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Are healthcare workers particularly vulnerable to loneliness? The role of social relationships and mental well-being during the COVID-19 pandemic

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ABSTRACT

Loneliness is a major public health issue with renewed prominence due to the COVID-19 pandemic and associated social restrictions. Healthcare workers (HCWs) may be at heightened risk, but research is lacking. We measured the prevalence of loneliness among HCWs during the pandemic in 2020 and examined pre-pandemic predictors and pandemic experiences associated with loneliness. HCWs at a designated COVID-19 hospital in Sydney, Australia completed an online survey examining health and well-being before and during the pandemic and changes to work, family and social experiences. Loneliness had negatively affected the well-being of 129 (39%) respondents (n = 330). Pre-pandemic factors predicting loneliness were younger age (<30years compared to ≥50years), having ever been told you had a mental health problem and living alone. These became non-significant when pandemic-related factors were added to the regression. Less contact with family and friends, increased conflict at home, and living alone or with family but not a partner, increased the odds of loneliness, while a sense of camaraderie with colleagues had the opposite effect. Psychological distress and poor mental health during the pandemic were also positively associated with loneliness. Efforts to promote congenial social contacts may be effective in averting loneliness among HCWs.

1. Introduction

Loneliness is increasingly recognised as a major public health concern affecting people across the globe (Holt-Lunstad, 2021; Smith and Lim, 2020). Loneliness, the subjective feeling of being socially isolated, is the perceived discrepancy between one's social needs and what one receives from their social environment (Hawkley and Capitanio, 2015). It is not necessarily synonymous with being alone (Mushtaq et al., 2014) and has been described as the 'psychological counterpart' (Shankar et al., 2011) of the objective construct of social isolation. The association between loneliness and social isolation is weak to moderate (Shankar et al., 2011).

The public health impact of loneliness relates to its adverse physical and mental health consequences. The odds of death are 26% higher among those who report being lonely (Holt-Lunstad et al., 2015) and elevated morbidity associated with loneliness includes coronary heart disease, stroke, hypertension, chronic pain and obesity (Hawkley and Cacioppo, 2010; Wang et al., 2018). Loneliness is associated with a greater risk of detrimental health behaviours such as physical inactivity, smoking and alcohol abuse (Beutel et al., 2017; Hawkley and Cacioppo, 2010; Shankar et al., 2011). Loneliness is also related to adverse mental health outcomes, including depression, anxiety, suicidal ideation, parasuicide and suicide (Beutel et al., 2017; Hawkley and Cacioppo, 2010; Killgore et al., 2020; Mushtaq et al., 2014; Wang et al., 2018). Lonely people are more likely to be depressed (Fang et al., 2021; McQuaid et al., 2021; Repon et al., 2021), have anxiety (McQuaid et al., 2021; Repon et al., 2021), score higher on suicidal ideation (Killgore et al., 2020; McQuaid et al., 2021) and report higher psychological distress (De Sio et al., 2020, 2021). The relationship between loneliness and mental health is likely bidirectional (Bu et al., 2020; Wang et al., 2018). Impaired cognitive functioning and cognitive decline are predicted by loneliness, which increases the risk of dementia more than 2-fold (Hawkley and Cacioppo, 2010; Mushtaq et al., 2014).

Government-instigated efforts to mitigate the spread of COVID-19 have been enacted across the world and have included social distancing, self-isolation, and stay at home orders that restrict non-essential movement. The resultant social disconnection has raised concerns about 'lockdown loneliness' (Shah et al., 2020). Discussions about the effects of COVID-19 must acknowledge its current and future psychological impact including the increased loneliness that many have experienced (Cabello et al., 2021; Cowan., 2020; Fang et al., 2021; Holmes et al., 2020; Holt-Lunstad, 2021; Killgore et al., 2020). Elevated levels of loneliness during the pandemic are evident across the globe and

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have been reported among the general population (Bu et al., 2020; Cabello et al., 2021; Khan and Kadoya, 2021; Killgore et al., 2020; O'Sullivan et al., 2021; Pai and Vella, 2021; Tutzer et al., 2021) and healthcare workers (HCWs) (Cabello et al., 2021; De Sio et al., 2020, 2021; Repon et al., 2021). The combined prevalence of severe loneliness across 101 countries during the pandemic was 21%, compared to 6% prior to the pandemic (O'Sullivan et al., 2021). Loneliness in HCWs has variously been reported to be 10.4% in Italian doctors (De Sio et al., 2021), 53% in Spanish HCWs (Cabello et al., 2021), and 89% in Bangladeshi HCWs (Repon et al., 2021), suggesting it is a greater concern for those at the fore-front of responding to the pandemic, despite the adverse impact of unemployment on loneliness (Hoffart et al., 2020; O'Sullivan et al., 2021; Tutzer et al., 2021) not being experienced by HCWs as it was by many in the general population. In addition to living under the restrictions experienced by the general public, HCWs have additionally shouldered the burden of a heightened risk of infection due to: potential work exposure; fear of infecting the people they live with; lack of contact with family members and, in some instances, isolating from their family to limit potential spread; being shunned by the community, even family and friends; and abuse from members of the public, including acts of violence and aggression (Ananda-Rajah et al., 2020; Johnson, 2021; Kang et al., 2020; Mehta et al., 2021; The Lancet, 2020).

Older age is generally considered to be a risk factor for loneliness and has received extensive attention in the literature, but during the pandemic younger age has frequently been found to be a higher risk (Groarke et al., 2020; Khan and Kadoya, 2021; Li and Wang, 2020; McQuaid et al., 2021; Rumas et al., 2021; Tutzer et al., 2021). In one study the odds of being lonely were six times higher in the youngest age group (Bu et al., 2020). Other studies have shown that being female (Bu et al., 2020; Li and Wang, 2020; McQuaid et al., 2021; Tutzer et al., 2021), on a low income (Bu et al., 2020; Groarke et al., 2020; Khan and Kadoya, 2021; McQuaid et al., 2021; Tutzer et al., 2021), and having physical (Groarke et al., 2020; Khan and Kadoya, 2021; Rumas et al., 2021) and mental health issues (Bu et al., 2020; Groarke et al., 2020; Khan and Kadoya, 2021; McQuaid et al., 2021; Rumas et al., 2021) are also associated with loneliness. Relationship status (partnered) (Tutzer et al., 2021), living with others, especially a partner (Bu et al., 2020; Groarke et al., 2020; Khan and Kadoya, 2021; Li and Wang, 2020; McQuaid et al., 2021), and high perceived social support (Bu et al., 2020; Groarke et al., 2020) are protective.

In evolutionary terms, social connections provide mutual protection and support (Cacioppo et al., 2014). The social neuroscience model of loneliness proposes that when these are absent, when one feels lonely or is isolated: there is an attentional bias towards social threats accompanied by elevated anxiety, hostility and social withdrawal; and increased symptoms of depression communicate one's need for support and connection (Cacioppo et al., 2014). The resulting negative cognitions and behaviours can further exacerbate loneliness and are consistent with the observed association between loneliness and mental health (Hutten et al., 2021). Conversely, social support can reduce loneliness and facilitate positive responses to stress (Segrin and Passalacqua, 2010). It assists in dealing with uncertainty and difficulties both directly (e.g., through tangible assistance) and indirectly through implied care and concern for the recipient (Segrin and Passalacqua, 2010).

Much of the research examining loneliness during the COVID-19 pandemic has explored its role as a risk factor for depression, primarily in the older general population. Few studies have focused specifically on loneliness in HCWs as the outcome of interest (Cabello et al., 2021; Fang et al., 2021; Repon et al., 2021). By virtue of their work, HCWs are exposed to a range of psychosocial and other risks which can impact on their health and well-being, and which are further aggravated by infectious disease outbreaks (Franklin and Gkiouleka, 2021). The absence of information about loneliness and its effects among HCWs limits our ability to support them, especially during highly stressful situations. We aimed to 1. measure the prevalence of loneliness among HCWs at a hospital accepting known or suspected COVID-19 positive patients and 2. identify factors, existing prior to the pandemic or during its height in 2020, associated with loneliness in these workers who are vital to our immediate and ongoing response to the COVID-19 pandemic. We hypothesised that loneliness would be common among our HCWs, and that loneliness would be inversely related to both mental well-being and indicators of social support.

2. Methods

2.1. Setting and participants

We conducted a cross-sectional survey of staff working at a large tertiary teaching hospital in NSW, Australia (Stubbs et al., 2021). It is a designated isolation facility where some of the first COVID-19 patients in Australia were admitted. Facilities included a COVID-19 testing clinic, a dedicated COVID-19 ward, and a COVID-19 ward within the intensive care unit.

Staff whose primary responsibility was to address the organisation's response to COVID-19 from mid-March to the end of May 2020, including those in departments caring for patients with suspected or confirmed COVID-19 (e.g. Emergency (ED), Intensive Care Unit (ICU), COVID-19 testing clinic, COVID-19 wards, Infection Control, Infectious Diseases, Respiratory Medicine, Oral Health, Cardiology, Geriatric Medicine, Ear Nose and Throat (ENT) and General Services), were targeted for participation.

2.2. Survey instrument

Basic demographic details (age, sex, usual living arrangements, highest educational qualification); health and wellbeing; health-related behaviours (physical activity, smoking, alcohol consumption and sleeping patterns); the impact of family/household and social circumstances on personal wellbeing; and workplace experiences during the pandemic were assessed using an online questionnaire developed in SurveyMonkey. Consent to participate was required before commencing the study questions.

The outcome measure of loneliness was contained within the family/household and social group of questions which retrospectively examined both the existence and impact of potential stressors, common during the pandemic (e.g. decreased household income, less contact with family and friends external to one's household, changed living arrangements). Response options for each situation were: experienced and affected their well-being; experienced but did not affect their well-being; not experienced. For analysis we grouped experienced but not affected with not experienced responses and compared them to experienced and affected based on research indicating that it is the subjective perception rather than objective experience of COVID-19 that influences mental health (Cabello et al., 2021).

Self-rated general health and mental health were reported as excellent, very good, good, fair, poor, or very poor for three time periods: before the pandemic, during the height of the pandemic in 2020 and currently (assessed six or more months after the height). Current psychological distress was assessed using the 10 item Kessler Psychological Distress Scale (K10) (Kessler et al., 2002). Distress during the height of the pandemic was retrospectively assessed using the same scale.

Workplace experiences will be reported separately (Trinh et al., Under review).

The questionnaire concluded with the contact details for various support services, was anonymous, took approximately 15 min to complete and was available from November 3, 2020 to January 31, 2021.

2.3. Recruitment and distribution of study questionnaire

The heads of targeted departments were informed of the intended study and their support obtained. Initially, targeted staff were emailed an invitation to participate, accompanied by a link to the participant

information and consent forms and online questionnaire (n = 1234). This was supplemented by the distribution of hard copy versions of the questionnaire and promotional posters with a QR code link to the online questionnaire. Three weeks after the initial invitation, a reminder email was sent. Visits were made to the ED, ICU and COVID clinic to promote the study and distribute study flyers containing the QR code. The General Services department was visited on three occasions to support the participation of cleaning staff which may otherwise have been limited due to English literacy and computer access issues.

Targeted recruitment was augmented by promotion to all hospital staff. Flyers were distributed to staff in hospital common areas (near the food court and at lifts) and posters were placed in the lift areas. Online articles including the QR code and weblink to the questionnaire were published in the staff bulletin, newsletter and social network channel.

2.4. Data analysis

Loneliness among HCWs was determined by the question about feelings of loneliness that negatively affected well-being during the height of the pandemic. Respondents who did not experience loneliness or who were not affected by it were classified as not lonely. Responses to the other family/household and social questions were similarly classified.

Responses to the general health and mental health questions were converted to dichotomous variables to indicate good (good, very good or excellent) or poor (fair, poor or very poor) health. Scores on each question of the K10 were summed to provide a total score. Where there were only nine valid responses, the missing score was imputated using the mean of the nine valid scores; less than nine valid responses resulted in a missing total score (Centre for Epidemiology and Evidence, 2020). Total K10 scores of 22 or more indicated high psychological distress; scores of 10–21 were classified as low distress (Australian Bureau of Statistics, 2012; Centre for Epidemiology and Evidence, 2020).

The relationship between loneliness and demographic, health, family/household, social and work-related factors were assessed using Chi squared. Unadjusted odds ratios indicated the size of each factor's relationship with loneliness. Multivariate logistic regression examined the association between pre-pandemic factors and loneliness, while controlling for other factors in the model (Model 1). Factors with $p < 0.1$ in univariate analysis were added to the multivariate model using a stepwise approach. Age and sex, and factors with $p < 0.05$ were retained in the final model. In Model 2, variables experienced during the height of the pandemic were added using the same method. Collinearity between variables in each model was assessed. Common method variance was assessed using Harman's single factor test.

Data analysis was performed using SAS EG v8.3. The study was approved by the hospital's Human Research Ethics Committee (2020/ETH01674).

3. Results

A total of 432 HCWs employed during the period of interest participated in the survey; of these 330 (76.4%) answered the question about loneliness and form the sample for this paper. Our sample was comparable to the hospital workforce in terms of sex (28.2% v 28.9% male); but had fewer clinicians (64.1% v 77.4%) and more experienced workers (52.6% v 41.8% with >10 years in their role).

Most commonly respondents were female (71.8%), aged 50 years or older (28.6%), nurses (39.0%), working in ICU (19.9%), in a patient facing role (77.1%), and had worked in their professional role for a mean of 12.4 years (range 0–42 years) (Table 1). The majority (78.8%) of respondents working in high exposure areas (the emergency department, intensive care unit, infectious diseases, or COVID-19 ward or clinic) were doctors, nurses or allied health professionals. Almost one-quarter of HCWs had ever been told by a doctor or other health professional they had mental health problems and 37% had sought support for their well-being during the pandemic from one or more sources, most commonly from family, friends or other informal sources (82.9%). More than half of the respondents who experienced a change in family/household and social circumstances reported that their well-being was affected by the change. Loneliness was experienced by 207 (62.7%) HCWs during the height of the pandemic; 129 (39.1%) reported that this had negatively affected their well-being, hereafter referred to as loneliness/being lonely. Reduced household income was experienced by 33.4% of HCW, with 18.8% affected; changed access to children and other dependents: 42.7% v 18.6%; changed living arrangements: 29.1% v 10.9%; increased conflict at home: 36.8% v 18.1%; less contact with family and friends: 87.9% v 56.1%.

3.1. Pre-pandemic variables associated with loneliness

Loneliness decreased with age (Cochran-Armitage trend test $Z = 4.11$, $p < 0.001$), with 60.5% of the youngest HCWs being lonely compared to only 30.0% of those aged 50 and older. HCWs living with a partner, with or without other family members, were least likely to be lonely; those who lived alone or with other family members had the highest rates of loneliness ($\chi^2(3) = 12.5$, $p = 0.006$). Poor health status prior to the pandemic was associated with loneliness, as measured by having ever been told by a health professional they had mental health problems ($\chi^2(1) = 10.3$, $p = 0.001$), and self-reported mental ($\chi^2(1) = 10.3$, $p = 0.001$) and general health ($\chi^2(1) = 5.0$, $p = 0.025$). HCWs with less than 10 years of experience in their professional role were more likely than more experienced colleagues to be lonely (Cochran-Armitage trend test $Z = -3.27$, $p = 0.001$).

3.2. Pandemic experiences associated with loneliness

HCWs with high psychological distress ($\chi^2(1) = 61.5$, $p < 0.0001$) and poor mental health ($\chi^2(1) = 56.3$, $p < 0.0001$) during the height of the pandemic were more likely to be lonely, as were those with sleeping problems ($\chi^2(1) = 23.1$, $p < 0.0001$) and poor general health during the height of the pandemic ($\chi^2(1) = 10.3$, $p = 0.001$).

Loneliness was more common among doctors, nurses and allied health workers than other HCWs ($\chi^2(1) = 5.6$, $p = 0.018$), and among those aware of increased conflict between co-workers ($\chi^2(1) = 5.82$, $p = 0.02$). HCWs who felt a sense of camaraderie with their colleagues were less likely to be lonely ($\chi^2(1) = 3.95$, $p = 0.047$).

HCWs who reported that the experience of specific family/household and social circumstances during the height of the pandemic did not affect their well-being were not prevented from feeling lonely, but it was less likely that their well-being was negatively associated with loneliness (Supplementary Table 1). Being affected by less contact with family or friends ($\chi^2(1) = 81.4$, $p < 0.0001$), increased conflict at home ($\chi^2(1) = 34.1$, $p < 0.0001$), changed living arrangements ($\chi^2(1) = 15.6$, $p < 0.0001$) and access to children or other dependents ($\chi^2(1) = 8.5$, $p = 0.004$), and decreased household income ($\chi^2(1) = 9.5$, $p = 0.002$) were each associated with an increased likelihood that loneliness affected well-being, compared to those who did not have the experience or were not affected by it. The experience of a traumatic life event (self-defined) during the height of the pandemic was also associated with increased loneliness ($\chi^2(1) = 5.2$, $p = 0.023$).

3.3. Multivariate analysis for loneliness

Adjusted logistic regression analysis examined the relationship between pre-pandemic factors and loneliness, adjusting for age and sex and other significant variables (Model 1, Table 2). Predictors of loneliness were being younger than 30 years (compared to 50 years or older; adjusted odds ratio (aOR) = 3.3; 95% CI:1.53–7.08), having ever been told by a doctor or other health professional that you had a mental health problem (aOR = 2.5; 95% CI: 1.42–4.51) and living alone (compared to living with a partner; aOR = 2.5; 95% CI: 1.08–5.53).

Table 1
Respondent characteristics and factors associated with loneliness during the height of the pandemic.

Variables	All (n = 330[a])		Lonely (n = 129[a])					
	n	(%)	n	(%)	Rate per 100	χ^2	*p*	OR (95% CI)
PRE-PANDEMIC								
Sex						2.90	0.098	
Female	227	(71.8)	95	(77.2)	41.9			ref
Male	89	(28.2)	28	(22.8)	31.5			0.64 (0.38–1.07)
Age (years)						4.11[b]	<.0001	
18–29	81	(25.7)	49	(40.2)	60.5			3.57 (1.90–6.73)
30–39	75	(23.8)	27	(22.1)	36.0			1.31 (0.68–2.52)
40–49	69	(21.9)	19	(15.6)	27.5			0.89 (0.44–1.78)
50+	90	(28.6)	27	(22.1)	30.0			ref
Living arrangement						12.50	0.006	
Partner with or without children or any other family	199	(62.8)	62	(50.8)	31.2			ref
Family excluding a partner	66	(20.8)	34	(27.9)	51.5			2.35 (1.33–4.14)
Non-family	20	(6.3)	9	(7.4)	45.0			1.81 (0.71–4.59)
Alone	32	(10.1)	17	(13.9)	53.1			2.50 (1.18–5.34)
Self-reported mental health – pre-pandemic						10.33	0.001	
Good	293	(89.1)	106	(82.2)	36.2			ref
Poor	36	(10.9)	23	(17.8)	63.9			3.12 (1.52–6.42)
Ever told had mental health problems						10.26	0.001	
No	233	(76.1)	76	(66.1)	32.6			ref
Yes	73	(23.9)	39	(33.9)	53.4			2.37 (1.39–4.05)
Self-reported general health – pre-pandemic						5.02	0.025	
Good	306	(93.0)	114	(89.1)	37.3			ref
Poor	23	(7.0)	14	(10.9)	60.9			2.62 (1.10–6.25)
Years of professional experience						−3.27[d]	0.001	
<5	83	(28.3)	41	(36.0)	49.4			2.4 (1.29–4.54)
5–9	56	(19.1)	28	(24.6)	50.0			2.4 (1.36–4.11)
10 or more	154	(52.6)	45	(39.5)	29.2			ref
DURING HEIGHT OF PANDEMIC								
Psychological distress (K10) – during height of pandemic						61.54	<.0001	
Low	213	(64.6)	50	(38.8)	23.5			ref
High	117	(35.5)	79	(61.2)	67.5			6.78 (4.11–11.18)
Self-reported mental health – during height of pandemic						56.34	<.0001	
Good	180	(55.1)	37	(29.1)	20.6			ref
Poor	147	(45.0)	90	(70.9)	61.2			6.10 (3.74–9.97)
Self-reported general health – during height of pandemic						10.32	0.001	
Good	265	(81.3)	93	(72.7)	35.1			ref
Poor	61	(18.7)	35	(27.3)	57.4			2.49 (1.41–4.39)
Alcohol consumption						2.98	0.084	
Same or less than usual	242	(74.7)	89	(69.5)	36.8			ref
More than usual	82	(25.3)	39	(30.5)	47.6			1.56 (0.94–2.59)
Sleep problems						23.08	<.0001	
No	187	(56.7)	52	(40.3)	27.8			ref
Yes	143	(43.3)	77	(59.7)	53.9			3.03 (1.92–4.79)
Work in high exposure area[b]						0.92	0.338	
No	193	(59.9)	72	(56.7)	37.3			ref
Yes	129	(40.1)	55	(43.3)	42.6			1.25 (0.79–1.97)
Work role						5.59	0.018	
Dr/nurse/allied health	207	(64.1)	92	(71.9)	44.4			1.79 (1.10–2.87)
Other[c]	116	(35.9)	36	(28.1)	31.0			ref
Felt a sense of camaraderie with fellow workers						3.95	0.047	
No	73	(22.6)	36	(28.4)	49.3			ref
Yes	250	(77.4)	91	(71.7)	36.4			0.59 (0.35–1.00)
Aware of increased conflict between fellow workers						5.82	0.016	
No	213	(66.2)	74	(58.3)	34.7			ref
Yes	109	(33.9)	53	(41.7)	48.6			1.78 (1.11–2.84)
Traumatic life event experienced during height of pandemic						5.19	0.023	
No	266	(19.4)	96	(74.4)	36.1			ref
Yes	64	(80.6)	33	(25.6)	51.6			1.89 (1.09–3.27)
During height of pandemic, well-being was negatively affected by:								
Decreased household income						9.53	0.002	
No	267	(81.2)	94	(72.9)	35.2			ref
Yes	62	(18.8)	35	(27.1)	56.5			2.39 (1.36–4.18)
Changed access to children or other dependents						8.46	0.004	
No	267	(81.4)	95	(73.6)	35.6			ref
Yes	61	(18.6)	34	(26.4)	55.7			2.28 (1.30–4.00)
Changed living arrangements						15.64	<.0001	
No	294	(89.1)	104	(80.6)	35.4			ref
Yes	36	(10.9)	25	(19.4)	69.4			4.15 (1.97–8.78)
Increased conflict at home						34.14	<.0001	
No	267	(81.9)	85	(66.4)	31.8			ref
Yes	59	(18.1)	43	(33.6)	72.9			5.75 (3.07–10.79)

(*continued on next page*)

Table 1 (*continued*)

Variables	All (n = 330[a])		Lonely (n = 129[a])					
	n	(%)	n	(%)	Rate per 100	χ^2	*p*	OR (95% CI)
Less contact with family or friends						81.36	<.0001	
No	145	(43.9)	17	(13.2)	11.7			ref
Yes	185	(56.1)	112	(86.8)	60.5			11.55 (6.43–20.75)

OR: odds ratio; CI: confidence interval.
[a] Maximum sample size, n may be smaller for some cross tabulations.
[b] Defined as working in the emergency department, intensive care unit, infectious diseases, or COVID-19 ward or clinic.
[c] Includes cleaners, administration workers, researchers, oral health workers, and others.
[d] Z statistic from Cochran-Armitage trend test.

Variables related to the height of the pandemic were added in Model 2 (Table 2). Adjusting for the covariates social interactions, living arrangements and mental well-being showed these were significantly associated with loneliness. Having less contact with family and friends (aOR = 10.4, 95% CI: 4.64–23.46) and increased conflict at home (aOR = 8.9, 95% CI: 3.25–24.51) had the strongest relationship with HCWs' loneliness. Living alone (aOR = 6.1, 95% CI: 1.85–19.95) or with family, but not a partner (aOR = 4.6, 95% CI: 1.69–12.25) was detrimental, compared to living with a partner. The odds of loneliness were approximately three times higher for those who had high psychological distress (aOR = 3.4, 95% CI: 1.53–7.60) or poor mental health (aOR = 2.9, 95% CI: 1.36–6.39) during the height of the pandemic. Having a sense of camaraderie with workmates reduced the odds of loneliness (aOR = 0.42, 95% CI: 0.19–0.92). Correlation between variables in the final model did not reach 0.5, and in most cases was much lower; variance inflation factors were all below 2. Harman's single factor test estimated the common method variance to be 33.3%, indicating that this type of bias was not a concern.

Table 2
Odds of loneliness, adjusted for pre-pandemic and pandemic factors.

	Model 1:	Model 2:
	Pre-pandemic variables aOR (95% CI)	Model 1 + pandemic experiences aOR (95% CI)
Sex		
Female	ref	ref
Male	0.61 (0.34–1.10)	1.10 (0.51–2.38)
Age (years)		
18–29	3.29 (1.53–7.08)**	1.78 (0.64–4.98)
30–39	1.32 (0.65–2.70)	1.06 (0.41–2.75)
40–49	1.04 (0.49–2.21)	0.60 (0.22–1.62)
50+	ref	ref
Living arrangement		
Partner with or without children or any other family	ref	ref
Family excluding a partner	1.63 (0.81–3.28)	4.55 (1.69–12.25)**
Non-family	1.23 (0.42–3.64)	1.20 (0.28–5.10)
Alone	2.45 (1.08–5.53)*	6.08 (1.85–19.95)**
Ever told had mental health problems		
No	ref	ref
Yes	2.53 (1.42–4.51)**	0.67 (0.28–1.59)
Psychological distress(K10) during height of pandemic		
Low		ref
High		3.41 (1.53–7.60)**
Self-reported mental health during height of pandemic		
Good		ref
Poor		2.95 (1.36–6.39)**
Felt a sense of camaraderie with fellow workers		
No		ref
Yes		0.42 (0.19–0.92)*
During the height of the pandemic, well-being was negatively affected by:		
Increased conflict at home		
No		ref
Yes		8.93 (3.25–24.51)***
Less contact with family and friends		
No		ref
Yes		10.44 (4.64–23.46)***

Model 1 = pre-pandemic variables significantly associated with loneliness after adjusting for covariates. Sex retained despite non-significance.
Model 2 = Model 1 + variables during the height of the pandemic significantly associated with loneliness after adjusting for other variables in the model.
aOR: adjusted odds ratio; CI: confidence interval.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

4. Discussion

Our study of a sample of HCWs from a designated COVID-19 hospital in Australia demonstrated that indicators of social support from within and external to home had strong relationships with loneliness, surpassing those of mental well-being. The predictive value of measures of pre-existing mental health were negated after adjusting for mental well-being during the pandemic.

Although not universal (Beutel et al., 2021; Luchetti et al., 2020), loneliness has increased as a result of the pandemic (Khan and Kadoya, 2021; Tutzer et al., 2021), with its requirements for altered social relationships and measures to combat infection creating feelings of loneliness in an otherwise stable population (Khan and Kadoya, 2021). Loneliness and its consequences are borne by a sizable proportion of HCWs. Three in every five of our HCWs experienced loneliness during the height of the COVID-19 pandemic, the majority of whom considered it had negatively affected their well-being. Although not directly comparable due to survey differences, loneliness in our HCWs was much higher than the 22% reported for the Australian public in that period (Australian Bureau of Statistics, 2020) and from population studies in other countries (Groarke et al., 2020; Li and Wang, 2020; O'Sullivan et al., 2021; Tutzer et al., 2021). Higher levels of loneliness amongst HCWs during the COVID-19 pandemic are not unique to Australia (Cabello et al., 2021; Kotera et al., 2021; Murata et al., 2021) and may be linked to their perceived increased risk of infection (Hawkley and Cacioppo, 2010; Wang et al., 2021), and the discrimination, stigmatization and isolation HCWs experienced (Hong et al., 2021; Vera San Juan et al., 2020; Shreffler et al., 2020).

Less contact with family and friends who do not live in the same house and living alone or with people other than a spouse/partner, could translate into a reduction in the potential benefits of social support and increased loneliness identified in this study. The protective value of being married or living with a partner against loneliness is well documented – both in non-pandemic times and during the pandemic (Beutel et al., 2017, 2021; Groarke et al., 2020; Hoffart et al., 2020; Li and Wang, 2020; McQuaid et al., 2021). Social contact, perceived social support, and having people you trust and feel close to, who help you feel safe, secure and happy can also protect against loneliness (Bu et al., 2020; Fang et al., 2021; Groarke et al., 2020; Guan, 2021; Macdonald and Hülür, 2021). The benefits of physical contact with family and friends (Hoffart et al., 2021) were diminished for our HCWs – 43% had a change in access to children and other dependents, and 29% had changed living

arrangements. Other sources of pandemic-induced instability in the home environment, namely decreased household income and increased conflict were also associated with HCWs' loneliness, the latter finding consistent with family conflict exacerbating the psychological consequences of the COVID-19 pandemic (Behar-Zusman et al., 2020).

Addressing loneliness is likely to be more complicated than simply increasing social connections (Smith and Lim, 2020). Loneliness is not only affected by social network size (Macdonald and Hülür, 2021; Rumas et al., 2021; Segrin and Passalacqua, 2010) and the frequency (Guan, 2021; Macdonald and Hülür, 2021) and type (in-person or remote) (Groarke et al., 2020; Hoffart et al., 2021; Rumas et al., 2021) of contact, but perceived closeness and quality of relationships (Bu et al., 2020; Groarke et al., 2020) are also influential. Fulfilment of personal needs may be the critical component: satisfaction with the frequency of contact (Macdonald and Hülür, 2021) and empathy focused phone calls (Kahlon et al., 2021) can protect against loneliness, while greater dissatisfaction with, but not frequency of video calls, has been found to increase the odds of loneliness (O'Sullivan et al., 2021). Identifying individual preferences and engineering social interactions accordingly may be an effective strategy for preventing loneliness.

Our study is one of the few during this pandemic to examine the relationship between workplace factors and loneliness among HCWs. Those most likely to be at the forefront of directly caring for and interacting with patients, including doctors, nurses and allied health professionals, were more likely to be lonely than were other HCWs. Interestingly however, the rate of loneliness among workers in high exposure areas was no different to that of HCWs in other areas, despite being primarily composed of doctors, nurses and allied health professionals. Working in high-risk settings during the SARS outbreak was similarly not associated with adverse psychological outcomes (Maunder et al., 2003, 2006), but during the current pandemic others have reported that workers with a greater likelihood of contact with COVID-19 patients have higher loneliness scores (Fang et al., 2021). The increased interaction our workers in high risk areas experienced as they received infection control training, collaborated with colleagues to minimise the risk of transmission and received ongoing offers for wellness support (K.Vashey, personal communication), and risk perception (Wang et al., 2021) may have ameliorated the otherwise detrimental effects of working in these areas (Maunder et al., 2003, 2006; Speroni et al., 2015). Prioritising high-risk situations as the target of protective measures might have contributed to counterbalancing factors associated with loneliness. It is plausible that effective workplace responses and the implementation of strategies to decrease perceived risk allay psychological outcomes in stressful situations.

Less experienced HCWs were more likely to be lonely than those working for ten or more years. Experience is likely to provide opportunities to develop defence mechanisms and coping skills (Shaw et al., 2013) and to have worked during previous outbreaks. The inverse association between years of experience and loneliness was no longer significant after adjusting for age and other variables.

The social support provided by work colleagues can be protective against loneliness (Rogers et al., 2016), and the experiences of the COVID-19 pandemic and previous infectious disease outbreaks reveal that a sense of camaraderie with work colleagues and feeling that one is not facing a crisis alone are crucial for maintaining well-being (Kim, 2018; Maunder et al., 2003; Sun et al., 2020). Loneliness in our HCWs was associated with increased workplace conflict, while a sense of camaraderie and common purpose with fellow workers had the opposite result. However, after adjusting for other factors only camaraderie remained significant, while the negative relationships between loneliness and less contact with family and friends, and conflict at home were maintained or strengthened. Our results indicate that, even in a healthcare setting where teamwork is essential, relationships with family and friends may be key to protecting against loneliness, surpassing the influence of workplace interactions.

The pandemic's detrimental impact on HCW's mental well-being (Stubbs et al., 2021), has heightened their risk of loneliness. The previously reported inverse relationship between loneliness and mental well-being (Beutel et al., 2017; Mushtaq et al., 2014), also evident during the current pandemic (Cabello et al., 2021; De Sio et al., 2020, 2021; Fang et al., 2021; Groarke et al., 2020; Hoffart et al., 2020; O'Sullivan et al., 2021), was further supported by our findings, irrespective of assessment method — a validated 10-item scale measuring psychological distress, self-report to a single question about mental health or a health professional advising they have mental health problems — and whether mental well-being related to the height of the pandemic or prior to its onset. Other factors related to well-being, notably sleep problems, traumatic life events and workplace conflict, were also significantly associated with loneliness. A significant relationship between loneliness and both psychological distress and self-reported mental health experienced during the height of the pandemic persisted after adjusting for other factors. Pre-pandemic mental health was no longer significantly associated with loneliness which, although our study design could not establish a causal relationship, suggests that loneliness was primarily a response to the pandemic, not a direct consequence of pre-existing problems.

Maintaining mental well-being in a crisis may protect HCWs from loneliness; conversely, preventing loneliness may protect against poor outcomes in terms of mental well-being. Adjusting for social support — specifically contact with family and friends, living arrangements and increased conflict at home — reduced the association between mental well-being and loneliness, contrary to the suggestion that social support may be insufficient to protect against loneliness in the face of higher levels of anxiety and depression in the context of the COVID-19 pandemic (Bu et al., 2020). Variations in how social support and mental health are measured are important considerations in evaluating the role of social support on the interplay between mental well-being and loneliness, but do not disavow the potential for interventions optimising social support to both promote mental well-being and avert loneliness.

Healthcare systems can play a role in protecting their staff from the adverse effects of crisis situations such as the current pandemic. Our results indicate the benefits of fostering a culture of teamwork and shared purpose. Making staff aware of the value of maintaining positive relationships outside the work environment and, where possible, facilitating such relationships may help to safeguard against loneliness and other mental health concerns. Evidence-based strategies that support and strengthen mental well-being as HCWs experience the realities of working during such circumstances will also be beneficial.

Interpreting our results should be undertaken in light of the study's limitations. Our initial recruitment targeted specific departments to encourage participation by those most involved in the pandemic response and was then extended to the wider hospital. The result was an increase in our sample size and a broader range of participating departments but the inability to calculate a response rate. Although the proportion of male respondents corresponded to that of the hospital's workforce, there were fewer clinicians and more experienced workers. Clinicians generally have less available work time to access computers for tasks not directly related to patient care (compared to people in desk-based roles) and the heightened stresses of their role may have diminished their motivation to participate in voluntary activities. Conversely, workers with greater experience are potentially in more senior roles that may allow greater work flexibility and motivation to participate in such investigations. We found that clinicians and less experienced workers were more likely to be lonely, suggesting that the results from our sample may under-estimate loneliness among all HCWs. Variables such as loneliness, mental well-being and family/household and social circumstances during the height of the pandemic, were assessed retrospectively and therefore susceptible to recall error. In particular, mental well-being at the time of questionnaire completion may have biased recall. Loneliness was assessed via a single question, with respondents indicating whether their well-being had been affected by feelings of loneliness. Although different aspects of loneliness were not measured, incorporating the existence and impact of loneliness facilitated a more holistic

appraisal of loneliness. Our cross-sectional data precluded conclusions regarding causality of loneliness.

Australia did not experience the high case numbers reported by other countries during the first wave of the pandemic in 2020. Nonetheless, the psychological well-being of HCWs at this and other Australian hospitals was similarly impacted (Dobson et al., 2021; Holton et al., 2021; Stubbs et al., 2021), indicating that our results are applicable to other settings in Australia and overseas.

5. Conclusion

Loneliness in HCWs is a legitimate concern, negatively impacting their well-being during a health crisis. Contact with family and friends, the support provided by living with one's partner and a sense of camaraderie with colleagues were associated with mental well-being and indicate potential avenues to ameliorate the adverse consequences of loneliness. Promoting the health and wellbeing of HCWs is an essential component of our response to any health crisis.

Author contributions

J.Stubbs: conceptualization, methodology, formal analysis, writing – original draft, review & editing. H. Achat: conceptualization, methodology, supervision, writing – review & editing. All authors approved the final version of the manuscript.

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Declaration of competing interest

The authors declare that there is no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psycom.2022.100050.

References

Ananda-Rajah, M., Veness, B., Berkovic, D., Parker, C., Kelly, G., Ayton, D., 2020. Hearing the Voices of Australian Healthcare Workers during the COVID-19 Pandemic. BMJ Leader. Published Online First. https://dio.org/10.1136/leader-2020-000386.

Australian Bureau of Statistics, 2012. Information Paper: Use of the Kessler Psychological Distress Scale in ABS Health Surveys, Australia, 2007-08, 4817.0.55.001. https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4817.0.55.001Main+Features12007-08?OpenDocument.

Australian Bureau of Statistics, 2020. Household Impacts of COVID-19 Survey. https://www.abs.gov.au/statistics/people/people-and-communities/household-impacts-covid-19-survey.

Behar-Zusman, V., Chavez, J.V., Gattamorta, K., 2020. Developing a measure of the impact of COVID-19 social distancing on household conflict and cohesion. Fam. Process 59 (3), 1045–1059. https://doi.org/10.1111/famp.12579.

Beutel, M.E., Hettich, N., Ernst, M., Schmutzer, G., Tibubos, A.N., Braehler, E., 2021. Mental health and loneliness in the German general population during the COVID-19 pandemic compared to a representative pre-pandemic assessment. Sci. Rep. 11 (1), 14946. https://doi.org/10.1038/s41598-021-94434-8.

Beutel, M.E., Klein, E.M., Brähler, E., Reiner, I., Jünger, C., Michal, M., Wiltink, J., Wild, P.S., Münzel, T., Lackner, K.J., Tibubos, A.N., 2017. Loneliness in the general population: prevalence, determinants and relations to mental health. BMC Psychiatr. 17 (1), 97. https://doi.org/10.1186/s12888-017-1262-x.

Bu, F., Steptoe, A., Fancourt, D., 2020. Loneliness during a strict lockdown: trajectories and predictors during the COVID-19 pandemic in 38,217 United Kingdom adults. Soc. Sci. Med. 265, 113521. https://doi.org/10.1016/j.socscimed.2020.113521.

Cabello, M., Izquierdo, A., Leal, I., 2021. Loneliness and not living alone is what impacted on the healthcare professional's mental health during the COVID-19 outbreak in Spain. Health Soc. Care Community 30, 968–975. https://doi.org/10.1111/hsc.13260.

Cacioppo, S., Capitanio, J.P., Cacioppo, J.T., 2014. Toward a neurology of loneliness. Psychol. Bull. 140 (6), 1464–1504. https://doi.org/10.1037/a0037618.

Centre for Epidemiology and Evidence, 2020. Health Statistics New South Wales. NSW Ministry of Health, Sydney. www.healthstats.nsw.gov.au.

Cowan, K., 2020. Survey Results: Understanding People's Concerns about the Mental Health Impacts of the COVID-19 Pandemic. MQ: Transforming Mental Health and the Academy of Medical Sciences. https://acmedsci.ac.uk/file-download/99436893.

De Sio, S., Buomprisco, G., La Torre, G., Lapteva, E., Perri, R., Greco, E., Mucci, N., Cedrone, F., 2020. The impact of COVID-19 on doctors' well-being: results of a web survey during the lockdown in Italy. Eur. Rev. Med. Pharmacol. Sci. 24 (14), 7869–7879. https://doi.org/10.26355/eurrev_202007_22292.

De Sio, S., La Torre, G., Buomprisco, G., Lapteva, E., Perri, R., Corbosiero, P., Ferraro, P., Giovannetti, A., Greco, E., Cedrone, F., 2021. Consequences of COVID19-pandemic lockdown on Italian occupational physicians' psychosocial health. PLoS One 16 (2), e0243194. https://doi.org/10.1371/journal.pone.0243194.

Dobson, H., Malpas, C.B., Burrell, A.J., Gurvich, C., Chen, L., Kulkarni, J., Winton-Brown, T., 2021. Burnout and psychological distress amongst Australian healthcare workers during the COVID-19 pandemic. Australas. Psychiatr. 29 (1), 26–30. https://doi.org/10.1177/1039856220965045.

Fang, X.-H., Wu, L., Lu, L.-S., Kan, X.-H., Wang, H., Xiong, Y.-J., Ma, D.-C., Wu, G.-C., 2021. Mental health problems and social supports in the COVID-19 healthcare workers: a Chinese explanatory study. BMC Psychiatr. 21 (1), 34. https://doi.org/10.1186/s12888-020-02998-y.

Franklin, P., Gkiouleka, A., 2021. A ccoping review of psychosocial risks to health workers during the Covid-19 pandemic. Int. J. Environ. Res. Publ. Health 18 (5). https://doi.org/10.3390/ijerph18052453.

Groarke, J.M., Berry, E., Graham-Wisener, L., McKenna-Plumley, P.E., McGlinchey, E., Armour, C., 2020. Loneliness in the UK during the COVID-19 pandemic: cross-sectional results from the COVID-19 psychological wellbeing study. PLoS One 15 (9), e0239698. https://doi.org/10.1371/journal.pone.0239698.

Guan, M., 2021. Could the associations of changes in living arrangement with mental disorders be moderated or mediated during COVID-19 pandemic? Psychol. Res. Behav. Manag. 14, 769–779. https://doi.org/10.2147/prbm.S302729.

Hawkley, L.C., Cacioppo, J.T., 2010. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. Ann. Behav. Med. 40 (2), 218–227. https://doi.org/10.1007/s12160-010-9210-8.

Hawkley, L.C., Capitanio, J.P., 2015. Perceived social isolation, evolutionary fitness and health outcomes: a lifespan approach. Philos. Trans. R. Soc. Lond. B Biol. Sci. 370 (1669). https://doi.org/10.1098/rstb.2014.0114.

Hoffart, A., Johnson, S.U., Ebrahimi, O.V., 2020. Loneliness and social distancing during the COVID-19 pandemic: risk factors and associations with psychopathology. Front. Psychiatr. 11, 589127. https://doi.org/10.3389/fpsyt.2020.589127.

Hoffart, A., Johnson, S.U., Ebrahimi, O.V., 2021. Loneliness during the COVID-19 pandemic: change and predictors of change from strict to discontinued social distancing protocols. Hist. Philos. Logic 1–14. https://doi.org/10.1080/10615806.2021.1958790.

Holmes, E.A., O'Connor, R.C., Perry, V.H., Tracey, I., Wessely, S., Arseneault, L., Ballard, C., Christensen, H., Cohen Silver, R., Everall, I., Ford, T., John, A., Kabir, T., King, K., Madan, I., Michie, S., Przybylski, A.K., Shafran, R., Sweeney, A., Worthman, C.M., Yardley, L., Cowan, K., Cope, C., Hotopf, M., Bullmore, E., 2020. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. Lancet Psychiatr. 7 (6), 547–560. https://doi.org/10.1016/s2215-0366(20)30168-1.

Holt-Lunstad, J., 2021. A pandemic of social isolation? World Psychiatr. 20 (1), 55–56. https://doi.org/10.1002/wps.20839.

Holt-Lunstad, J., Smith, T.B., Baker, M., Harris, T., Stephenson, D., 2015. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. Perspect. Psychol. Sci. 10 (2), 227–237. https://doi.org/10.1177/1745691614568352.

Holton, S., Wynter, K., Trueman, M., Bruce, S., Sweeney, S., Crowe, S., Dabscheck, A., Eleftheriou, P., Booth, S., Hitch, D., Said, C.M., Haines, K.J., Rasmussen, B., 2021. Psychological well-being of Australian hospital clinical staff during the COVID-19 pandemic. Aust. Health Rev. 45 (3), 297–305. https://doi.org/10.1071/AH20203.

Hong, S., Ai, M., Xu, X., Wang, W., Chen, J., Zhang, Q., Wang, L., Kuang, L., 2021. Immediate psychological impact on nurses working at 42 government-designated hospitals during COVID-19 outbreak in China: a cross-sectional study. Nurs. Outlook 69 (1), 6–12. https://doi.org/10.1016/j.outlook.2020.07.007.

Hutten, E., Jongen, E.M.M., Vos, A., van den Hout, A., van Lankveld, J., 2021. Loneliness and mental health: the mediating effect of perceived social support. Int. J. Environ. Res. Publ. Health 18 (22). https://doi.org/10.3390/ijerph182211963.

Johnson, S., 2021. Spat at, Abused, Attacked: Healthcare Staff Face Rising Violence during Covid. 7 June 2021. The Guardian. https://www.theguardian.com/global-development/2021/jun/07/spat-at-abused-attacked-healthcare-staff-face-rising-violence-during-covid.

Kahlon, M.K., Aksan, N., Aubrey, R., Clark, N., Cowley-Morillo, M., Jacobs, E.A., Mundhenk, R., Sebastian, K.R., Tomlinson, S., 2021. Effect of layperson-delivered, empathy-focused program of telephone calls on loneliness, depression, and anxiety among adults during the COVID-19 pandemic: a randomized clinical trial. JAMA Psychiatr. 78 (6), 616–622. https://doi.org/10.1001/jamapsychiatry.2021.0113.

Kang, L., Li, Y., Hu, S., Chen, M., Yang, C., Yang, B.X., Wang, Y., Hu, J., Lai, J., Ma, X., Chen, J., Guan, L., Wang, G., Ma, H., Liu, Z., 2020. The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. Lancet Psychiatr. 7 (3), e14. https://doi.org/10.1016/s2215-0366(20)30047-x.

Kessler, R.C., Andrews, G., Colpe, L.J., Hiripi, E., Mroczek, D.K., Normand, S.L., Walters, E.E., Zaslavsky, A.M., 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol. Med. 32 (6), 959–976. https://doi.org/10.1017/s0033291702006074.

Khan, M.S.R., Kadoya, Y., 2021. Loneliness during the COVID-19 pandemic: a comparison between older and younger people. Int. J. Environ. Res. Publ. Health 18 (15), 7871. https://doi.org/10.3390/ijerph18157871.

Killgore, W.D.S., Cloonan, S.A., Taylor, E.C., Dailey, N.S., 2020. Loneliness: a signature mental health concern in the era of COVID-19. Psychiatr. Res. 290, 113117. https://doi.org/10.1016/j.psychres.2020.113117.

Kim, Y., 2018. Nurses' experiences of care for patients with Middle East respiratory syndrome-coronavirus in South Korea. Am. J. Infect. Control 46 (7), 781–787. https://doi.org/10.1016/j.ajic.2018.01.012.

Kotera, Y., Ozaki, A., Miyatake, H., Tsunetoshi, C., Nishikawa, Y., Tanimoto, T., 2021. Mental health of medical workers in Japan during COVID-19: relationships with loneliness, hope and self-compassion. Curr. Psychol. 1–4. https://doi.org/10.1007/s12144-021-01514-z.

Li, L.Z., Wang, S., 2020. Prevalence and predictors of general psychiatric disorders and loneliness during COVID-19 in the United Kingdom. Psychiatr. Res. 291, 113267. https://doi.org/10.1016/j.psychres.2020.113267.

Luchetti, M., Lee, J.H., Aschwanden, D., Sesker, A., Strickhouser, J.E., Terracciano, A., Sutin, A.R., 2020. The trajectory of loneliness in response to COVID-19. Am. Psychol. 75 (7), 897–908. https://doi.org/10.1037/amp0000690.

Macdonald, B., Hülür, G., 2021. Well-being and loneliness in Swiss older adults during the COVID-19 pandemic: the role of social relationships. Gerontol. 61 (2), 240–250. https://doi.org/10.1093/geront/gnaa194.

Maunder, R., Hunter, J., Vincent, L., Bennett, J., Peladeau, N., Leszcz, M., Sadavoy, J., Verhaeghe, L.M., Steinberg, R., Mazzulli, T., 2003. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. CMAJ (Can. Med. Assoc. J.) 168 (10), 1245–1251.

Maunder, R.G., Lancee, W.J., Balderson, K.E., Bennett, J.P., Borgundvaag, B., Evans, S., Fernandes, C.M., Goldbloom, D.S., Gupta, M., Hunter, J.J., McGillis Hall, L., Nagle, L.M., Pain, C., Peczeniuk, S.S., Raymond, G., Read, N., Rourke, S.B., Steinberg, R.J., Stewart, T.E., VanDeVelde-Coke, S., Veldhorst, G.G., Wasylenki, D.A., 2006. Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. Emerg. Infect. Dis. 12 (12), 1924–1932. https://doi.org/10.3201/eid1212.060584.

McQuaid, R.J., Cox, S.M.L., Ogunlana, A., Jaworska, N., 2021. The burden of loneliness: implications of the social determinants of health during COVID-19. Psychiatr. Res. 296, 113648. https://doi.org/10.1016/j.psychres.2020.113648.

Mehta, S., Machado, F., Kwizera, A., Papazian, L., Moss, M., Azoulay, É., Herridge, M., 2021. COVID-19: a heavy toll on health-care workers. Lancet Respir. Med. 9 (3), 226–228. https://doi.org/10.1016/S2213-2600(21)00068-0.

Murata, S., Rezeppa, T., Thoma, B., Marengo, L., Krancevich, K., Chiyka, E., Hayes, B., Goodfriend, E., Deal, M., Zhong, Y., Brummit, B., Coury, T., Riston, S., Brent, D.A., Melhem, N.M., 2021. The psychiatric sequelae of the COVID-19 pandemic in adolescents, adults, and health care workers. Depress. Anxiety 38 (2), 233–246. https://doi.org/10.1002/da.23120.

Mushtaq, R., Shoib, S., Shah, T., Mushtaq, S., 2014. Relationship between loneliness, psychiatric disorders and physical health? A review on the psychological aspects of loneliness. J. Clin. Diagn. Res. 8 (9), We01–4. https://doi.org/10.7860/jcdr/2014/10077.4828.

O'Sullivan, R., Burns, A., Leavey, G., Leroi, I., Burholt, V., Lubben, J., Holt-Lunstad, J., Victor, C., Lawlor, B., Vilar-Compte, M., Perissinotto, C.M., Tully, M.A., Sullivan, M.P., Rosato, M., Power, J.M., Tiilikainen, E., Prohaska, T.R., 2021. Impact of the COVID-19 pandemic on loneliness and social isolation: a multi-country study. Int. J. Environ. Res. Publ. Health 18 (19), 9982. https://doi.org/10.3390/ijerph18199982.

Pai, N., Vella, S.-L., 2021. COVID-19 and loneliness: a rapid systematic review. Aust. N. Z. J. Psychiatr., 00048674211031489 https://doi.org/10.1177/00048674211031489, 0 (0).

Repon, M.A.U., Pakhe, S.A., Quaiyum, S., Das, R., Daria, S., Islam, M.R., 2021. Effect of COVID-19 pandemic on mental health among Bangladeshi healthcare professionals: a cross-sectional study. Sci. Prog. 104 (2), 368504211026409. https://doi.org/10.1177/00368504211026409.

Rogers, E., Polonijo, A.N., Carpiano, R.M., 2016. Getting by with a little help from friends and colleagues: testing how residents' social support networks affect loneliness and burnout. Can. Fam. Physician 62 (11), e677–e683.

Rumas, R., Shamblaw, A.L., Jagtap, S., Best, M.W., 2021. Predictors and consequences of loneliness during the COVID-19 Pandemic. Psychiatr. Res. 300, 113934. https://doi.org/10.1016/j.psychres.2021.113934.

Segrin, C., Passalacqua, S.A., 2010. Functions of loneliness, social support, health behaviors, and stress in association with poor health. Health Commun. 25 (4), 312–322. https://doi.org/10.1080/10410231003773334.

Shah, S.G.S., Nogueras, D., van Woerden, H.C., Kiparoglou, V., 2020. The COVID-19 pandemic: a pandemic of lockdown loneliness and the role of digital technology. J. Med. Internet Res. 22 (11), e22287. https://doi.org/10.2196/22287.

Shankar, A., McMunn, A., Banks, J., Steptoe, A., 2011. Loneliness, social isolation, and behavioral and biological health indicators in older adults. Health Psychol. 30 (4), 377–385. https://doi.org/10.1037/a0022826.

Shaw, J.M., Brown, R.F., Dunn, S.M., 2013. A qualitative study of stress and coping responses in doctors breaking bad news. Patient Educ. Counsel. 91 (2), 243–248. https://doi.org/10.1016/j.pec.2012.11.006.

Shreffler, J., Petrey, J., Huecker, M., 2020. The impact of COVID-19 on healthcare worker wellness: a scoping review. West. J. Emerg. Med. 21 (5), 1059–1066. https://doi.org/10.5811/westjem.2020.7.48684.

Smith, B., Lim, M., 2020. How the COVID-19 pandemic is focusing attention on loneliness and social isolation. Public Health Res Pract 30 (2), e3022008. https://doi.org/10.17061/phrp3022008.

Speroni, K.G., Seibert, D.J., Mallinson, R.K., 2015. Nurses' perceptions on Ebola care in the United States, part 2: a qualitative analysis. J. Nurs. Adm. 45 (11), 544–550. https://doi.org/10.1097/nna.0000000000000261.

Stubbs, J.M., Achat, H.M., Schindeler, S., 2021. Detrimental changes to the health and well-being of healthcare workers in an Australian COVID-19 hospital. BMC Health Serv. Res. 21 (1), 1002. https://doi.org/10.1186/s12913-021-07013-y.

Sun, N., Wei, L., Shi, S., Jiao, D., Song, R., Ma, L., Wang, H., Wang, C., Wang, Z., You, Y., Liu, S., Wang, H., 2020. A qualitative study on the psychological experience of caregivers of COVID-19 patients. Am. J. Infect. Control 48 (6), 592–598. https://doi.org/10.1016/j.ajic.2020.03.018.

The Lancet, 2020. COVID-19: protecting health-care workers. Lancet 395 (10228), 922. https://doi.org/10.1016/S0140-6736(20)30644-9, 922.

Trinh, L.T.T., Stubbs, J.M., Gilroy, N., Schindeler, S., Achat, H.M., Under Review. Using the Experiences and Perceptions of Healthcare Workers to Improve the Healthcare Response to the COVID-19 Pandemic. Workplace Health & Safety.

Tutzer, F., Frajo-Apor, B., Pardeller, S., Plattner, B., Chernova, A., Haring, C., Holzner, B., Kemmler, G., Marksteiner, J., Miller, C., Schmidt, M., Sperner-Unterweger, B., Hofer, A., 2021. Psychological distress, loneliness, and boredom among the general population of Tyrol, Austria during the COVID-19 pandemic. Front. Psychiatr. 12, 691896. https://doi.org/10.3389/fpsyt.2021.691896.

Vera San Juan, N., Aceituno, D., Djellouli, N., Sumray, K., Regenold, N., Syversen, A., Symmons, S.M., Dowrick, A., Mitchinson, L., Singleton, G., Vindrola-Padros, C., 2020. Mental health and well-being of healthcare workers during the COVID-19 pandemic in the UK: contrasting guidelines with experiences in practice. BJPsych Open 7 (1), e15. https://doi.org/10.1192/bjo.2020.148.

Wang, J., Mann, F., Lloyd-Evans, B., Ma, R., Johnson, S., 2018. Associations between loneliness and perceived social support and outcomes of mental health problems: a systematic review. BMC Psychiatr. 18 (1), 156. https://doi.org/10.1186/s12888-018-1736-5.

Wang, Y., Ariyo, T., Liu, H., Ma, C., 2021. Does psychosocial support buffer the effect of COVID-19 related stressors on mental health among Chinese during quarantine? Curr. Psychol. 1–11. https://doi.org/10.1007/s12144-021-01663-1.