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CLINICAL RESEARCH ARTICLE

Impact of COVID-19 pandemic on pediatric healthcare burnout in acute care: a longitudinal study

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BACKGROUND: COVID-19 pandemic introduced significant challenges that may have exacerbated healthcare worker (HCW) burnout. To date, assessments of burnout during COVID-19 pandemic have been cross-sectional, limiting our understanding of changes in burnout. This longitudinal study assessed change across time in pediatric HCW burnout during the COVID-19 pandemic and whether demographic and psychological factors were associated with changes in burnout.

METHODS: This longitudinal study included 162 physicians, physician assistants, nurses, and medical technicians within the emergency department (ED), intensive care, perioperative, and inter-hospital transport services in a children's hospital. HCW demographics, anxiety and personality traits were reported via validated measures. HCWs completed the Maslach Burnout Inventory in April 2020 and March 2021. Data were analyzed using generalized estimating equations.

RESULTS: The percentage of HCWs reporting high emotional exhaustion and/or depersonalization burnout increased significantly across time (18.5% to 28.4%, $P = 0.010$). Factors associated with increased emotional exhaustion included working in the ED ($P = 0.011$) or perioperative department ($P < 0.001$), being a nurse or medical technician ($P's < 0.001$), not having children ($P < 0.001$), and low conscientiousness ($P < 0.001$).

CONCLUSIONS: Pediatric HCW burnout significantly increased over 11-months of the COVID-19 pandemic. Results suggest that certain demographic and psychological factors may represent potential area to target for intervention for future pandemics.

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IMPACT:

- This longitudinal study revealed that the COVID-19 pandemic has had a significant impact on pediatric healthcare worker burnout.
- The percentage of healthcare workers reporting high levels of emotional exhaustion and depersonalization burnout increased significantly over 11-months of the COVID-19 pandemic.
- Results suggest that certain demographic and psychological factors may represent potential targets for future interventions.

INTRODUCTION

Burnout in healthcare is a growing concern with current data estimating that 30–70% of healthcare providers experience burnout.[1–4] Prevalence of burnout is similar in pediatric care settings, with data indicating that 20–67% of pediatric healthcare workers (HCWs), including physicians, nurses, and support staff report experiencing burnout.[1,4–8] According to the multidimensional theory of burnout, burnout is an individual experience of work- or care-related stress that occurs within a social context and has three components: emotional exhaustion, an impersonal attitude, and a decreased sense of personal competence.[9] HCW burnout can result in a host of negative professional and personal consequences including poor clinical care, patient satisfaction, and HCW mental and physical health.[2,10–15] Previous work has

collectively identified certain demographic (younger age, female, unmarried), occupational (less experience, high-acuity setting, workload), professional role (nurses, technicians), and psychological (anxiety, depression) factors associated with higher levels of burnout.[3,4,8,15–17]

The COVID-19 pandemic has introduced significant clinical care and personal safety challenges that may exacerbate levels of burnout in HCWs.[18] A recent review on physician psychological symptoms during infectious disease outbreaks, including COVID-19, reported burnout prevalence rates up to 75%.[19] Results from cross-sectional studies assessing burnout during COVID-19 specifically indicate that United States HCWs may be experiencing higher levels of burnout compared to those in other countrie,[20–22] and data suggest that social isolation, work experience, and

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contact with COVID-19 patients may be associated with higher levels of burnout.[22–26]

To date, limited longitudinal data exist on burnout HCW during the COVID-19 pandemic and most of the existing data were collected early in the first year of the pandemic. Longitudinal assessments of burnout may help us better understand the impact of the pandemic on HCWs and, importantly, identify risk and protective factors associated with burnout trajectory.

The objective of the current study was to conduct a longitudinal assessment of burnout among pediatric HCWs from April 2020 to March 2021. We aimed to assess whether there was a change in pediatric HCW burnout over an eleven-month period during the COVID-19 pandemic and identify demographic and psychological factors associated with change in burnout. Informed by the multidimensional theory of burnout and by previous results from cross-sectional studies of HCW burnout, we hypothesized that years of experience,[5,15] parental status,[3] anxiety,[19,22] and conscientious[27] and neuroticism personality characteristics[27,28] would be associated with changes in burnout.

METHODS
Design/Participants
The current study employed a longitudinal, observational study design to assess change in burnout during the COVID-19 pandemic. The study included a convenience sample of HCWs enrolled in a larger longitudinal study[29,30] assessing COVID-19 antibody seroprevalence in HCWs at a quaternary care pediatric hospital in Orange, California USA. Participants of the study included attending physicians, physician assistants (PAs), nurse practitioners (NPs), registered nurses (RNs), and medical technicians with direct patient contact in the emergency department (ED), pediatric intensive care unit, perioperative services, and the inter-hospital transport services teams. Results of this the larger seroprevalence study were previously reported elsewhere.[29,30] This present analysis focuses only on a sub-sample of HCWs who were given and completed burnout measures on April 2020 (Time 1) and March 2021 (Time 2). Results included in this report were not published previously.

Measures
Demographics and occupation. A demographics questionnaire assessed HCWs self-reported age, sex, race, marital status, number of children, job position, and years of experience (post-training).

Personality. The Big Five Inventory[31] assessed the 'Big Five' dimensions of personality: openness (sample $\alpha = 0.66$), conscientiousness (sample $\alpha = 0.69$), extraversion (sample $\alpha = 0.762$), agreeableness (sample $\alpha = 0.77$), and neuroticism (sample $\alpha = 0.78$). This 44-item measure is widely used to assess personality, has demonstrated reliability and validity across large international adult samples, and has been used in health care worker samples.[27,32,33] The personality dimension subscale average scores were used for analyses.

Anxiety. HCW trait anxiety was assessed via the State-Trait Anxiety Inventory (STAI), which is a 20- item self-report measure used to assess adult general (trait) anxiety. The STAI is considered a gold standard measurement for anxiety, demonstrating good reliability and validity in diverse adult samples and health care workers.[34–38] A cut-off score of 40[39] has been utilized to detect clinically significant symptoms of anxiety. The total and cut-off scores were used in analyses ($\alpha = 0.87$).

Primary outcome
Burnout. Maslach Burnout Inventory – Human Services Survey (MBI-HSS)[11] is the most widely accepted measure for the assessment of burnout in health care workers and has demonstrated validity across international samples of health care workers.[40–43] This measure assesses three dimensions of burnout in healthcare service workers: emotional exhaustion (i.e., feelings of being emotionally overextended by one's work), depersonalization (i.e., an impersonal response to one's service or responsibilities), and personal accomplishment (i.e., feelings of competence and successful achievement in one's work with people) dimensions of burnout. Each of the 22 items are rated on a seven-point Likert-type scale ranging from *never* to *everyday*. Higher emotional exhaustion and

depersonalization scores reflect higher burnout within those dimensions whereas lower personal accomplishment scores reflect higher burnout within the personal accomplishment burnout dimension. The MBI-HSS authors recommend utilizing continuous total scores for each burnout dimension when examining predictors or outcomes of burnout, but *low, moderate* and *high* population norms can be used to characterize levels of burnout across samples.[11,44,45] This study utilized both the continuous total emotional exhaustion, depersonalization, and personal accomplishment scores and characterized burnout dimension scores into *low, moderate,* and *high* levels based on published norms.[11] Sample Cronbach's alphas for Emotional Exhaustion, Depersonalization and Personal Accomplishment were 0.89, 0.71, and 0.80, respectively.

Procedures
Study data were collected during the spring of 2020 (April–May; Time 1) and in March 2021 (Time 2) as part of a larger study examining seroprevalence of SARS-CoV-2 in HCWs.[29,30] HCWs were recruited via department-wide emails and interested HCWs completed informed consent. At Time 1, selected participants completed demographics and the first burnout assessment. At Time 2, those participants completed the second burnout assessment and personality and anxiety questionnaires. Participant questionnaires were administered via REDCap. Ethical approval for all study procedures was obtained from the Children's Hospital of Orange County Institutional Review Board (# 200452).

Data analyses
Study participants were described by percentage with defined trait for categorical and by mean (SD) for continuous factors. Burnout outcomes were described by mean (SD) and categorically (percent low, moderate, and high) at Time 1 and Time 2. Based on normative data,[11] the interpretation of the total subscale scores are as follows: emotional exhaustion low 0–16, moderate 17–26, high 27–54; depersonalization low 0–6, moderate 7–12, high 13–35; personal accomplishment (lower scores reflect higher burnout) low 0–31, moderate 32–38, high 39–48. To aide in the comparison of current sample burnout levels to other health care provider samples,[3,46,47] categorical burnout data for those that endorsed high emotional exhaustion and/or depersonalization burnout are also reported. When <10% of items were missing on any measure subscale, the value was imputed based on mean of remaining items. Imputation was required in less than 5% ($n = 6$) of participants. Generalized estimating equations (GEE) analyses with specification of repeat measures and exchangeable correlation structure assessed significance of change across time in burnout scale scores. In the GEE analyses, distribution specification was determined by parameterization of outcome (binomial, ordinal, or linear). For burnout subscales that demonstrated a significant change from Time 1 to Time 2, bivariate analyses examined whether change in average burnout scale scores were associated with HCW demographics and occupational and psychological characteristics. Multivariate analyses were used to model the composite of risk and protective factors that contributed to change in burnout using a stepwise procedure. Each factor and interaction with time was stepped into the multivariate model in order of significance in the bivariate examination. Factors were retained in the final model when their interaction with time was significant at the 0.05 level. The study sample size of 162 participants provided 99.0% power to detect the average difference of 3.3 points (SD = 9.7) in our primary outcome of pediatric HCW's burnout from emotional exhaustion at the 0.05 level of significance. Analyses were conducted using SPSS Statistics for Windows, Version 27.0. Armonk, NY:IBM Corp.

RESULTS
A total of 863-institution wide HCWs were emailed about the study and enrollment was discontinued at 382 due to availability of testing resources for the larger seroprevalence study.[29,30] Out of the 382 participants that completed study measures at Time 1 (T1), 162 (42.4%) completed measures at Time 2 (T2). Sample demographics and descriptive statistics for participants that completed measures at T1 and T2 are presented in Table 1. It is important to note that T1 emotional exhaustion ($t = -0.77$, $P > 0.05$) and depersonalization burnout ($t = -1.34$, $P > 0.05$) did not significantly differ between the HCWs who completed only T1 and the HCWs who completed T1 and T2.

Table 1. Healthcare worker demographic characteristics (N = 162).

	N (%)	Mean (SD)
Age (years)		
≤30	44 (27.2%)	
31–40	53 (32.7%)	
41–50	40 (24.7%)	
>50	25 (15.4%)	
Sex (Female)	115 (71.0%)	
Race		
Asian	24 (14.8%)	
Hispanic	20 (12.3%)	
White	112 (61.1%)	
Multi-Racial/ Other	6 (3.7%)	
Marital Status (Married)	107 (66.0%)	
Children (Yes)	78 (65.0%)	
Department		
Emergency Department	87 (53.7%)	
Intensive Care Unit	31 (19.1%)	
Perioperative	36 (22.2%)	
Transport	8 (4.9%)	
Position		
Nurse (RN)	85 (52.5%)	
Nurse Practitioner/ Physician Assistant	11 (6.8%)	
Physician (MD)	36 (22.2%)	
Medical Technician[a]	30 (18.5%)	
Years of experience (median (IQR))		12.2 (6.0, 20.0)
Big Five Personality Domains (Score ≥ 4)[b]		
Extraversion	88 (54.3%)	3.5 (0.8)
Agreeableness	135 (83.3%)	4.2 (0.6)
Conscientiousness	132 (81.5%)	4.0 (0.6)
Neuroticism/Negative Emotionality	10 (6.2%)	2.2 (0.8)
Openness	113 (69.8%)	3.7 (0.6)
Trait Anxiety (Total Score > 40)[b]	70 (43.2%)	39.7 (7.9)

[a]Medical Technician' included specialty technicians, medical assistants, transport staff, and administrative support.
[b]Personality domain item agreement score ranges from 1 to 5 with higher scores suggesting attitude more aligned with domain; agree or strongly agree, score ≥4; [b]Scores >40 indicate high anxiety.

From T1 to T2, we observed a significant increase in the percentage of HCWs endorsing high levels of emotional exhaustion and/or high levels of depersonalization burnout from T1 to T2 (18.5% vs. 28.4%, P = 0.01; Fig. 1). There was also a significant increase in both emotional exhaustion and depersonalization total burnout scores (Table 2 and Table 3, respectively). Personal accomplishment burnout did not significantly change from T1 (40.0, 95% CI 39.0–41.1) to T2 (39.2, 95% CI 38.2–40.3; P = 0.08).

HCW characteristics and change in emotional exhaustion burnout
As shown in Table 2, results from bivariate analyses revealed that demographic variables such as age (P < 0.001), job position (P = 0.008), and years of experience (P < 0.001), and psychological variables such as conscientiousness personality (P = 0.041) and anxiety (P = 0.016) factors were significantly associated with increases in emotional exhaustion burnout.

In the final multivariate model (see Table 4), certain job professions (i.e., nurse or technician; P's < 0.001), departments (i.e., ED [P = 0.011] or perioperative [P < .001]), and conscientiousness personality (P = 0.030) were found to be independent contributing factors to change in emotional exhaustion burnout. In HCWs that endorsed low conscientiousness, average emotional exhaustion increased from low to moderate burnout levels (+7.2, 95% CI 3.3–11.0, P < 0.001).

HCW characteristics and change in depersonalization burnout
Bivariate analyses for depersonalization burnout also indicated that both demographic (HCW age, marital status, parental status, job position, and years of experience) and psychological (conscientiousness, agreeableness, and neuroticism personality) factors were associated with a significant increase in depersonalization burnout from T1 to T2 (see Table 3).

In the multivariate model (Table 4), younger age (P < 0.001) and working within the intensive care (P = 0.008) or perioperative departments (P = 0.012) were the only demographic characteristics that were independently associated with change in depersonalization burnout. Lower agreeableness (P = 0.004) and higher neuroticism personality traits were also significant independent contributing factors to change in depersonalization burnout, with higher neuroticism contributing to an increase in depersonalization burnout from low to moderate levels (+3.1, 95% CI 0.80–5.40, P = 0.008).

DISCUSSION
Under the conditions of this study, we found that the percentage of HCWs reporting high emotional exhaustion and/or depersonalization burnout increased significantly from 18.5% to 28.4% during an 11-month period of the COVID-19 pandemic. The theoretical contribution of this manuscript is that we have identified a number of factors that are associated with increased emotional exhaustion or depersonalization burnout such as unit in the hospital, function in the hospital, family status, low conscientiousness, low agreeableness and high neuroticism. While many of these predictive variables have only theoretical implications, some have contribution for the practitioners and hospital administration. For example, while one is not likely to change their role or unit in the hospital, it is the case that if hospital administration is aware of this increased risk, they can provide more resources to these personnel. Similarly, more psychological support and intervention may be especially beneficial for those who score high on neuroticism and for those who scored low conscientiousness there is a need for more support to address challenges surrounding prioritizing tasks and assertiveness.

Factors independently associated with emotional exhaustion burnout included being in a nursing or medical technician role, not having children, and low conscientiousness. The emotional exhaustion dimension of burnout reflects feeling emotionally overextended and fatigued by one's work. Having a family may have offered additional emotional support outside of work[3,16,24,48] and working in a more senior role, non-support position may have afforded more autonomy and control[1,49] to protect against the emotional toll of working in a healthcare setting during the pandemic. Further, high conscientiousness, a trait that reflects a tendency to be responsible, organized, and industrious, may have been protective against feeling emotionally depleted in the context of COVID-19-related clinical care challenges. Cross-sectional studies have also shown a beneficial effect of conscientiousness on burnout,[27] and current results suggest that characteristics reflective of this personality trait may have a prolonged protective effect.

Younger age, low agreeableness and high neuroticism were each independently associated with increased depersonalization burnout. Depersonalization is indicative of a more interpersonal
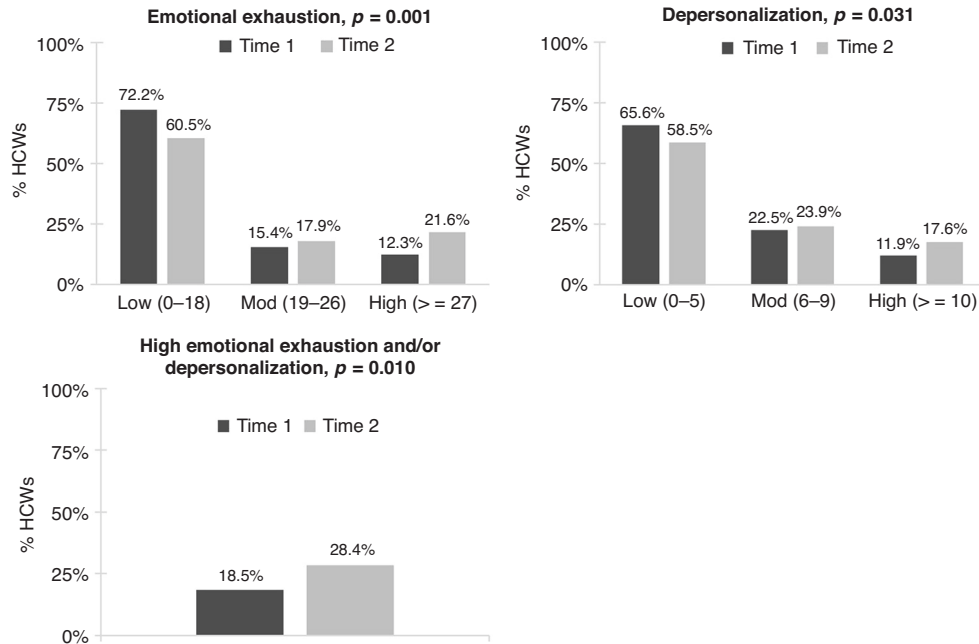
Emotional exhaustion, *p* = 0.001

Depersonalization, *p* = 0.031

High emotional exhaustion and/or depersonalization, *p* = 0.010

Fig. 1 Change in burnout from emotional exhaustion and depersonalization evaluated categorically (Time 1 to Time 2), unadjusted. GEE analyses with repeat measures specified determined significance of change, respectively. HCWs=Healthcare Workers.

component of burnout and reflects an impersonal response to one's service or responsibilities and the development of a more negative or callous attitude. Study findings align with previous cross-sectional work indicating that high neuroticism and low agreeableness are associated with higher depersonalization burnout.[5,27,28,48] Attributes associated with agreeableness including compassion, trust and respectfulness may have contributed to lower levels of interpersonal detachment while navigating fluctuating clinical and personal stressors during the pandemic. Neuroticism, on the other hand, is characterized by emotional instability and more intense negative affect. HCWs high on this trait may have had increased difficulty navigating exposure to uncertainty and stressors throughout the pandemic and subsequent negative emotional responses and volatility may have contributed to interpersonal challenges and detachment. Studies conducted prior to and during the COVID-19 pandemic have also reported that older age is associated with lower risk for HCW burnout more generally and have suggested that training and experience may play a role in this association.[5,15] Years of experience did not remain a significant contributor to change in burnout in our study, however the association between age and depersonalization burnout may reflect related factors such as time within in the institution and/or current role, with older HCWs potentially having more seniority with regards to scheduling and more time within their departments to build interpersonal relationships.

This study identified demographic and psychological factors unique to the individual HCW (i.e., age, family, personality characteristics) as well as those pertaining to the work environment and occupational role (i.e., department, job position) that may independently contribute to changes in burnout in the context of a stressor such as a pandemic. These findings are relatively consistent with past cross-sectional studies conducted prior to and during the COVID-19 pandemic that have reported higher burnout in HCWs that do not have children and endorse less support from family, less experience, and lower conscientiousness and agreeableness.[3–5,49,50] The longitudinal methodology of the current study, conducted over approximately one-year of the COVID-19 pandemic, builds on past work by providing important data on the changes in HCW burnout during the pandemic and multiple potential targets for intervention.

Interventions and workplace health promotion programs aimed at early identification as well as offering emotional support and enhancing appropriate coping skills (e.g., mindfulness) have shown promise in minimizing burnout and preventing negative long-term outcomes.[51,52] Given the current results, access to these interventions may be especially important for HCWs in lower-level, support roles and those working in high acuity departments. HCW personality traits and associated characteristics can change over time and in response to training or intervention.[53–55] Thus, the assessment of HCW personality, and subsequent identification of potentially protective and detrimental characteristics, may also further direct intervention efforts to mitigate burnout. For example, prioritizing access to psychological support and intervention may be especially beneficial for those who score high on neuroticism and might be prone to experience increased emotional distress when exposed to new stressors. On the other hand, low conscientiousness scores may indicate a need for more administrative and/or team support to address potential challenges surrounding prioritizing tasks and assertiveness.

The current study findings should be considered in the context of potential limitations. Data were collected from a convenience sample from four units within a single children's hospital and the majority of the sample was White, female, nurses, and worked in the ED. Collectively, the under- or over-representation of certain groups within the sample may limit the generalizability of current study findings to other medical settings. Although time 1 burnout among study completers did not differ from those lost to follow-up, attrition from time 1 to time 2 may have implications for external validity and selection bias. Other factors not assessed, including employment status or resignation, which has accelerated during the COVID-19 pandemic[52] may have also affected study attrition. We also did not collect pre-COVID-19 burnout levels nor assess safety concerns or family stressors, which may have affected burnout in our sample.

CONCLUSION

In a sample of pediatric HCWs, emotional exhaustion and depersonalization burnout significantly increased over 11-months of working during the COVID-19 pandemic, with the

Table 2. Bivariate emotional exhaustion burnout results.

Estimated mean sum score	Emotional exhaustion burnout		Factor level *p* value
	Time 1 (95% CI)	Time 2 (95% CI)	
Burnout	14.4 (12.8, 16.0)	17.7 (16.2, 19.3)**	
Age, years			<0.001
<=30	*15.2 (12.3, 18.1)*	*23.9 (21.0, 26.9)***	
31–40	15.0 (12.4, 17.7)	17.4 (14.7, 20.0)	
41–50	13.4 (10.3, 16.4)	14.1 (11.0, 17.1)	
>=50	13.4 (9.6, 17.3)	13.4 (9.6, 17.3)	
Sex			0.380
Female	14.5 (12.6, 16.4)	18.2 (16.4, 20.1)**	
Male	14.2 (11.3, 17.1)	16.5 (13.6, 19.4)	
Race			0.150
Asian	17.1 (13.0, 21.1)	19.8 (15.7, 23.8)	
Hispanic	10.1 (5.6, 14.5)	17.7 (13.2, 22.1)**	
White	14.7 (12.8, 16.6)	17.6 (15.7, 19.5)**	
Multi-Racial/Other	12.5 (4.4, 20.6)	12.5 (4.4, 20.6)	
Marital Status			<0.001
Married	14.7 (12.8, 16.6)	16.0 (14.1, 17.9)	
Not married	*13.9 (11.2, 16.5)*	*21.1 (18.4, 23.8)***	
Children			<0.001
Yes	13.6 (11.5, 15.8)	14.3 (12.1, 16.4)	
No	*15.4 (12.5, 18.4)*	*23.3 (20.3, 26.3)***	
Department			0.258
Emergency Department	14.6 (12.4, 16.7)	18.2 (16.1, 20.4)**	
Intensive Care Unit	13.8 (10.2, 17.4)	15.8 (12.2, 19.4)	
Perioperative	15.0 (11.6, 18.3)	19.8 (16.5, 23.1)**	
Transport	12.6 (5.6, 19.7)	10.7 (3.6, 17.7)	
Position			0.008
Nurse (RN)	14.9 (12.8, 17.1)	17.9 (15.7, 20.0)**	
NP/PA	10.9 (5.0, 16.9)	12.8 (6.9, 18.8)	
Physician	14.1 (10.8, 17.4)	14.7 (11.4, 18.0)	
Medical Technician	*14.7 (11.1, 18.3)*	*22.8 (19.2, 26.4)***	
Years of experience	(r = −0.303**)		<0.001
Personality			
Extraversion			0.399
≥4	12.7 (10.6, 14.9)	15.2 (13.1, 17.4)*	
<4	16.4 (14.1, 18.8)	20.2 (17.8, 22.6)**	
Agreeableness			0.293
≥4	16.8 (15.1, 18.5)	13.9 (12.2, 15.6)**	
<4	16.5 (12.6, 20.3)	21.5 (17.7, 25.3)**	
Conscientiousness			0.041
≥4	13.7 (12.0, 15.4)	16.4 (14.6, 18.1)**	
<4	*17.8 (14.1, 21.4)*	*24.4 (20.8, 28.1)***	
Neuroticism			0.172
≥4	21.7 (15.5, 27.8)	29.0 (22.8, 35.2)*	
<4	14.0 (12.4, 15.6)	17.0 (15.5, 18.6)**	
Openness			0.942
≥4	13.9 (11.9, 15.8)	17.1 (15.2, 19.0)**	
<4	15.6 (12.8, 18.4)	19.0 (16.2, 21.8)*	
Trait Anxiety			0.016
>40	*18.6 (16.5, 20.8)*	*24.0 (21.9, 26.1)***	
≤40	11.2 (9.3, 13.1)	13.0 (11.1, 14.8)	

Notes. Score norm interpretation: 0–18 low, 19-26, moderate, ≥27 high burnout. **Bold italics** indicate within level scores that cross burnout norm levels (only noted for variables that were significant at the factor level). *NP* nurse practitioner; *PA* physician associate *within level P < .05; **within level P < 0.01.

Table 3. Bivariate depersonalization burnout results.

Estimated mean sum score	Depersonalization burnout		Factor level P value
	Time 1 (95% CI)	Time 2 (95% CI)	
Burnout	4.7 (4.0, 5.4)	5.4 (4.7, 6.1)*	
Age, years			0.012
<=30	*5.8 (4.5, 7.0)*	*8.2 (6.9, 9.5)***	
31–40	5.3 (4.1, 6.5)	5.3 (4.2, 6.5)	
41–50	3.7 (2.3, 5.1)	4.1 (2.7, 5.4)	
>=50	3.3 (1.6, 5.0)	3.1 (1.4, 4.8)	
Sex			0.989
Female	4.5 (3.7, 5.3)	5.2 (4.4, 6.0)	
Male	5.3 (4.0, 6.6)	6.0 (4.7, 7.3)	
Race			0.247
Asian	6.6 (4.8, 8.4)	6.5 (4.7, 8.3)	
Hispanic	2.5 (0.5, 4.5)	4.6 (0.5, 4.5)*	
White	4.7 (3.9, 5.5)	5.3 (4.4, 6.1)	
Multi-Racial/Other	4.8 (1.0, 8.6)	7.3 (3.8, 10.9)	
Marital Status			0.011
Married	4.5 (3.6, 5.3)	4.6 (3.7, 5.4)	
Not married	*5.2 (4.0, 6.4)*	*7.1 (5.9, 8.3)***	
Children			0.001
Yes	3.8 (3.0, 4.7)	3.9 (3.0, 4.8)	
No	*4.3 (3.1, 5.5)*	*6.6 (5.4, 7.8)***	
Department			0.159
Emergency Department	6.0 (5.0, 6.9)	6.3 (5.4, 7.3)	
Intensive Care Unit	3.7 (2.1, 5.2)	5.5 (3.9, 7.0)*	
Perioperative	3.1 (1.6, 4.5)	4.1 (2.6, 5.5)	
Transport	3.0 (-0.0, 6.0)	1.5 (–1.5, 4.5)	
Position			0.051
Nurse (RN)	4.6 (3.7, 5.6)	5.5 (4.5, 6.4)	
NP/PA	5.5 (4.1, 6.8)	5.0 (3.7, 6.3)	
Physician	6.5 (3.8, 9.1)	4.2 (1.4, 6.9)	
Medical Technician	4.1 (2.5, 5.7)	5.9 (4.3, 7.5)*	
Years of experience	(r = −0.225*)		0.015
Personality			
Extraversion			0.153
≥4	4.2 (3.3, 5.2)	4.5 (3.5, 5.4)	
<4	5.3 (4.3, 6.3)	6.5 (5.5, 7.6)*	
Agreeableness			0.028
≥4	4.3 (3.6, 5.0)	4.7 (4.0, 5.4)	
<4	6.9 (5.3, 8.6)	9.3 (7.6, 11.0)**	
Conscientio usness			0.039
≥4	4.2 (3.4, 4.9)	4.6 (3.8, 5.3)	
<4	7.2 (5.7, 8.8)	9.4 (7.8, 11.0)**	
Neuroticism			0.025
≥4	*5.2 (2.4, 8.0)*	*8.8 (6.0, 11.6)***	
<4	4.7 (4.0, 5.4)	5.2 (4.5, 5.9)	
Openness			0.826
≥4	4.7 (3.8, 5.5)	5.4 (4.6, 6.2)	
<4	4.9 (3.6, 6.1)	5.5 (4.2, 6.7)	
Trait anxiety			0.265
>40	6.2 (5.2, 7.2)	7.3 (6.3, 8.3)*	
≤40	3.6 (2.7, 4.5)	4.0 (3.1, 4.9)	

Notes. Score norm interpretation: 0–5 low, 6–9 moderate, >=10 high burnout. **Bold italics** indicate within level scores that cross burnout norm levels (only noted for variables that were significant at the factor level).
NP nurse practitioner, *PA* physician associate.
*within level $P < 0.05$; **within level $P < 0.01$.

Table 4. Multivariate model burnout results.

	Emotional exhaustion		Factor *P* value	Depersonalization		Factor *P* value
	Time 1 (95%CI)	Time 2 (95%CI)		Time 1 (95%CI)	Time 2 (95%CI)	
Adjusted Burnout	14.3 (12.6–16.0)	17.4 (15.7–19.1)**		4.7 (4.1–5.3)	5.4 (4.8–6.1)*	
Age-years						0.008
<=30				*5.2 (3.9–6.4)*	*7.8 (6.5–9.0)***	
Children			<0.001			
Yes	13.6 (11.4–15.7)	14.4 (12.3–16.5)				
No	15.6 (12.7–18.5)	23.0 (20.0–25.9)**				
Department			0.038			0.051
Emergency	14.2 (11.4–17.0)	17.3 (14.5–20.1)*		5.9 (5.0–6.7)	6.0 (5.0–6.9)	
Intensive Care	13.4 (10.0–16.7)	15.3 (12.0–18.7)		3.8 (2.3–5.2)	5.5 (4.1–7.0)**	
Perioperative	*15.2 (12.1–18.4)*	*20.9 (17.7–24.0)***		3.1 (1.7–4.4)	4.7 (3.3–6.0)*	
Transport	13.7 (7.0–20.4)	10.6 (4.0–17.3)		3.2 (0.3–6.0)	2.3 (–0.6 to 5.1)	
Position			0.008			
Nurse (RN)	14.5 (12.2–16.8)	18.3 (16.0–20.6)**				
NP/PA	11.5 (3.8–19.2)	12.6 (4.9–20.3)				
Physician	14.6 (11.2–18.1)	14.0 (10.5–17.5)				
Medical Technician	*13.8 (9.4–18.2)*	*21.2 (16.7–25.6)***				
Personality						
Agreeableness						0.040
≥4				4.3 (3.6–5.0)	4.8 (4.1–5.5)	
<4				6.8 (5.2–8.3)	8.9 (7.3–10.5)**	
Conscientiousness			0.030			
≥4	13.5 (11.7–15.3)	16.0 (14.2–17.8)**				
<4	*18.7 (14.2–23.3)*	*25.9 (21.4–30.4)***				
Neuroticism						0.037
≥4				*4.4 (1.9–7.0)*	*7.5 (5.0–10.1)***	
<4				4.7 (4.1–5.4)	5.3 (4.6–5.9)	

Notes. Score norm interpretation for emotional exhaustion: 0–18 low, 19-26, moderate, ≥27 high burnout. Score norm interpretation for depersonalization: 0–5 low, 6–9 mod, ≥10 high burnout. **Bold italics** indicate within level scores that cross burnout norm levels (only noted for variables that were significant at the factor level).

NP nurse practitioner, *PA* physician associate.

*within level *P* < 0.05; **within level *P* < 0.01.

proportion of HCWs endorsing high emotional exhaustion or depersonalization burnout rising significantly. Study results demonstrated that certain demographic and psychological factors were associated with increased burnout, which may have implications for burnout mitigation strategies. Additional longitudinal research assessing HCW burnout during pandemic surges is needed to confirm the current results. Future research including more diverse HCW samples working in other units and within other institutions, as well as the assessment of additional social and institutional-level variables may help further characterize risk and protective factors associated with HCW burnout trajectory and inform the development and implementation of burnout interventions.

DATA AVAILABILITY
The de-identified datasets analyzed during the current study are available from the corresponding author upon reasonable request.

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AUTHOR CONTRIBUTIONS

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Z.N.K. serves as a consultant for Edwards Lifesciences and Pacira and is the President of the American College of Perioperative Medicine. All other authors have no conflicts of interest to report.

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Healthcare worker participants completed informed consent prior to completing study procedures.

ADDITIONAL INFORMATION

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