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Exploring burnout, resilience and the coping strategies among critical healthcare professionals in post-COVID Taiwan

Yueh-Lin Lee[1,3], Jhih-Wei Dai[2,3], Xiu-Wei Li[3,4], Yu-Chen Lin[5] & Chien-Ho Wang[3,5]✉

The mental well-being of critical healthcare professionals is a global public health issue, but its characteristics vary geographically. This study investigates the features of burnout, resilience, and coping strategies among critical healthcare professionals in Taiwan during the post-pandemic era. A survey incorporating the Maslach Burnout Inventory for Medical Professionals (MBI-MP) and the 14-item Resilience Scale (RS-14) was conducted between December 2023 and January 2024, targeting critical healthcare professionals at Chang Gung Memorial Hospital Foundation. Among 254 participants, the overall burnout rate was 35.4%, with high emotional exhaustion (EE, 70.9%), high depersonalization (DP, 56.3%), and low personal accomplishment (PA, 60.6%). The average resilience score was 70.7 ± 12.3. Younger, unmarried individuals and those with less work experience exhibited lower resilience and higher burnout scores. Resilience was significantly associated with reduced EE ($p < 0.001$), reduced DP ($p < 0.001$), and increased PA ($p < 0.001$). Family and friend companionship was the most common coping strategy. A high prevalence of burnout and low resilience was observed among critical healthcare professionals in Taiwan during the post-pandemic era. Identifying vulnerable populations and implementing locally tailored strategies are crucial to supporting the mental well-being of healthcare professionals.

Keywords Burnout, Mental wellbeing, Resilience, Critical healthcare professionals, Post-COVID-19 era

Healthcare workers' mental wellbeing is now recognized as a global public health concern. Burnout, defined by the World Health Organization as an occupational phenomenon resulting from unsuccessfully managed chronic workplace stress, manifests as EE, DP and PA[1–4]. Burnout not only harms the physical and psychological health of affected individuals but also leads to undesirable organizational outcomes[5–9]. Resilience, often described as the capacity to adapt and "bounce back" in the face of adversity[10–13]. Previous studies suggest that resilience shapes the appraisal of stressful events, whereas coping strategies govern the behaviors implemented after this appraisal[14]. Moreover, individuals with high resilience are better able to identify and use adaptive coping strategies and are therefore less susceptible to burnout[14,15].

There has been substantial variability in prevalence estimates of burnout, ranging from 14.3% to 67.0%[16–18]. Since the outbreak of COVID-19 pandemic, the physical and psychological burden on frontline critical healthcare professionals has been increasing[19–27]. High-quality critical care is not without cost to the clinicians[28]. Multiple studies have demonstrated that critical healthcare professionals, such as emergency department and intensive care unit staff, are a vulnerable population due to high-acuity patients, intense workload, conflicts over goals of care, and emotional stress, with more than 50% of them suffering from burnout[18,20,22,29–38]. Early identification and prevention of burnout is crucial to reduce negative consequences on critical healthcare professionals, patients, organizations, and the healthcare system[39–41].

Resilience, often defined as the capacity to maintain or regain mental health in the face of significant challenges, is therefore regarded as a measure of one's ability to adapt positively to workplace adversity[42–45]. Developing resilience skills and good coping strategies may be solutions to reduce the risk of burnout[45]. A cross-sectional study by P. Ferreira et al. during the COVID-19 pandemic found that a 1% increase in resilience

[1]Division of Pulmonary and Critical Care Medicine, Chiayi Branch, Chang Gung Memorial Hospital, Chiayi, Taiwan. [2]Department of Cardiology, Keelung Chang Gung Memorial Hospital, Keelung, Taiwan. [3]College of Medicine, Chang Gung University, Taoyuan, Taiwan. [4]Division of Hepatogastroenterology, Department of Internal Medicine, Jen-Ai Hospital, Taichung, Taiwan. [5]Department of Emergency Medicine, Jen-Ai Hospital, Taichung, Taiwan. ✉email: Jen.y441@mail.jah.org.tw

is associated with a 1.7% reduction in EE and DP and a 5% increase in PA[45]. Especially in highly demanding working conditions such as critical care units and emergency departments, the importance of the mediational role of resilience cannot be overemphasized. According to previous literature, resilience may differ depending on regions and sociodemographic characteristics of individuals. younger individuals and physicians were reported with more resilience; however, no consensus has been achieved[45–47].

Burnout coping strategies are behavioral and cognitive techniques designed to manage chronic workplace stress by helping individuals reduce or tolerate specific internal and external demands, thereby preventing burnout or aiding recovery[48]. According to the Coping Strategy Inventory constructed by Tobin et al. (1984, 1989) consists of two scales measuring engagement and disengagement coping strategies. Both scales were further divided into dimensions of emotion focused and problem-focused subscales. The surge in recognition of the importance of healthcare professionals' wellbeing has prompted exploration of coping strategies[13,49,50]. Effective coping strategies may theoretically prevent burnout from progressing to negative psychological consequences[11,12]. A review of the literature identifies both self-directed individual coping strategies and organizational interventions as beneficial for mental health, though they address different aspects. Generally, individual strategies serve as reactive approaches to manage shortterm occupational stress, whereas organizational interventions promote healthcare professionals' longterm wellbeing[13,49,51–53]. Moreover, differences in healthcare systems, cultural diversity, religious beliefs and social factors may influence the development of selfcoping mechanisms[49].

Recent literature has indicated that even in the post pandemic era, burnout levels among healthcare workers remain high even with greater knowledge of the disease and more established care processes. This demonstrated the persistently elevated burnout levels in the post COVID-19 pandemic as compared with those during the COVID-19 pandemic, indicating the long-term consequences of stressful situations associated with combating the pandemic. However, there is a paucity of literature on the present situation of burnout and resilience among critical healthcare professionals in Asia during the post-pandemic era. The diversity of cultures and career values makes it difficult to extrapolate previous findings from the West to Asia[54]. This study, conducted within one of Taiwan's largest healthcare systems, seeks to clarify[1]: the sociodemographic determinants of burnout and resilience, examine the associations between resilience and burnout, and[2] investigate the role of leisure participation in relation to stress among critical healthcare professionals. The ultimate goal is to enhance the physical, mental, and overall well-being of this population.

Methods

Study design and setting

We conducted an online questionnaire from December 1, 2023, to January 31, 2024, collecting self-reported data anonymously. The questionnaire Link was shared with emergency and intensive care unit staff at Chang Gung Memorial Hospital Foundation facilities, which Handle 8.6 million outpatient visits and 370,000 admissions annually. The hospitals included were Keelung (regional hospital), Linkou (medical center), Chiayi Chang Gung (regional hospital), and Jen-Ai Hospital, Dali Branch (regional hospital).

Since this was a multi-center study, an online questionnaire distribution protocol was implemented. Purposive sampling was adopted, with voluntary participation. The survey was distributed to healthcare workers in emergency departments and intensive care units of the hospital branches mentioned above to target frontline staff in high-intensity settings. Each participating institution designated a local coordinator who was responsible for explaining the study objectives and questionnaire content to potential participants. Informed consent was obtained prior to questionnaire distribution. Individuals who met the inclusion criteria were free to decide whether to complete the questionnaire, and participation was entirely voluntary. During the survey period, local coordinators were available to address any questions raised by participants. Upon submission, all questionnaires were reviewed by Yueh-Lin Lee to ensure completeness and accuracy before being included in the final analysis.

Study participants

Critical care professionals working in the emergency department or intensive care unit at the selected institutions since the onset of the COVID-19 pandemic were invited to participate in this study. Only those who completed the questionnaire were included in the final analysis. Staff who did not work in these departments or were not involved in the care of COVID-19 patients were excluded. Non-clinical personnel, such as social workers, pharmacists, porters, and radiographers, were also deemed ineligible. Based on hospital records, the total number of eligible critical care professionals was 501 (physicians: 122; nurses: 379). A minimum required sample size of 218 was determined using a 95% confidence interval and a 5% margin of error.

Description of the questionnaire

The questionnaire comprises six sections with a total of sixty questions (Appendix Table 1). The sections, in sequence, encompass demographic data, personal health information, COVID-related inquiries, Maslach Burnout Inventory for Medical Professionals (MBI-MP), the 14-item Resilience Scale (RS-14), and the self-developed questionnaire designed to assess coping strategies for workplace adversity.

The MBI-HSS-MP is a widely used instrument with strong psychometric properties[55], which comprises three subscales and a total of 22 items (EE: 9 items, DP: 5 items, PA: 8 items)[48]. Responses to scale items range from "1 = never" to "7 = always." The scores of the three subscales are calculated separately and categorized as low, moderate, or high levels of burnout (EE, high: ≥27, moderate: 19 to 26, low: ≤18; DP, high: ≥10, moderate: 6 to 9, low: ≤5; PA, high: ≥40, moderate: 34 to 39, low: ≤33). In this study, burnout was defined as having 'high EE,' 'high DP,' and 'low PA[16,57]. Cronbach's alpha coefficients in our study were 0.895 for emotional exhaustion, 0.798 for depersonalization, and 0.808 for personal accomplishment.

The RS-14 has also been validated and demonstrates good reliability and validity, with a reported Cronbach's alpha of 0.93[56]. The Resilience Scale (RS-14) assesses five core traits—purpose, perseverance, self-reliance,

equanimity, and authenticity—via 14 items on a 7-point scale. Higher scores indicate greater resilience, categorized into six levels: very low (14-56), low (57-64), low-end (65-73), moderate (74-81), moderately high (82-90), and high (91-98)[58].

Statistical analysis

Baseline demographic categorical variables are presented as percentages (%), while continuous variables are expressed as mean ± SD. Independent t-tests and one-way ANOVA were employed to identify significant differences in burnout subscales and resilience across demographic variables (Table 1 and Table 2). Supplementary results of the post hoc tests are provided in Appendix Tables 4, 5, 6, 7, 8, 9 and 10. Pearson´s correlation was used to assess the association between resilience scores and MBI subscales (Table 3). All analyses were conducted using SPSS Statistics, version 24.

Ethics statement

Ethics approval was obtained from the Institutional Review Board of Jen-Ai Hospital (IRB Number: 202300084B0). Informed consent was obtained in written form, and the documentation was properly preserved. All submitted questionnaires were treated with strict confidentiality and were accessible only to the researchers involved in this study. A license granting the right to utilize and administer the Maslach Burnout Inventory (MBI) and 14-item Resilience Scale (RS-14) has been obtained. All methods were performed in accordance with the relevant guidelines and regulations. No external funding source was involved in this research initiative.

Results

The study involved 254 critical healthcare professionals across four hospitals in Taiwan (Fig. 1). The distribution of responders was as follows: Keelung Chang Gung Emergency Department ($n = 23$), Keelung Chang Gung Intensive Care Unit ($n = 15$), Linkou Chang Gung Emergency Department ($n = 57$), Linkou Chang Gung Intensive Care Unit ($n = 17$), Taichung Jen-Ai Emergency Department ($n = 42$), Taichung Jen-Ai Intensive Care Unit ($n = 36$), Chiayi Chang Gung Emergency Department ($n = 11$), and Chiayi Chang Gung Intensive Care Unit ($n = 53$). The response rate achieved was approximately 51.0%. One participant decided to withdraw after reviewing the participant consent form.

Demographic characteristics

Among 254 participants, 81.9% were nurses, 46.9% were under 30, and 60.6% were unmarried. Most (52.4%) worked in emergency departments, and 41.3% had under five years of critical care experience. Additionally, 53.2% worked over 40 h weekly, and 45.7% had frequent night shifts (Table 1).

Prevalence of burnout and the results of each subscale of the MBI-Human Services Survey for Medical Personnel (MBI-MP)

The overall burnout rate in this study was 35.4%, with 70.9% experiencing high EE, 56.3% reporting high DP, and 60.6% indicating low PA. The mean EE score was 35.4 ± 11.6, higher among nurses than physicians. Higher EE levels were associated with younger age, being unmarried, less critical care experience, longer working hours, more night shifts, and sleep aid use. The mean DP score was 11.8 ± 6.5, higher among younger, unmarried individuals, emergency department workers, and those with more night shifts or less critical care experience. The mean PA score was 30.6 ± 7.9, with lower levels observed in unmarried individuals and those without regular exercise (Table 1, Appendix Tables 4, 5, 6, 7 and 8).

The results of the 14-item resilience scale (RS-14)

The average total resilience score was 70.7 ± 12.3, with 140 participants (55.1%) classified as having low, low-end, or very low levels. Total resilience scores correlated with specific demographic features. Older individuals, married individuals, and those with longer working experience in critical care units demonstrated higher total resilience scores (Table 1, Appendix Table 9, and 10). However, workplace, occupation, previous working experience, use of pharmaceuticals for sleep aid, alcohol consumption, and lack of regular exercise habits showed no significant difference in resilience scores (Table 2).

The relationship between MBI subscales and resilience

Table 3 presents Pearson's correlation coefficients between total resilience score and each MBI subscale. Higher total resilience scores were associated with lower EE scores ($p < 0.001$), lower DP scores ($p < 0.001$), and higher PA scores ($p < 0.0001$).

General health conditions and their correlation with burnout and resilience

Detailed health-related findings are in Appendix Table 2. Half of participants rated their health as comparable to others. Few relied on sleep aids (7.8%), used tobacco (2.4%), or consumed alcohol (2.8%). Most (41.7%) lacked regular exercise habits. Over half (58.3%) occasionally felt stressed, while 15.7% had never considered quitting in the past month.

Higher EE was observed in those using sleep aids ($p = 0.01$), while regular exercisers had higher PA scores ($p = 0.033$). Alcohol consumption showed no significant correlation with burnout subscales. Resilience scores were unrelated to sleep aid use, alcohol consumption, or exercise frequency ($p = 0.549$, $p = 0.194$, and $p = 0.144$, respectively). See Tables 1 and 2 for further details.

Variable	*N*	Emotional exhaustion (EE)					Depersonalization (DP)					Personal accomplishment (PA)				
		Low	median	High	M ± SD	P-value	Low	median	High	M ± SD	P-value	Low	median	High	M ± SD	P-value
All	**254**	**29(11.4%)**	**45(17.7%)**	**180(70.9%)**	**35.4 ± 11.6**	NA	**41(16.1%)**	**70(27.6%)**	**143(56.3%)**	**11.8 ± 6.5**	NA	**154(60.6%)**	**71(28.0%)**	**29(11.4%)**	**30.6 ± 7.9**	NA
Age																
20–29	119	10(8.4%)	16(13.4%)	93(78.2%)	35.4 ± 11.6	**< 0.001**	16(13.4%)	33(27.7%)	70(58.8%)	12.7 ± 6.7	**0.008**	81(68.0%)	27(22.7%)	11(9.2%)	29.7 ± 8.1	0.121
30–39	92	9(9.8%)	15(16.3%)	68(73.9%)	32.9 ± 11.4		12(13.0%)	23(25.0%)	57(62.0%)	12.1 ± 6.4		53(57.6%)	29(31.5%)	10(10.9%)	30.8 ± 7.4	
40–49	39	7(17.9%)	13(33.3%)	19(48.7%)	28.3 ± 10.2		10(25.6%)	14(35.9%)	15(41.0%)	9.2 ± 5.5		17(43.6%)	14(35.9%)	8(20.5%)	33.2 ± 8.3	
> 50	4	3(75.0%)	1(25.0%)	0(0.0%)	16.8 ± 5.6		3(75.0%)	0(0.0%)	1(25.0%)	6.0 ± 4.0		3(75.0%)	1(25.0%)	0(0.0%)	30.0 ± 5.0	
Occupation																
Physician	46	9(19.6%)	9(19.6%)	28(60.9%)	30.6 ± 12.7	0.106	8(17.4%)	11(23.9.%)	27(62.8%)	12.7 ± 6.9	0.331	24(52.2%)	19(41.3%)	3(6.6%)	31.4 ± 8.3	0.483
Nurse	208	20(9.6%)	36(17.3%)	152(73.1%)	33.7 ± 11.3		33(15.9%)	59(28.4%)	116(55.8%)	11.6 ± 6.5		130(62.5.%)	52(25.0%)	26(12.5%)	30.5 ± 7.8	
Workplace																
ER	133	16(12.0%)	22(16.6%)	95(71.4%)	33.9 ± 12.7	0.270	15(11.3%)	32(24.1%)	86(64.7%)	13.7 ± 7.0	**< 0.001**	81(60.9%)	36(27.1%)	16(12.0%)	30.3 ± 8.3	0.570
ICU	121	13(10.7%)	23(19.0%)	85(70.2%)	32.3 ± 10.3		26(21.5%)	38(31.4%)	57(47.1%)	9.7 ± 5.3		73(60.3%)	35(28.9%)	13(10.7%)	30.9 ± 7.4	
Marital status																
Single	154	12(7.8%)	21(13.6%)	121(78.6%)	35.4 ± 11.9	**< 0.001**	21(13.6%)	38(24.7%)	95(61.7%)	12.8 ± 6.8	**0.002**	102(66.2%)	39(25.3%)	13(8.4%)	29.7 ± 7.7	**0.015**
Married	100	17(17.0%)	24(24.0%)	59(59.0%)	29.6 ± 10.3		20(20.0%)	32(32.0%)	48(48.0%)	10.2 ± 5.8		52(52.0%)	32(32.0%)	16(16.0%)	32.1 ± 8.0	
Number of children																
0	170	14(8.2%)	24(14.1%)	132(77.6%)	34.6 ± 11.6	**0.007**	24(14.1%)	42(24.7%)	104(61.2%)	12.7 ± 6.7	**0.007**	113(66.5%)	44(25.9%)	13(7.7%)	29.8 ± 7.6	0.091
1	22	3(13.6%)	4(18.2%)	15(68.2%)	33.7 ± 11.6		1(4.6%)	7(31.8%)	14(63.6%)	11.9 ± 6.2		13(59.1%)	5(22.7%)	4(18.2%)	31.4 ± 7.9	
2	50	9(18.0%)	14(28.0%)	27(54.0%)	29.2 ± 10.8		13(26.0%)	17(34.0%)	20(40.0%)	9.7 ± 6.0		22(44.0%)	18(36.0%)	10(20.0%)	32.7 ± 8.7	
≥ 3	12	3(25.0%)	3(25.0%)	6(50.0%)	26.9 ± 10.3		3(25.0%)	4(33.3%)	5(41.7%)	8.1 ± 4.7		6(50.0%)	4(33.3%)	2(16.7%)	32.6 ± 7.7	
Do you have pets																
No	189	22(11.6%)	36(19.0%)	131(69.3%)	33.2 ± 11.9	0.789	28(14.8%)	51(27.0%)	110(58.2%)	11.7 ± 6.2	0.633	117(61.9%)	50(26.5%)	22(11.6%)	30.7 ± 7.9	0.928
Yes	65	7(10.8%)	9(13.8%)	49(75.4%)	32.8 ± 10.9		13(20.0%)	19(29.2%)	33(50.8%)	12.1 ± 7.4		37(56.9%)	21(32.3%)	7(10.8%)	30.6 ± 7.8	
Previous work experience in ED/ICU																
No	190	19(10.0%)	30(15.8%)	141(74.2%)	35.4 ± 12.1	0.108	28(14.7%)	54(28.4%)	108(56.8%)	12.0 ± 6.7	0.338	118(62.1%)	54(28.4%)	18(9.5%)	30.7 ± 7.3	0.908
Yes	64	10(15.6%)	15(23.4%)	39(60.9%)	33.2 ± 10.2		13(20.3%)	16(25.0%)	35(54.7%)	11.1 ± 6.0		36(56.3%)	17(26.6%)	11(17.2%)	30.5 ± 9.5	
The length of time of being critical healthcare professional (years)																
1–5	105	8(7.6%)	13(12.4%)	84(80.0%)	35.5 ± 11.1	**0.005**	13(12.4%)	26(24.8%)	66(62.9%)	13.0 ± 6.7	**0.002**	67(63.8%)	28(26.7%)	10(9.5%)	30.5 ± 7.6	0.126
6–10	56	5(8.9%)	12(21.4%)	39(69.6%)	33.9 ± 12.6		7(12.5%)	15(26.8%)	34(60.7%)	12.6 ± 6.7		37(66.1%)	13(23.2%)	6(10.7%)	29.1 ± 8.4	
11–15	46	6(13.0%)	8(17.3%)	32(69.6%)	31.2 ± 10.5		8(17.3%)	12(26.1%)	26(56.5%)	11.2 ± 6.3		28(60.9%)	11(23.9%)	7(15.2%)	30.6 ± 8.2	
> 15	47	10(21.3%)	12(25.5%)	25(53.2%)	28.7 ± 11.3		13(27.7%)	17(37.0%)	17(36.1%)	8.8 ± 5.3		22(47.8%)	19(40.4%)	6(12.8%)	32.8 ± 7.2	
Average working hours a week																
≤ 30	5	0(0.0%)	2(40.0%)	3(60.0%)	32.2 ± 10.0	**0.001**	1(20.0%)	2(40.0%)	2(40.0%)	11.0 ± 6.3	0.474	3(60.0%)	1(20.0%)	1(20.0%)	33.2 ± 7.0	0.743
31–40	114	15(13.2%)	25(21.9%)	74(64.9%)	30.9 ± 11.3		16(14.0%)	34(29.8%)	64(56.1%)	11.5 ± 6.0		68(59.6%)	35(30.7%)	11(9.6%)	30.2 ± 8.4	
41–50	114	14(12.3%)	16(14.0%)	84(73.7%)	33.8 ± 11.5		21(18.4%)	30(26.3%)	63(55.3%)	11.8 ± 6.7		71(62.3%)	29(25.4%)	14(12.3%)	31.3 ± 7.4	
> 50	21	0(0.0%)	2(9.5%)	19(90.5%)	41.7 ± 10.4		3(14.3%)	4(19.0%)	14(66.7%)	13.9 ± 8.4		12(57.1%)	6(28.6%)	3(14.3%)	30.3 ± 8.1	
Average night shifts in one month																

Continued

Variable	*N*	Emotional exhaustion (EE)					Depersonalization (DP)					Personal accomplishment (PA)				
≤ 25%	64	12(18.8%)	16(25.0%)	36(56.3%)	29.2 ± 11.4	**0.014**	14(21.9%)	24(37.5%)	26(40.6%)	9.9 ± 6.4	**0.038**	33(51.6%)	22(34.4%)	9(14.1%)	31.5 ± 8.4	0.445
25–50%	74	5(6.8%)	15(20.3%)	54(73.0%)	33.9 ± 10.8		8(10.8%)	16(21.6%)	50(65.8%)	13.0 ± 6.4		47(63.5%)	18(24.3%)	9(12.2%)	29.5 ± 8.7	
50–75%	60	6(10.0%)	6(10.0%)	48(80.0%)	35.6 ± 11.9		10(16.7%)	16(26.7%)	34(56.7%)	12.2 ± 6.4		39(65.0%)	16(26.7%)	5(8.3%)	30.5 ± 7.5	
≥ 75%	56	6(10.7%)	8(14.3%)	42(75.0%)	34.0 ± 11.7		9(16.1%)	14(25.0%)	33(58.9%)	12.0 ± 6.7		35(62.5%)	15(26.8%)	6(10.7%)	31.3 ± 6.6	
Taking pharmaceuticals to help me sleep																
No	184	23(12.5%)	39(21.2%)	122(66.3%)	32.0 ± 11.5	**0.010**	34(18.5%)	56(30.4%)	94(51.1%)	11.5 ± 6.8	0.171	109(59.2%)	52(28.3%)	23(12.5%)	30.9 ± 7.9	0.413
Yes	70	6(8.6%)	6(8.6%)	58(82.9%)	36.1 ± 11.6		7(10.0%)	14(20.0%)	49(70.0%)	12.7 ± 5.8		45(64.3%)	19(27.1%)	6(8.6%)	30.0 ± 8.0	
Having alcoholic drinks																
No	107	16(15.0%)	17(15.9%)	74(69.2%)	32.6 ± 11.5	0.559	23(21.5%)	28(26.2%)	56(52.3%)	10.9 ± 6.3	0.071	63(58.9%)	31(29.0%)	13(12.2%)	30.4 ± 8.2	0.625
Yes	147	13(8.8%)	28(19.1%)	106(72.1%)	33.5 ± 11.8		18(12.2%)	42(28.6%)	87(59.2%)	12.4 ± 6.7		91(61.9%)	40(27.2%)	16(10.9%)	30.8 ± 7.7	
Exercise regularly																
No	106	12(11.3%)	18(17.0%)	76(71.7%)	33.3 ± 11.8	0.866	16(15.1%)	28(26.4%)	62(58.5%)	11.7 ± 6.3	0.890	71(67.0%)	24(22.6%)	11(10.4%)	29.4 ± 8.3	**0.033**
Yes	148	17(11.5%)	27(18.2%)	104(70.3%)	33.0 ± 11.6		25(16.9%)	42(28.4%)	81(54.7%)	11.9 ± 6.8		83(56.1%)	47(31.8%)	18(12.2%)	31.5 ± 7.5	

Table 1. The demographics of the included participants and the differences in MBI scales.

Variable	*N*	Resilience level							
		Very low	Low	On the low end	Moderate	Moderate high	High	M ± SD	P-value
All	**254**	**30(11.8%)**	**40(15.7%)**	**70(27.6%)**	**71(28.0%)**	**34(13.4%)**	**9(3.5%)**	**70.7 ± 12.3**	NA
Age									
20–29	119	21(17.7%)	21(17.7%)	37(31.1%)	23(19.3%)	12(10.1%)	5(4.2%)	68.3 ± 13.3	**0.001**
30–39	92	9(9.8%)	17(18.5%)	24(26.1%)	25(27.2%)	14(15.2%)	3(3.3%)	71.1 ± 12.0	
40–49	39	0(0%)	2(5.1%)	9(23.1%)	20(51.3%)	7(17.9%)	1(2.6%)	76.6 ± 6.6	
> 50	4	0(0%)	0(0%)	0(0%)	3(75.0%)	1(25.0%)	0(0%)	80.3 ± 4.1	
Occupation									
Physician	46	7(15.2%)	6(13.0%)	11(23.9%)	15(32.6%)	7(15.2%)	0(0%)	70.8 ± 11.8	0.967
Nurse	208	23(11.1%)	34(16.3%)	59(28.4%)	56(26.9%)	27(13.0%)	9(4.3%)	70.7 ± 12.4	
Workplace									
ER	133	17(12.8%)	22(16.5%)	35(26.3%)	35(26.3%)	19(14.3%)	5(3.8%)	70.7 ± 12.1	0.919
ICU	121	13(10.7%)	18(14.9%)	35(28.9%)	36(29.8%)	15(12.4%)	4(3.3%)	70.8 ± 12.5	
Marital status									
Single	154	23(14.9%)	32(20.8%)	44(28.6%)	34(22.1%)	16(10.4%)	5(3.3%)	68.6 ± 12.9	**0.001**
Married	100	7(7.0%)	8(8.0%)	26(26.0%)	37(37.0%)	18(18.0%)	4(2.0%)	74.0 ± 10.5	
Previous work experience in ED/ICU									
No	190	24(12.6%)	34(17.9%)	51(26.8%)	52(27.4%)	21(11.1%)	8(4.2%)	70.0 ± 12.7	0.097
Yes	64	6(9.4%)	6(9.4%)	19(29.7%)	19(29.7%)	13(20.3%)	1(1.6%)	72.9 ± 10.6	
The length of time of being critical healthcare professional (years)									
1–5	105	20(19.1%)	22(21.0%)	30(28.6%)	17(16.2%)	11(10.5%)	5(4.8%)	67.7 ± 13.5	**< 0.001**
6–10	56	7(12.5%)	9(16.1%)	19(33.9%)	13(23.2%)	8(14.3%)	0(0%)	69.4 ± 11.7	
11–15	46	3(6.5%)	6(13.0%)	10(21.7%)	18(39.1%)	6(13.0%)	3(6.5%)	73.5 ± 11.8	
> 15	47	0(0%)	3(6.4%)	11(23.4%)	23(48.9%)	9(19.1%)	1(2.1%)	76.5 ± 7.2	
Using pharmaceuticals for sleep aid									
No	184	22(12.0%)	30(16.3%)	49(26.6%)	50(27.2%)	27(14.7%)	6(3.3%)	71.0 ± 12.2	0.549
Yes	70	8(11.4%)	10(14.3%)	21(30.0%)	21(30.0%)	7(10.0%)	3(4.3%)	70.0 ± 12.5	
Having alcoholic drinks									
No	107	14(8.2%)	21(19.6%)	32(29.9%)	23(21.5%)	12(11.2%)	5(4.7%)	69.6 ± 12.8	0.194
Yes	147	16(10.9%)	19(12.9%)	38(25.9%)	48(32.7%)	22(15.0%)	4(2.7%)	71.6 ± 11.8	
Exercise regularly									
No	106	17(16.0%)	19(17.9%)	29(27.4%)	23(21.7%)	12(11.3%)	6(5.7%)	69.4 ± 13.4	0.144
Yes	148	13(8.8%)	21(14.2%)	41(27.7%)	48(32.4%)	22(14.9%)	3(2.0%)	71.7 ± 11.4	

Table 2. The demographics of the included participants and the differences in RS-14 scales.

		Emotional exhaustion	Depersonalization	Personal accomplishment	Resilience score
Emotional exhaustion	Person correlation	1	0.717	−0.165	−0.375
	Sig.(2-tailed)	.	**0.000**	**0.008**	**0.000**
Depersonalization	Person correlation	0.717	1	−0.192	−0.290
	Sig.(2-tailed)	**0.000**	.	**0.002**	**0.000**
Personal accomplishment	Person correlation	−0.165	−0.192	1	0.531
	Sig.(2-tailed)	**0.008**	**0.002**	.	**0.000**
Resilience score	Person correlation	−0.375	−0.290	0.531	1
	Sig.(2-tailed)	**0.000**	**0.000**	**0.000**	.

Table 3. Pearson's correlation coefficients between total resilience scores and each MBI subscale. *Correlation is significant at the 0.01 level (2-tailed).

A comparison of stress levels when caring for COVID-19 patients before and after the COVID-19 pandemic

As shown in Appendix Table 3, 40.1% of healthcare workers reported that, during the pandemic, they frequently or almost always found caring for COVID-19 patients highly stressful. In the post-pandemic period, only 11.1% reported feeling that way. In contrast, 32.7% of healthcare workers after the pandemic stated that caring for COVID-19 patients was almost stress-free, compared with only about 6.3% during the pandemic.

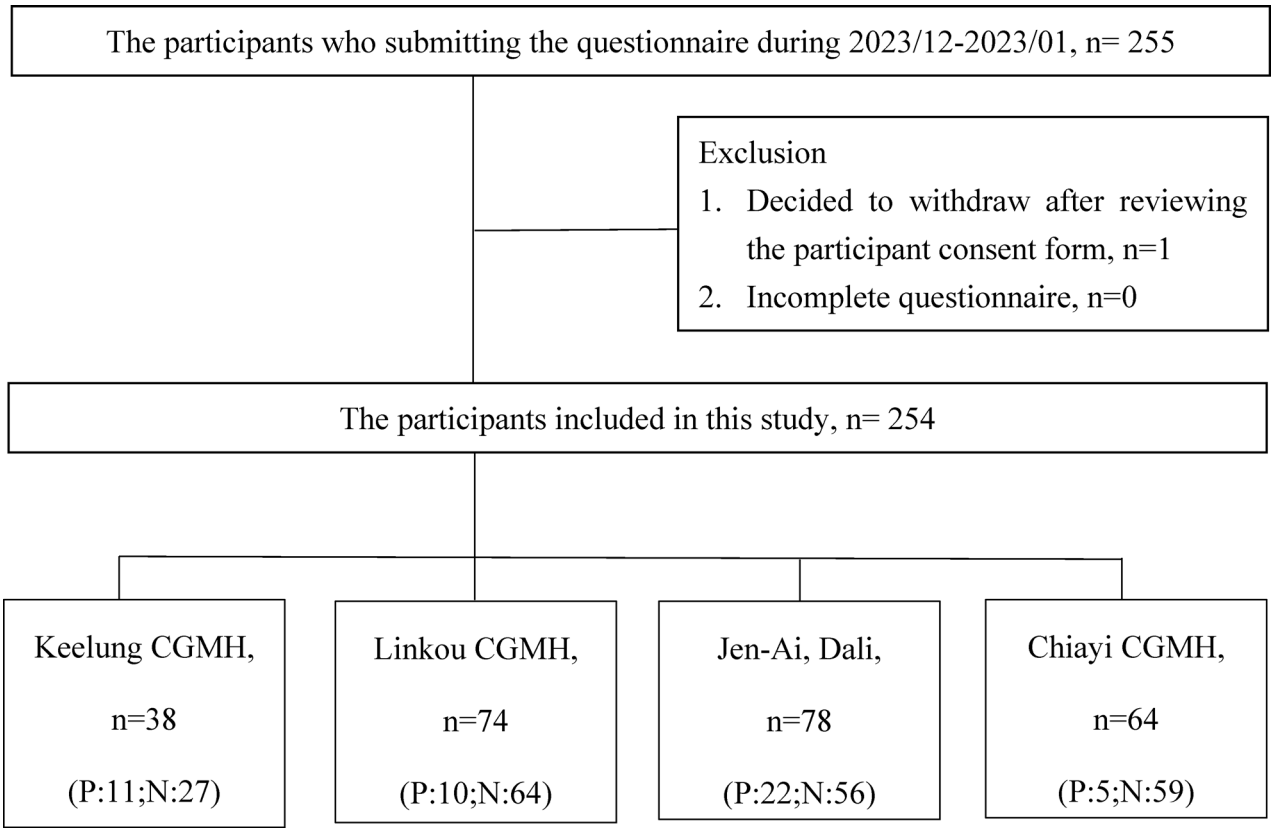

Fig. 1. The study flowchart.

The distribution of workplace stressors and the coping strategies for workplace adversity

Appendix Fig. 1 highlights workplace stressors reported by physicians and nurses, showing differences between groups. Nurses most often cited workload burden (73.6%), administrative tasks (63.0%), and limited vacation time (61.5%), while physicians reported workload burden (39.1%), fear of inadequate capabilities (37.0%), and shift work stress (34.8%).

Appendix Fig. 2 outlines coping strategies. Both groups prioritized time with friends or family (74% vs. 65.2%), sleep (63.0% vs. 58.7%), and social media use (60.1% vs. 47.8%). Physicians were more likely to exercise (39.1% vs. 15.9%) or play games (34.8% vs. 25.5%). Notably, only 1.18% sought help from counselors or therapists.

Discussion

In Taiwan, the National Health Insurance (NHI) system provides universal, convenient, and affordable healthcare to all citizens, consistently maintaining a high satisfaction rate[59]. However, in recent years, the increasing volume of patient visits, overcrowding in emergency departments, and the high ICU occupancy rates have posed significant challenges[60–63]. Our study found that burnout rates among Taiwan's critical care professionals remain high. This persists even though stress levels associated with caring for COVID-19 patients have declined (Appendix Table 3), suggesting that the COVID-19 pandemic alone does not fully explain the observed burnout. In addition to personal characteristics, the quality of working relationships, the exposure to end-of-life issues[63], structural challenges within the NHI system, including shortages of critical healthcare personnel, insufficient compensation, and excessive working hours may contribute to burnout[64,66,67,67].

Being a critical care professional entails a high risk of burnout compared to other specialties due to the nature of the job[18,68–70]. Taiwan leads in the number of adult critical care beds among Asian countries, with 28.5 beds per 100,000 population, compared to the average of 3.6 beds per 100,000 population[64]. In Taiwan, the physician-to-population and nurse-to-population ratios are lower than in most Organization for Economic Cooperation and Development (OECD) countries, with 2.2 physicians and 7.9 nurses per 1,000 people, compared to the OECD averages of 3.6 and 9.6 per 1,000, respectively[65,67,67]. Therefore, in our study, the reason we found no significant difference in burnout between physicians and nurses may be because both groups had heavy workloads and suffered from high burnout[18]. Additionally, increased shift work or working hours were shown to have detrimental effects on burnout and resilience. One-third of critical care professionals reported stress related to shift work, and over 70% of nurses experienced a workload burden (Appendix Fig. 2). While other studies have shown nurses suffered from more burnout[71], the variation between countries may reflect the difference in organization-level healthcare systems.

Further analysis of the demographic features reveals that younger, less experienced individuals are at a higher risk of burnout, consistent with the findings from previous studies[72–75]. This contrasts with the notion

that burnout primarily affects those in late career stages[1,76,77]. This trend may be associated with the increasing workplace stressor resulting from the shortage of critical professionals. According to a survey by the Taiwan Ministry of Health and Welfare, one nurse in Taiwan cares for an average of 9 to 15 patients. Notably, younger individuals comprise most critical healthcare professionals in Taiwan. Workload burden, vacation shortage, extra administrative tasks, and lacking staff were common work stressors mentioned (Appendix Fig. 1). Therefore, it's not surprising that the turnover rate for nurses is as high as 14.5% annually, with most nurses leaving within an average of 6.5 years, according to the Taiwan Ministry of Health and Welfare's 2023 survey[78,79].

Undoubtedly, maintaining a work-life balance is a strong protective factor against burnout[80,81]. Drawing from the theory of work-family enrichment, research suggests that married individuals tend to experience better job satisfaction by actively engaging in their parental roles[82]. Recent studies conducted during the COVID-19 pandemic have highlighted the significant moderating role of family support in mitigating burnout across various dimensions and enhancing subjective wellbeing[83,84]. Despite the inherent stresses of parenthood, the protective effects of marriage can be attributed to active involvement in parental responsibilities, lifestyle changes, and participation in leisure activities with family members[85]. Consistent with prior research, our study found that married individuals exhibited lower levels of EE and DP, alongside significantly higher resilience scores compared to their unmarried counterparts[86]. Additionally, the significance of family support is also reflected in the fact that spending time with family was discovered to be the most adopted coping strategy for reducing burnout (Appendix Fig. 2).

Resilience shares a strong association with burnout, particularly in maintaining a balance between work and personal life. It serves as a protective factor by enabling individuals to effectively manage stress. Fostering resilience has been shown to both directly and indirectly reduce burnout and enhance mental health among healthcare professionals[87,89,89]. Higher resilience also results in enhanced autonomy, decreased compassion fatigue, development of optimism, and purpose in life[90]. According to the study by Pedro Ferreira et al.[45], a 1% increase in resilience is associated with a 1.7% reduction in EE and DP, and about a 5% increase in PA, which the results are in line with the previous hypotheses and studies[87,91]. In our study, high resilience was discovered to have a negative moderate correlation with EE and DP and a positive moderate correlation with PA. Nowadays, multiple resilience training programs targeting vulnerable populations have been designed and already proven effectively[28,92–94].

Individual sociodemographic characteristics and regions significantly influence resilience[45,47,88]. In our study, younger, less experienced, and unmarried individuals were identified as high-risk groups with lower resilience. While younger individuals may possess greater physical resilience due to their overall health and fitness, senior healthcare professionals often have more experience and are better equipped to manage stress in rapidly changing clinical environments[43]. Besides, inconclusive results were obtained regarding the relationship between occupation and resilience. We found no significant resilience differences between physicians and nurses, despite the differences in their work nature and workplace stress[45,94]. By identifying vulnerable populations, understanding the work stress within each group, and leveraging local data, interventions can be tailored more precisely at the individual or organizational level. Prioritizing the well-being of healthcare staff forms the foundation for improving the quality of care, lowering medical expenditures, and reducing turnover rates.

The adoption of dysfunctional coping strategies may be associated with increased EE and DP. Therefore, accurately identifying and promoting effective coping strategies is essential for mitigating burnout and fostering resilience among healthcare professionals[95–98]. As for the coping strategies used by the included participants. Spending time with friends or family was the most common strategy, followed by sleeping, using technology or social media, and traveling. Contrary to previous survey in Asian ICUs, religiosity plays a minor role in addressing burnout[18]. Our findings align with previous research, highlighting social support as a prevalent and vital strategy for coping with stress and burnout[98]. Robust social support and connections within the workplace cultivate a sense of belonging, potentially enhancing morale and resilience in the face of challenges or stressors. This approach leads to higher PA and lower DP. In contrast, constantly avoiding or escaping work-related stressors may hinder individuals from effectively addressing them, resulting in a decline in perceived competence and effectiveness in fulfilling work-related tasks[99,100]. However, healthcare professionals in our study were less likely to engage in exercise or seek psychological counseling or support sessions. This highlights the potential value of institution-led initiatives that actively arrange such activities, thereby encouraging staff to adopt or learn more comprehensive and effective mental health care practices.

Based on the cultural context of Taiwan and our study findings, several feasible recommendations to mitigate burnout and enhance resilience are proposed. At the individual level, strategies include practicing physical and emotional self-care, cultivating regular exercise habits, fostering strong social connections and maintaining a healthy work–family balance[101]. At the organizational level, suggested interventions include regulating the number of workdays and shifts per month, fostering a supportive work environment, minimizing unnecessary administrative tasks and extracurricular competitions, and providing financial incentives such as salary increases or tax benefits. Ensuring the well-being of healthcare professionals is fundamental to improving care quality, decreasing medical costs, and minimizing workforce attrition.

Conclusion

The persistently high prevalence of burnout (overall rate: 35.4%) and low resilience (mean score: 70.7 ± 12.3) among critical healthcare professionals during the post-pandemic era in Taiwan is concerning. Younger, less experienced, and unmarried individuals represent potentially vulnerable populations susceptible to burnout and lower resilience. Higher resilience correlated with lower EE and DP, as well as higher PA. These findings highlight the importance of identifying vulnerable subgroups and implementing context-specific strategies to enhance resilience and support the mental well-being of healthcare professionals.

Strength and limitations

This study has several Limitations that should be considered. First, it employed a cross-sectional design conducted in the post-pandemic era across four hospitals within a single healthcare system, Limiting causal inference and preventing longitudinal comparisons from the pandemic period. Relevant longitudinal Literature for reference was lacking, especially in Asia. Second, despite using a widely accepted definition, the lack of a universal definition of burnout requires caution when comparing results across studies. Third, the assessment of coping strategies relied on a self-developed questionnaire, which primarily included emotion-focused strategies and leisure-related activities, was not adapted from a standardized scale, and lacked formal psychometric validation. This may limit the comprehensiveness of the findings, and future research should adopt validated instruments to further explore the impact of coping strategies on burnout and resilience. Fourth, the study had a 51% response rate, and as an online, voluntary survey, it is inherently susceptible to non-response bias. While anonymity and a concise questionnaire likely improved response accuracy and reduced social desirability bias, caution is warranted in interpreting the results. Finally, gender information was not collected due to privacy concerns, particularly in units with significant gender imbalance, which limited the ability to examine gender-specific differences. Future studies should consider including gender as a variable to investigate its influence on mental health outcomes among healthcare professionals.

Data availability

The data underlying this article are available in the article and in its online supplementary material.

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Author contributions

JWD, CHW: study design; YLL, JWD: evaluating the questionnaire's adequacy and data extraction; CHW: verified the extracted data; YLL, YCL: performed the statistical analysis; JWD, XWL, CHW: drift the manuscript; CHW: revised the manuscript; All authors read and approved the final manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

This research received approval from the Jen-Ai Hospital Institutional Review Board (IRB Number: 202300084B0). All participants fully understood the study's goal and reviewed the informed consent form before proceeding.

Additional information

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Correspondence and requests for materials should be addressed to C.-H.W.