. *Australas Psychiatry* 2021;29:26–30.
- 37 Holton S, Wynter K, Trueman M, *et al.* Psychological well-being of Australian hospital clinical staff during the COVID-19 pandemic. *Aust Health Rev* 2020.
- 38 Arpacioğlu S, Gurler M, Cakiroğlu S. Secondary traumatization outcomes and associated factors among the health care workers exposed to the COVID-19. *Int J Soc Psychiatry* 2021;67:84–9.
- 39 Zhang W-R, Wang K, Yin L, *et al.* Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. *Psychother Psychosom* 2020;89:242–50.
- 40 Magnavita N, Chirico F, Garbarino S, *et al.* SARS/MERS/SARS-CoV-2 outbreaks and burnout syndrome among healthcare workers. An umbrella systematic review. *Int J Environ Res Public Health* 2021;18:4361.
- 41 Lebares CC, Braun HJ, Guvva EV, *et al.* Burnout and gender in surgical training: a call to re-evaluate coping and dysfunction. *Am J Surg* 2018;216:800–4.
- 42 Strauss P-C. COVID-19 and the female health and care workforce - Survey of health and care staff for the Health and Care Women Leaders Network, 2020.
- 43 Australian Bureau of Statistics. Household impacts of COVID-19 survey: coronavirus (COVID-19) impacts on jobs, unpaid care, domestic work, mental health and related services, and life after COVID-19 restrictions, 2020. Available: <https://www.abs.gov.au/statistics/people/people-and-communities/household-impacts-covid-19-survey/6-10-july-2020>
- 44 Australian Institute of Health and Welfare. *Health workforce*. Canberra: Australian Institute of Health and Welfare, 2020. <https://www.aihw.gov.au/reports/australias-health/health-workforce>
- 45 Medical Board of Australia. *Registration Data Table - December 2020 2020 10th February*, 2021.
- 46 Nursing and Midwifery Board. *Nursing and midwifery board of Australia Registrant data*, 2020.
- 47 Hollingsworth CE, Wesley C, Huckridge J, *et al.* Impact of child death on paediatric trainees. *Arch Dis Child* 2018;103:14–18.
- 48 Thompson CV, Naumann DN, Fellows JL, *et al.* Post-traumatic stress disorder amongst surgical trainees: an unrecognised risk? *Surgeon* 2017;15:123–30.
- 49 Leinweber J, Creedy DK, Rowe H, *et al.* Responses to birth trauma and prevalence of posttraumatic stress among Australian midwives. *Women Birth* 2017;30:40–5.
- 50 Australian Government Department of Health. Coronavirus (COVID-19) at a glance – 23 October 2020, 2020. Available: <https://www.health.gov.au/resources/publications/coronavirus-covid-19-at-a-glance-23-october-2020>
- 51 Magnavita N, Soave PM, Antonelli M. Prolonged stress causes depression in frontline workers facing the COVID-19 pandemic-A repeated cross-sectional study in a COVID-19 hub-hospital in central Italy. *Int J Environ Res Public Health* 2021;18:7316.



Associate Professor Natasha Smallwood qualified as doctor (BMedSci, BMBS) from Nottingham University Medical School, Nottingham, UK, in 1999. She holds medical fellowships with the Royal College of Physicians (UK) and the Royal Australasian College of Physicians (Australia). She is a consultant respiratory physician in the Department of Respiratory Medicine at the Alfred Hospital (Melbourne, Australia), head of the Chronic Respiratory Disease Research Lab at the Central Clinical School (Monash University, Melbourne, Australia) and principal research fellow (associate professor) at Monash University (Australia). In addition to her qualifications in respiratory care, she got postgraduate qualifications in Palliative Care and Epidemiology (MSc; University of Melbourne, 2011) and a PhD (University of Melbourne, 2019). Assistant Professor Smallwood holds various major research grants including an NHMRC Investigator grant and fellowship research grant from the Windermere foundation. She has clinical and research interests in severe lung disease. As a frontline health worker, she designed and co-led the Australian COVID-19 Frontline Healthcare Workers study, which is the largest multi-professional, national study that has examined the psychosocial effects of the pandemic on healthcare workers in primary and secondary care. She is a board director for the Thoracic Society of Australia and New Zealand (TSANZ), the Victorian TSANZ branch president and serves on multiple national committees for TSANZ, the Lung Foundation Australia and the Palliative Care Clinical Studies Collaborative. In addition, she is a taskforce member for various national and international respiratory guidelines.