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General Hospital Psychiatry 71 (2021) 88–94

Contents lists available at ScienceDirect

General Hospital Psychiatry

journal homepage: www.elsevier.com/locate/genhospsych

Psychological impact of the COVID-19 pandemic on hospital workers over time: Relationship to occupational role, living with children and elders, and modifiable factors

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ARTICLE INFO

Keywords:
Healthcare workers
Covid-19
Burnout
Mental health
Occupational health
Nursing

ABSTRACT

Objective: The COVID-19 pandemic is expected to have a sustained psychological impact on healthcare workers. We assessed individual characteristics related to changes in emotional exhaustion and psychological distress over time.

Methods: A survey of diverse hospital staff measured emotional exhaustion (Maslach Burnout Inventory) and psychological distress (K6) in Fall 2020 (T_1) and Winter 2021 (T_2). Relationships between occupational, personal, and psychological variables were assessed using repeated measures ANOVA.

Results: Of 539 T_1 participants, 484 (89.9%) completed T_2. Emotional exhaustion differed by occupational role ($F = 7.3$, $p < .001$; greatest in nurses), with increases over time in those with children ($F = 8.5$, $p = .004$) or elders ($F = 4.0$, $p = .047$). Psychological distress was inversely related to pandemic self-efficacy ($F = 110.0$, $p < .001$), with increases over time in those with children ($F = 7.0$, $p = .008$). Severe emotional exhaustion occurred in 41.1% (95%CI 36.6–45.4) at T_1 and 49.8% (95%CI 45.4–54.2) at T_2 (McNemar test $p < .001$). Psychological distress occurred in 9.7% (95%CI 7.1–12.2) at T_1 and 11.6% (95%CI 8.8–14.4) at T_2 (McNemar test $p = .33$).

Conclusions: Healthcare workers' psychological burden is high and rising as the pandemic persists. Ongoing support is warranted, especially for nurses and those with children and elders at home. Modifiable protective factors, restorative sleep and self-efficacy, merit special attention.

1. Introduction

The stress of healthcare work during the COVID-19 pandemic adds to high pre-existing levels of burnout and psychological symptoms. Professional burnout in healthcare workers consists of emotional exhaustion, a sense of diminished personal connection to patients, and a diminished sense of personal accomplishment [1]. Prior to the pandemic, prevalence of severe emotional exhaustion was reported to range from 30% to as high as 50% in some settings [2–4]. The prevalence of depression and suicide was also higher than in the general population [5,6].

Occupational stressors in healthcare settings have potentially been amplified during the pandemic. These include working in circumstances of high-demand/low-control or high-effort/low-reward [7,8], shift work and long shifts [9,10], sleep deprivation [11], and challenges to work-life balance, including conflicts between work and home responsibilities [12]. Protective factors include social support and self-efficacy [13,14]. Self-efficacy is the belief in one's capacity to achieve specific performance goals, which is often induced and maintained by experiences of mastery [15]. Self-efficacy refers to specific goals (e.g. capacity to work in a hospital during a pandemic) rather than to a general self-appraisal. Higher self-efficacy is associated with lower occupational burnout in healthcare workers and in other professions [13].

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https://doi.org/10.1016/j.genhosppsych.2021.04.012
Received 8 March 2021; Received in revised form 28 April 2021; Accepted 30 April 2021
Available online 5 May 2021
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As of this writing, COVID-19 has infected over 148 million people and killed over 3 million worldwide, with over 1,000,000 cases and 24,000 deaths in Canada [16]. Healthcare workers reported high levels of distress early in the pandemic [17–19]. Ongoing stress may have effects that last for months or years afterwards [20]. In previous outbreaks, predictors of outcomes included the type of work done within the hospital, with greater impact documented in nurses, in those who worked in higher-risk areas, and in those who had greater exposure to infected patients [21,22].

In our work to provide peer support during COVID-19 [23], healthcare workers report the dual impact of stressors at work and at home, including social disconnection and isolation. Parents have felt strained by having school-age children at home with little warning due to unpredictable transitions between virtual and in-school teaching, classes dismissed because of new cases, and children staying home for isolation or testing when symptomatic. Further, healthcare workers providing care for elderly relatives, who are at the highest risk of serious illness and mortality [24], have noted strain and a reduction in support resources for seniors.

The purpose of this study is to use data collected from hospital-based healthcare workers in the fall of 2020 (prior to the peak of the second wave in Ontario, Canada) and in the winter of 2021 (immediately after a peak in cases) to assess the relationship of occupational roles, care for children and elders at home, sleep quality, and self-efficacy with respect to the occupational challenges of the pandemic, on changes in emotional exhaustion and psychological distress over this time.

2. Methods

A survey of the psychological well-being and experiences of a cohort of hospital staff, learners (nursing students, medical students, residents), and volunteers during the pandemic was conducted at two sites of Sinai Health (a general hospital and a rehabilitation hospital, with >6000 employed staff) in Toronto, Canada at two time-points. Invitations to participate were distributed through hospital communications and unit/department managers. The first survey (T_1) was conducted from Sept 21-Nov 15, 2020. During that interval, daily COVID-19 cases/100,000 rose in Toronto from 8.1 to 13.0 (peak: 17.1, Nov 9). Participants who provided data at T_1 were invited to participate in T_2. The T_2 survey interval, Jan 25-Feb 15 2021, followed a peak of 34.8 cases/100,000 on Jan 4 and occurred during a period of decreasing case rates from 17.3 to 7.9 [25]. The study was approved by the Sinai Health Research Ethics Board.

The first survey was open to all hospital employees, physicians, learners, volunteers, retail employees, and contractors, whether or not they had regular patient contact. All surveys were completed online using PHIPA-compliant software (Alchemer, Louiseville, CO). To facilitate randomization to a longer or shorter version of the survey (not reported here), the baseline survey was conducted in two phases (T_0 and T_1) spaced by about two weeks. The T_0 survey collected demographic data, personal circumstances including whether or not the participant lived with children under the age of 18 or adults over the age of 60, location and type of work, a checklist of COVID-19-related experiences, and an email address at which to receive the invitation link for subsequent surveys. The T_1 survey included the measures of emotional exhaustion, psychological distress, sleep quality, and pandemic self-efficacy. The T_2 survey used the same instruments to re-measure these constructs. Only emotional exhaustion and psychological distress at T_2 are included in this analysis.

Burnout was measured with the widely used Maslach Burnout Inventory (MBI), which includes scales for emotional exhaustion, depersonalization, and personal achievement [1]. When the MBI is used to define burnout categorically, researchers employ various definitions which depend on the choice of high or severe cut-off scores, and the choice of using the emotional exhaustion scale alone or various combinations of the three scales [26]. In order to allow comparison to a broad range of pre-pandemic studies in healthcare settings, we used the emotional exhaustion scale (9 items scored from 0 to 6, yielding a score from 0 to 54) for analysis as a continuous measure of burnout, and defined burnout categorically using a cut-off of ≥27 to indicate severe emotional exhaustion.

Psychological distress is a composite of depressive and anxiety symptoms which is measured dimensionally as an indicator of severity of common mental disorders [27] and with a validated cut-off as a screening test for likely mental disorder. Psychological distress was measured with the Kessler K6, which has 6 items scored from 0 to 4, yielding a range of 0–24 [27]. The K6 strongly discriminates between community cases and non-cases of psychiatric disorders diagnosed by structured interview [27] and has acceptable sensitivity and specificity [28]. A cut-off of ≥13 indicates likely serious mental illness [29].

Sleep quality was measured with a single item ("During the past 7 days, how would you rate your sleep quality overall?") rated on an 11-point visual analogue scale (0 "terrible" to 10 "excellent"). This measure has strong inverse correlations with validated multi-item measures of sleep quality, discriminates between groups whose sleep quality is known, and has adequate test-retest reliability [30].

Self-efficacy for COVID-19 prevention and control self-efficacy was measured with an instrument developed for the 2009 H1N1 pandemic, revised to change the instruction "How confident are you now that in the event of an influenza pandemic you will be able to…" by removing the word influenza. It has 23 items probing confidence in one's ability to meet pandemic-related challenges (e.g. "trust in the infection control procedures that are in place", "perform duties that are outside your usual job") scored on a 5-point scale, yielding a score from 23 to 115. In preparation for H1N1, self-efficacy scores measured with this scale increased after pandemic–related training [31]. In the current study internal reliability was high (Cronbach's alpha = 0.94).

A gift card (about US$15 value) was provided for each completed survey (T_0, T_1, T_2). One hundred and twenty-one respondents who completed the T_0/T_1 survey more than once (possibly to collect extra reward cards) were identified by duplication of email address and/or IP address, timing of survey, and response patterns and eliminated from both the dataset and the retention rate denominator.

2.1. Analysis

In order to identify hospital workers with different types of stressful exposure and different training and expertise, participants were sorted into categories of occupational role based on (i) professional qualifications (e.g, whether their job is regulated by a professional college) and (ii) close patient contact (within two metres of a patient for more than 15 min in the previous month). The four roles were nurses, other healthcare professionals, other clinical staff (non-professionals who reported close patient contact), and non-clinical roles. Nurses were analyzed separately based on evidence from the SARS outbreak that nurses experienced a greater burden of stress than other professionals [21,22].

Participant characteristics and COVID-19-related experiences were summarized using descriptive statistics. Continuous measures were summarized using means and standard deviations (SD). Categorical measures were summarized using counts and percentages. Occurrence of COVID-19-related experiences associated with greater exposure to risk, or to extraordinary job stresses (yes/no), were compared between job categories with differences tested using $\chi 2$ tests or Fisher's exact tests for low expected cell counts. Proportions of participants of each occupational role with high scores for psychological outcomes were calculated using validated cut-offs. Differences in proportions of high scores in the same group at two time-points were tested using the McNemar test.

Changes over time in emotional exhaustion and psychological distress by occupational role were analyzed using repeated measures ANOVA. We included as covariates pandemic self-efficacy at T_1 (divided into terciles), having children at home (none/any), having adults over

60 at home (none/any), and T_1 sleep quality (as a continuous measure). Because poor sleep quality can be understood as both a provocative factor for poor psychological outcomes and as a consequence of psychological distress which may vary over time, sleep quality was compared at T_1 and T_2 using paired *t*-tests which revealed no significant difference between timepoints (Cohen's d effect size 95% confidence interval −0.09–0.09). Prior to analysis, the covariates were assessed for multicollinearity (tolerance statistic < 0.4). Multicollinearity was not found to be a concern and therefore all variables were retained for the multivariable model. All analyses were done with IBS SPSS Statistics 27 (Armonk, New York).

3. Results

Eight-hundred and eighty-four respondents provided consent. Of these, 539 (61.0%) completed a T_1 survey to form the cohort for further follow-up. Respondents providing consent at T_0 who did not provide data at T_1 were more often male (25% vs 16% male, $\chi2 = 11.8$, $p = .003$), of lower education (35% vs 17% with less than a professional or graduate degree, $\chi2 = 37.3$, $p < .001$), and not healthcare professionals (55% vs 46% in non-professional role, $\chi2 = 6.6$, $p = .01$). The T_2 survey, including at least one of the emotional exhaustion or psychological distress scales, was completed by 484 participants (89.9% of the T_1 cohort). The median time between the T_1 and T_2 surveys was 125 days (interquartile range 15, from 111 to 126 days).

The characteristics of the cohort at T_1 are described in Table 1. The prevalence of COVID-19-related experiences in the month before the T_1 survey differed by occupational role. Healthcare professionals were more likely than non-professionals to have been in isolation for symptoms associated with COVID-19 (nurses 15.7%, other professionals 16.7%, other clinical positions 4.4%, non-clinical positions 8.2%; $\chi2 = 12.1$, $p = .007$), to have been tested for the virus (nurses 50.7%, other professionals 49.4%, other clinical positions 39.6%, non-clinical positions 29.1%; $\chi2 = 18.7$, $p < .001$), and to have been separated from family members that they usually live with because of the risk of contagion (nurses 15.7%, other professionals 7.7%, other clinical positions 7.7%, non-clinical positions 3.8%; $\chi2 = 13.5$, $p = .004$). Non-professionals with close patient contact were more likely to have worked as a screener (nurses 15.7%, other professionals 12.2%, other clinical positions 33.3%, non-clinical positions 18.4%; $\chi2 = 17.6$, $p = .001$) and to report a major change in work activities (nurses 11.2%, other professionals 20.5%, other clinical positions 25.3%, non-clinical positions 13.9%; $\chi2 = 10.0$, $p = .02$). Nurses were most likely to have been in a situation in which insufficient personal protective equipment (PPE) was available (nurses 20.9%, other professionals 5.1%, other clinical positions 8.8%, non-clinical positions 0.0%; $\chi2 = 45.0$, $p < .001$), to have experienced a breach in PPE (nurses 17.9%, other professionals 7.7%, other clinical positions 2.2%, non-clinical positions 0.0%; $\chi2 = 39.5$, $p < .001$), and to have not had enough time to don PPE and provided patient care nonetheless (nurses 14.2%, other professionals 3.8%, other clinical positions 1.1%, non-clinical positions 0.0%; $\chi2 = 36.6$, $p < .001$).

Mean levels of emotional exhaustion by occupational role were: nurses (T_1: 28.9 [SD 12.4], T_2: 32.6 [SD 12.6]); other professionals (T_1: 24.1 [SD 11.8], T_2: 28.2 [SD 11.9]); other clinical staff (T_1: 24.8 [SD 13.0], T_2: 25.0 [SD12.7]); and non-clinical staff (T_1: 22.2 [SD 11.2], T_2: 24.0 [SD 12.3]). The statistically significant relationships between personal and occupational characteristics and emotional exhaustion at T_1 and T_2 (identified in Table 2) are illustrated in Fig. 1. Specifically, emotional exhaustion varied by occupational role (highest in nurses, lowest in non-clinical roles), and was greater in those with low pandemic self-efficacy and those with poor sleep quality at T_1. The rate of increase in emotional exhaustion from T_1 to T_2 was greatest in nurses and other healthcare professionals, and in participants with children or elders at home.

Mean levels of psychological distress by occupational role were: nurses (T_1: 7.4 [SD 4.0], T_2: 8.5 [SD 4.2]); other professionals (T_1: 5.4 [SD 3.6], T_2: 6.0 [SD 4.0]); other clinical staff (T_1: 6.6 [SD 5.3], T_2: 6.9 [SD 5.1]); and non-clinical staff (T_1: 6.6 [SD 4.2], T_2: 6.9 [SD 4.3]). The statistically significant relationships between personal and occupational characteristics and psychological distress at T_1 and T_2 (identified in Table 2) are illustrated in Fig. 2. Psychological distress increased overall from T_1 to T_2. Participants with children at home had a greater increase from T_1 to T_2 (Fig. 2a). Participants with lower T_1 sleep quality had higher overall levels of distress and a greater increase from T_1 to T_2 (Fig. 2b). Psychological distress was strongly and inversely related to pandemic self-efficacy (Fig. 2c).

Table 1
Characteristics of 539 participants at T_1.

		N (%)
Role type[a]	Nursing	134 (24.9)
	Other clinical professionals	156 (28.9)
	Other clinical positions	91(16.9)
	Non-clinical position	158 (29.3)
Age (missing 5)	18–30	174 (32.3)
	31–40	143 (26.5)
	41–50	121 (22.4)
	Over 50	96 (17.8)
Gender (missing 1)	Female	422 (78.3)
	Male	86 (16.0)
	Other/prefer not to say	30 (5.6)
Education	High school or less	13 (2.4)
	College diploma	79 (14.7)
	Undergraduate degree	176 (32.7)
	Professional or graduate degree	271 (50.3)
Race/ethnicity (missing 1)	African/black	30 (5.6)
	Asian	149 (27.6)
	East Indian	35 (6.5)
	European/white	278 (51.6)
	Hispanic	15 (2.8)
	Other	31 (5.8)
Marital status	Married/common-law	307 (57.0)
	Single	211 (39.1)
	Divorced/separated/ widowed	21 (3.9)
Children under 18 living at home (missing 3)	None	355 (65.9)
	Any	181 (33.6)
Adults over 60 living at home (missing 8)	None	412 (76.4)
	Any	119 (22.1)

Other clinical professionals: Physician, resident, dietician, occupational therapist, social worker, physiotherapist, manager of clinical area, speech language pathologist, pharmacist, respiratory therapist, spiritual care practitioner.
Other clinical positions: Administrative assistant, medical imaging technologist, assistant to physician/occupational therapist/physiotherapist, retail employee, porter, clinical research staff, volunteer.
Non-clinical positions: Research scientist, research staff, laboratory technician, corporate and administrative staff, administrative assistant, volunteer, manager of non-clinical area, building services staff, clerk, laboratory technologist, housekeeper.
[a] Specific job types, in descending order of number of participants. Groups with two or fewer members not listed. Some roles appear in both clinical and non-clinical lists as determined by patient contact as described by participant.

Table 2
Repeated measures analysis of variance in psychological outcomes at two time points.

	Emotional exhaustion		Psychological distress	
	F	P	F	p
Time	0.1	0.8	4.1	0.046
Role	7.3	<0.001	1.9	0.1
Role × Time	3.8	0.01	1.0	0.4
Pandemic Self-Efficacy (PSE)	79.8	<0.001	110.0	<0.001
PSE × Time	0.4	0.6	0.3	0.6
Child at home	0.5	0.5	10.0	0.002
Child at home × Time	8.5	0.004	7.0	0.008
Elderly adult at home	0.0	1.0	0.1	0.8
Elderly adult at home × Time	4.0	0.047	0.3	0.6
Sleep quality	35.3	<0.001	36.4	<0.001
Sleep quality × Time	3.0	0.09	77.7	<0.001

In order to aid interpretation, the proportion of survey participants whose scores indicated severe emotional exhaustion was 41.1% (95%CI 36.6–45.4) at T_1 and 49.8% (95%CI 45.4–54.2) at T_2 (McNemar test $p <$ .001). Prevalence of severe emotional exhaustion by occupational role was: nurses, 54.3% at T_1 (95%CI 45.9–62.7), 62.9% at T_2 (95%CI 54.7–71.1); other healthcare professionals, 42.2% at T_1 (95%CI 34.4–50.0), 55.6% at T_2 (95%CI 47.8–63.4); clinical non-professionals, 38.4% at T_1 (95%CI 28.4–48.4), 44.2% at T_2 (95%CI 34.0–54.4); and non-clinical participants, 31.7% at T_1 (95%CI 24.5–38.9), 37.9% at T_2 (95%CI 30.4–45.4). The proportion of survey participants whose psychological distress scores indicated likely mental illness was 9.7% (95% CI 7.1–12.2) at T_1 and 11.6% (95%CI 8.8–14.4) at T_2 (McNemar test $p =$ .33).

4. Discussion

There have been few reports of the psychological impact of the pandemic on healthcare workers at multiple time points [32], and this is the first that reports on the pandemic's second wave, to our knowledge. The value of this report is (i) to document levels of psychological distress and emotional exhaustion which are unsurprising but alarming (ii) to identify trends in these variables over time, (iii) to identify the groups of healthcare workers who are at greatest risk, and (iv) to identify potentially modifiable correlates of psychological distress and emotional exhaustion.

Prior to the pandemic, rates of severe emotional exhaustion in healthcare professionals were already high, typically reported in the range of 30% to 50%, with the highest rates in specialized settings such as critical care [2–4]. In the early months of the pandemic, rates of severe emotional exhaustion in healthcare settings ranged from 30 to 42% [18,19,33]. In this context, rates of severe emotional exhaustion in nurses of 54.3% in the fall of 2020, rising to 62.0% in early 2021 (and of 42.2% rising to 55.6% in other healthcare professionals) are both consistent with prior evidence and concerning. Despite fewer comparators for hospital staff who are not healthcare professionals, rates of severe emotional exhaustion above 30% at each measurement point also merit attention.

Rates of high psychological distress indicate likely mental illness [29]. For comparison to the rates found in this study (9.7% at T_1 and 11.6% at T_2), a study of over 60,000 employees of 58 large corporations found the prevalence of high K6 scores to be 4.5% [34], whereas a study of representative households directly impacted by Hurricane Katrina found a prevalence of high K6 scores of 10.9% 5–7 months after the hurricane and 14.0% one year later [35]. Thus, the range found in this study is similar to that found after a severe natural disaster.

Reports from other healthcare settings will provide context for these findings when they are available. Several factors suggest the impact might be higher elsewhere: (i) downtown Toronto has experienced a lesser impact of COVID-19 hospitalizations than other cities, (ii) the site of this study has implemented an extensive program of peer support for staff since early in the pandemic [23], and (iii) was recently re-designated with Magnet™ status from the American Nursing Credentialing Centre for having a professional work environment that yields positive outcomes for the nursing profession and excellence in patient care [36].

Although it is concerning that healthcare workers' burnout and psychological distress appear to be high and rising during the pandemic, it remains to be seen what the long-term psychological impact of the pandemic will be in this setting. On one hand, there is much evidence that the most common long-term response to exposure to highly aversive events is resilience [37]. On the other hand, evidence from longitudinal follow-up of healthcare workers in hospitals affected by the 2003 SARS outbreak, a much less severe and prolonged stressor than the COVID-19 pandemic at a societal level, demonstrated persistent meaningful effects of chronic stress 18 to 24 months after the resolution of the outbreak, including elevated burnout, psychological distress, posttraumatic stress symptoms, self-reported sick days, and self-reported decreases in patient contact and work hours [20]. Prospective, longitudinal research measuring a wide range of contextual protective and risk factors as the pandemic continues and resolves is needed to determine the prevalence of outcomes from chronic psychopathology to recovery and resilience and the contextual factors that favor different outcomes [37].

Increasing burnout and psychological distress associated with the ongoing pandemic emphasize the importance of identifying provocative and protective factors. In this study, significant correlations identify candidate provocative factors, extraordinary stresses related to caring for children and elders, and disrupted sleep, and a protective factor, self-efficacy. This study indicates that the challenge of balancing the extraordinary demands of parenting with hospital work contributes to the impact of stress, leading to increasing emotional exhaustion and psychological distress over time. The impact of parenting on outcomes was also observed in previous outbreaks [21]. Efforts to support work-home balance through flexible hours, support for daycare, or other supports for parents might mitigate this impact. This study also validates the impression that having elders at home during the COVID-19 pandemic has contributed to increases in healthcare workers' burnout and psychological distress. Flexibility and support for healthcare workers' who are challenged to balance work and home responsibilities should extend beyond those with parenting responsibilities.

The effect of pandemic self-efficacy, which was the strongest correlate of both psychological outcomes, is important because self-efficacy is modifiable through training in relevant tasks, role-modeling, and possibly organizational leadership [31,38–40]. The relationship of sleep quality with psychological outcomes was also substantial. This relationship may be bidirectional as it is consistent with both the known deleterious effects of nonrestorative sleep on professional burnout [41] and the sleep-disrupting effects of common psychiatric illnesses. Education about sleep hygiene, as well as organizational attention to the impact of shift work and shift length on sleep may support resilience, although this requires further research since the direction of causality cannot be determined in the current study.

This study's strengths include its use of validated measures of burnout and psychological distress at two time-points, relatively large sample size, high retention rate from T_1 to T_2, and representation of a wide variety of hospital roles. It also has limitations. The survey did not use a sampling strategy that ensures a representative population of hospital staff and the loss of 39% of consenting staff with demonstrated biases among drop-outs towards male gender, lower education and non-professional status indicates that non-represented staff differ from those who chose to participate. The survey question about having children under 18 at home did not distinguish between pre-school, elementary school-age children, and teenagers, which may affect pandemic-related parenting stresses. The survey question about having adults over 60 at home did not distinguish between elders who do or do not need care, or those who are able to help with childcare or other household activities.

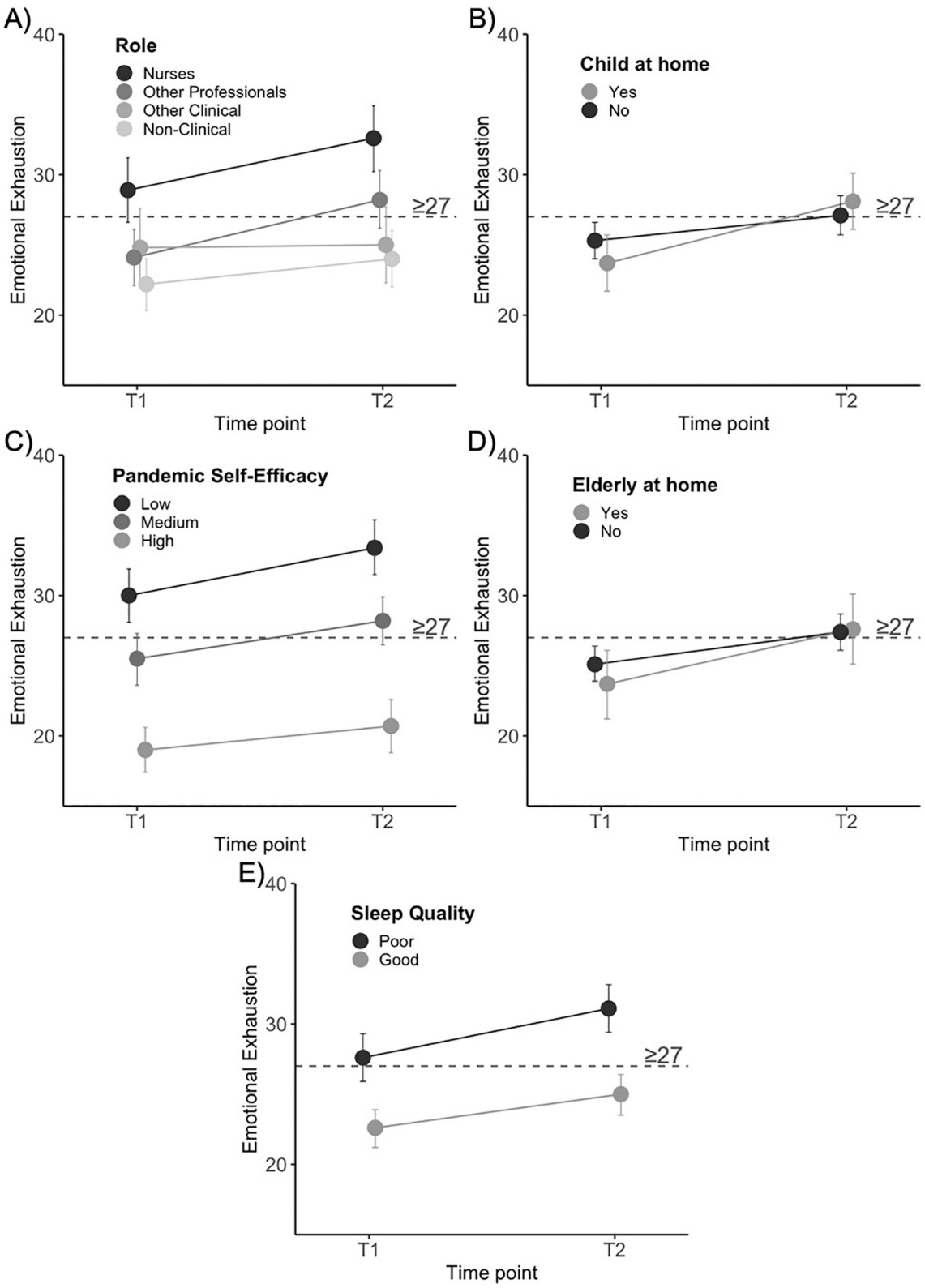

Fig. 1. Significant relationships between emotional exhaustion in September–November 2020 (T_1) and January–February 2021 (T_2) and occupational or personal variables (as reported at T_1).
The cut-off for severe burnout (≥27), measured using the emotional exhaustion scale of the Maslach Burnout Inventory, is indicated by a dashed line on each panel.

Further research to understand these aspects of personal circumstances is justified. The study is also limited by having not measured income or other factors that have resulted in greater impact of COVID-19 in marginalized communities.

Working in healthcare during the COVID-19 pandemic is contributing to both burnout and psychological distress for hospital workers and the psychological burden is rising as the pandemic persists. Our results indicate that the challenge is greater for healthcare workers with

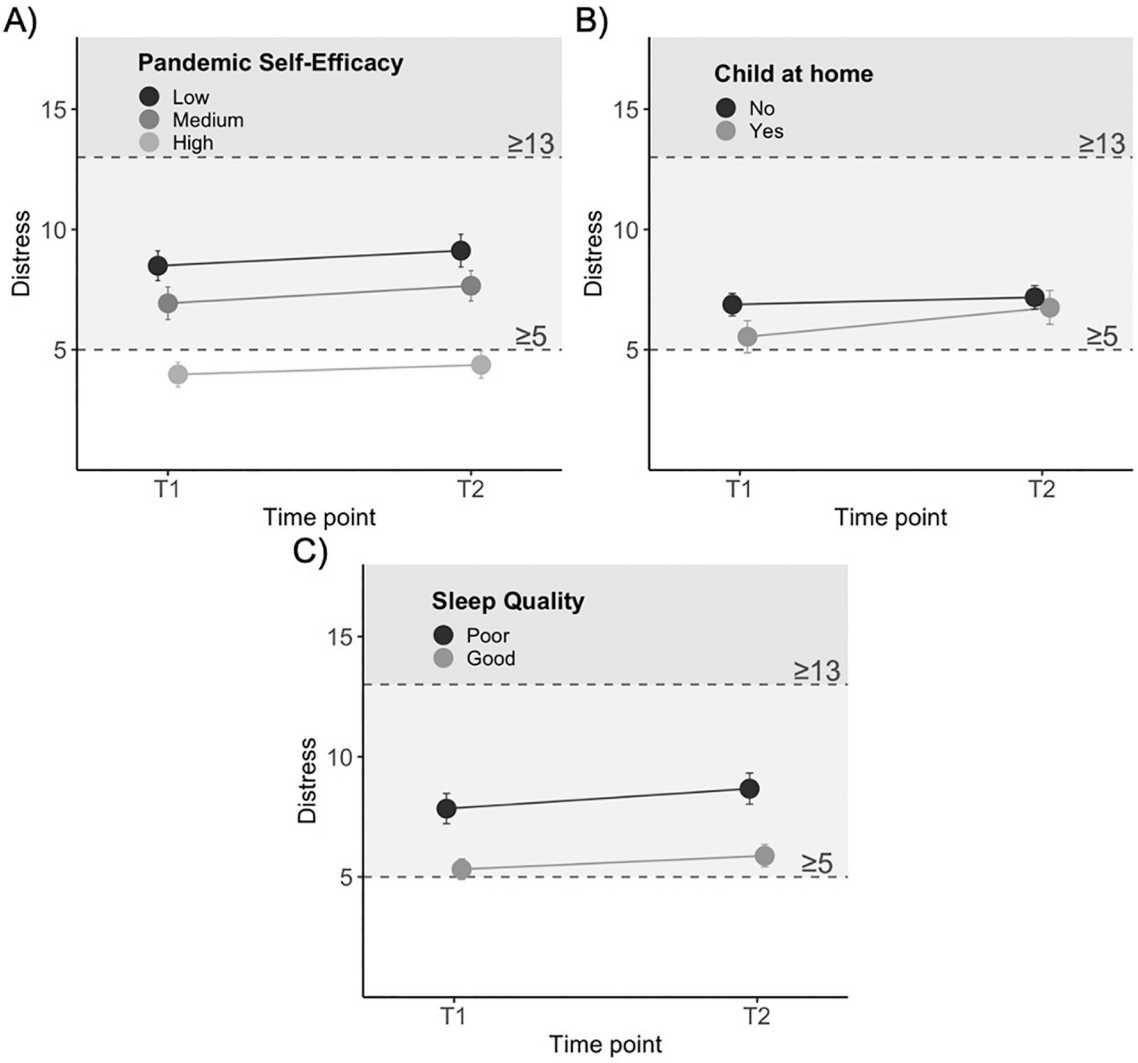

Fig. 2. Significant relationships between psychological distress in September–November 2020 (T_1) and January–February 2021 (T_2) and occupational or personal variables (as reported at T_1).
The cut-off for severe psychological distress (≥13), as measured by the Kessler K6, is indicated by a dashed line and darker shaded region on each panel. The cut-off for medium distress ($5 \leq K6 < 13$) is indicated by a dashed line and a lighter shaded region on each panel.

children and elders at home and is greatest in nurses. Substantive efforts to provide ongoing support to healthcare workers at both an organizational and individual level are needed. Further assessment of the psychological impact of this work over time is required to determine the long-term impact of the pandemic on healthcare providers.

Funding

This work was funded by a CIHR Canadian 2019 Novel Coronavirus (COVID-19) Rapid Research Grant (FRN 170642).

Declaration of Competing Interest

The authors of this paper have no competing interests to declare.

Acknowledgements

The authors gratefully acknowledge the contributions of Dr. Allison McGeer, Kate Wilkinson, and Jane Merkley to this work.

References

[1] Maslach C, Jackson SE, Leitner MP. Maslach burnout inventory: third edition. In: Zalaquett CP, Woods RJ, editors. Evaluating stress: a book of resources. Lanham, MD: Scarecrow Press; 1997. p. 191–218.
[2] Shanafelt TD, Dyrbye LN, Sinsky C, Hasan O, Satele D, Sloan J, et al. Relationship between clerical burden and characteristics of the electronic environment with physician burnout and professional satisfaction. Mayo Clin Proc 2016;91(7):836–48.
[3] Embriaco N, Papazian L, Kentish-Barnes N, Pochard F, Azoulay E. Burnout syndrome among critical care healthcare workers. Curr Opin Crit Care 2007;13(5):482–8.
[4] Gomez-Urquiza JL, De la Fuente-Solana EI, Albendin-Garcia L, Vargas-Pecino C, Ortega-Campos EM, Canadas-De la Fuente GA. Prevalence of burnout syndrome in emergency nurses: a meta-analysis. Crit Care Nurse 2017;37(5):e1–9.
[5] Mata DA, Ramos MA, Bansal N, Khan R, Guille C, Di Angelantonio E, et al. Prevalence of depression and depressive symptoms among resident physicians: a systematic review and meta-analysis. JAMA 2015;314(22):2373–83.
[6] Dutheil F, Aubert C, Pereira B, Dambrun M, Moustafa F, Mermillod M, et al. Suicide among physicians and health-care workers: a systematic review and meta-analysis. PLoS One 2019;14(12):e0226361.
[7] Padilla Fortunatti C, Palmeiro-Silva YK. Effort-reward imbalance and burnout among ICU nursing staff: a cross-sectional study. Nurs Res 2017;66(5):410–6.
[8] Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012;380(9859):2197–223.

[9] Portoghese I, Galletta M, Coppola RC, Finco G, Campagna M. Burnout and workload among health care workers: the moderating role of job control. Saf Health Work 2014;5(3):152–7.
[10] Wisetborisut A, Angkurawaranon C, Jiraporncharoen W, Uaphanthasath R, Wiwatanadate P. Shift work and burnout among health care workers. Occup Med (Lond) 2014;64(4):279–86.
[11] Soderstrom M, Jeding K, Ekstedt M, Perski A, Akerstedt T. Insufficient sleep predicts clinical burnout. J Occup Health Psychol 2012;17(2):175–83.
[12] Shanafelt TD, Sloan JA, Habermann TM. The well-being of physicians. Am J Med 2003;114(6):513–9.
[13] Shoji K, Cieslak R, Smoktunowicz E, Rogala A, Benight CC, Luszczynska A. Associations between job burnout and self-efficacy: a meta-analysis. Anxiety Stress Coping 2016;29(4):367–86.
[14] Maunder RG, Lancee WJ, Rourke S, Hunter JJ, Goldbloom D, Balderson K, et al. Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other hospital workers in Toronto. Psychosom Med 2004;66(6):938–42.
[15] Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychol Rev 1977;84:191–215.
[16] Worldometer. Coronavirus update (live). Available from: https://www.worldometers.info/coronavirus/; 2021.
[17] Luceno-Moreno L, Talavera-Velasco B, Garcia-Albuerne Y, Martin-Garcia J. 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(15).
[18] Naldi A, Vallelonga F, Di Liberto A, Cavallo R, Agnesone M, Gonella M, et al. COVID-19 pandemic-related anxiety, distress and burnout: prevalence and associated factors in healthcare workers of North-West Italy. BJPsych Open 2021;7(1):e27.
[19] Orru G, Marzetti F, Conversano C, Vagheggini G, Miccoli M, Ciacchini R, et al. Secondary traumatic stress and burnout in healthcare workers during COVID-19 outbreak. Int J Environ Res Public Health 2021;18(1).
[20] Maunder RG, Lancee WJ, Balderson KE, Bennett JP, Borgundvaag B, Evans S, et al. Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. Emerg Infect Dis 2006;12:1924–32.
[21] Kisely S, Warren N, McMahon L, Dalais C, Henry I, Siskind D. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. BMJ 2020;369:m1642.
[22] Brooks SK, Dunn R, Amlot R, Rubin GJ, Greenberg N. A systematic, thematic review of social and occupational factors associated with psychological outcomes in healthcare employees during an infectious disease outbreak. J Occup Environ Med 2018;60(3):248–57.
[23] Rosen B, Preisman M, Hunter J, Maunder R. Applying psychotherapeutic principles to bolster resilience among health care workers during the COVID-19 pandemic. Am J Psychother 2020;73(4):144–8.
[24] Nabors C, Sridhar A, Hooda U, Lobo SA, Levine A, Frishman WH, et al. Characteristics and outcomes of patients 80 years and older hospitalized with coronavirus disease 2019 (COVID-19). Cardiol Rev 2021;29(1):39–42.
[25] Public Health Ontario. ontario COVID-19 data tool. Available from: https://www.publichealthontario.ca/en/data-and-analysis/infectious-disease/covid-19-data-surveillance/covid-19-data-tool?tab=trends; 2021.
[26] Rotenstein LS, Torre M, Ramos MA, Rosales RC, Guille C, Sen S, et al. Prevalence of burnout among physicians: a systematic review. JAMA 2018;320(11):1131–50.
[27] Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 2002;32(6):959–76.
[28] Staples LG, Dear BF, Gandy M, Fogliati V, Fogliati R, Karin E, et al. Psychometric properties and clinical utility of brief measures of depression, anxiety, and general distress: the PHQ-2, GAD-2, and K-6. Gen Hosp Psychiatry 2019;56:13–8.
[29] Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry 2003;60(2):184–9.
[30] Snyder E, Cai B, DeMuro C, Morrison MF, Ball W. A new single-item sleep quality scale: results of psychometric evaluation in patients with chronic primary insomnia and depression. J Clin Sleep Med 2018;14(11):1849–57.
[31] Maunder RG, Lancee WJ, Mae R, Vincent L, Peladeau N, Beduz MA, et al. Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. BMC Health Serv Res 2010;10:72.
[32] Hines SE, Chin KH, Glick DR, Wickwire EM. Trends in moral injury, distress, and resilience factors among healthcare workers at the beginning of the COVID-19 pandemic. Int J Environ Res Public Health 2021;18(2).
[33] Giusti EM, Pedroli E, D'Aniello GE, Stramba Badiale C, Pietrabissa G, Manna C, et al. The psychological impact of the COVID-19 outbreak on health professionals: a cross-sectional study. Front Psychol 2020;11:1684.
[34] Hilton MF, Whiteford HA, Sheridan JS, Cleary CM, Chant DC, Wang PS, et al. The prevalence of psychological distress in employees and associated occupational risk factors. J Occup Environ Med 2008;50(7):746–57.
[35] Kessler RC, Galea S, Gruber MJ, Sampson NA, Ursano RJ, Wessely S. Trends in mental illness and suicidality after Hurricane Katrina. Mol Psychiatry 2008;13(4):374–84.
[36] Stone L, Arneil M, Coventry L, Casey V, Moss S, Cavadino A, et al. Benchmarking nurse outcomes in Australian Magnet(R) hospitals: cross-sectional survey. BMC Nurs 2019;18:62.
[37] Chen S, Bonanno GA. Psychological adjustment during the global outbreak of COVID-19: a resilience perspective. Psychol Trauma 2020;12(S1):S51–4.
[38] Bartimote-Aufflick K, Bridgeman A, Walker R, Sharma M, Smith L. The study, evaluation, and improvement of university student self-efficacy. Stud High Educ 2016;41(11):1918–42.
[39] Heslin PA, Klehe U. Self-efficacy. In: Rogelberg SG, editor. Encyclopedia of industrial/organizational psychology. 2. Thousand Oaks: Sage; 2006. p. 705–8.
[40] Slatten T. Determinants and effects of employee's creative self-efficacy on innovative activities. Int J Qual Serv Sci 2014;6(4):326–47.
[41] Weaver MD, Robbins R, Quan SF, O'Brien CS, Viyaran NC, Czeisler CA, et al. Association of sleep disorders with physician burnout. JAMA Netw Open 2020;3(10):e2023256.