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ORIGINAL

Professional burnout among physicians and nurses in Asian intensive care units: a multinational survey

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Abstract

Purpose: Professional burnout is a multidimensional syndrome comprising emotional exhaustion, depersonalization, and diminished sense of personal accomplishment, and is associated with poor staff health and decreased quality of medical care. We investigated burnout prevalence and its associated risk factors among Asian intensive care unit (ICU) physicians and nurses.

Methods: We conducted a cross-sectional survey of 159 ICUs in 16 Asian countries and regions. The main outcome measure was burnout as assessed by the Maslach Burnout Inventory-Human Services Survey. Multivariate random effects logistic regression analyses of predictors for physician and nurse burnout were performed.

Results: A total of 992 ICU physicians (response rate 76.5%) and 3100 ICU nurses (response rate 63.3%) were studied. Both physicians and nurses had high levels of burnout (50.3% versus 52.0%, $P = 0.362$). Among countries or regions, burnout rates ranged from 34.6 to 61.5%. Among physicians, religiosity (i.e. having a religious background or belief), years of working in the current department, shift work (versus no shift work) and number of stay-home night calls had a protective effect (negative association) against burnout, while work days per month had a harmful effect (positive association). Among nurses, religiosity and better work-life balance had a protective effect against burnout, while having a bachelor's degree (compared to having a non-degree qualification) had a harmful effect.

Conclusions: A large proportion of Asian ICU physicians and nurses experience professional burnout. Our study results suggest that individual-level interventions could include religious/spiritual practice, and organizational-level interventions could include employing shift-based coverage, stay-home night calls, and regulating the number of work days per month.

Keywords: Critical care, Intensive care units, Nurses, Physicians, Professional burnout

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Background

Professional burnout is a multidimensional syndrome comprising emotional exhaustion, depersonalization (establishment of detached, distant, and cynical relationships with patients and colleagues), and a diminished sense of personal accomplishment [1]. Burnout has been associated with depressive symptoms among healthcare staff, absenteeism, increased staff turnover, early retirement, substance abuse, decreased professionalism, medical errors and poor adherence to safety standards [2, 3]. In response, the Critical Care Societies Collaborative highlighted the deleterious consequences of burnout in ICUs, and called for further work to mitigate this problem [3].

Among intensive care unit (ICU) physicians and nurses, high levels of burnout (33–70%) are prevalent in Western countries [4–7]. However, no prior study has elucidated the prevalence and variation of burnout within Asian ICUs. The diversity of cultures makes it hard to extrapolate psychometric findings from the West to Asia. Some studies have shown that Chinese work values, comprising collectivism (prioritizing group goals over personal interests), endurance (patience and persistence), hard work (thrift and steadiness), and *guanxi* (relation orientation, respecting social order and protecting others' reputations), contribute to greater overall well-being [8]. Conversely, other studies have shown that Asian/Confucian values may exacerbate burnout [9, 10]. Moreover, unlike the US or Western Europe, Asia has a mix of high, middle, and low-income economies, and it is unclear if economic status and cultural/religious diversity influence burnout.

Given the dearth of knowledge of burnout in Asian ICUs, our primary aim was to examine the prevalence and variation of burnout among Asian ICU physicians and nurses. As knowing the risk factors for burnout can guide future interventions, our secondary aim was to examine organizational and individual risk factors for burnout among Asian ICU physicians and nurses.

Methods

From October 2015 to March 2016, we conducted the Stress And Burnout in Asian ICUs (SABA) study, which was a cross-sectional survey of physicians and nurses of Asian ICUs, using a snowball method of sampling via national coordinators. National coordinators invited ICU directors. ICU directors in turn provided basic information about their ICUs, and invited their staff to participate (see eMethods 1 of Online Resource for detailed methodology information). The research protocol was approved by the relevant institutional review boards in each country and all participants provided informed consent.

Take home message

Among 992 physicians and 3100 nurses from 159 ICUs in 16 Asian countries/regions, country-level burnout rates ranged from 34.6 to 61.5%.

Work demand and work-life imbalance appear to be the predominant risk factors, and religiosity had a protective effect, which could guide individual-level and organization-level interventions.

Participants self-completed an anonymized web-based survey delivered using SurveyMonkey™ (see eMethods 2 of Online Resource). For the participant survey, we employed the following psychometric instruments: Maslach Burnout Inventory—Human Services Survey (22-questions) [2, 11]; Cohen Perceived Stress Scale (10-question version) [12, 13]; Patient Health Questionnaire for depression screening (2-question version) [14]. All ICU directors completed an additional web-based survey, which collected information on organizational characteristics (see eMethods 3 of Online Resource). Countries and regions were grouped according to the World Bank 2015 classification (http://data.worldbank.org/about/country-classifications/country-and-lending-groups), with China, Hong Kong and Taiwan considered separately.

Univariate and multivariate logistic regression analyses were performed as mixed effects analyses using high burnout as the outcome variable, intensive care unit as the random intercept, and ten integration points. Quantitative analysis was done with Stata 13.1 (StataCorp, College Station, Texas). Statistical significance was taken as $P < 0.05$. Thematic analysis was done for the free-text comments [15], which were given in response to the question "please let us know any other reasons & solutions for burnout". Lexical analysis was done for comments given in English.

Results

Of 193 ICUs approached, 159 (82.4%) from 16 countries agreed to contribute participant data. Among the latter ICUs, 1296 physicians were approached with 992 (76.5%) completing the survey, and 4895 nurses with 3100 (63.3%) completing the survey. Among participants, significant differences existed between physicians and nurses in terms of demographics, lifestyle factors, and work-related factors (see eTables 1–3 of Online Resource). Among ICUs, no significant differences existed between ICUs who participated in the survey (i.e. contributed participant data) and ICUs who did not participate, except for a slightly shorter (by 0.25 h) median ICU visitation duration for ICUs which did not participate (Table 1).

Table 1 Intensive care unit characteristics

Characteristics	All (*N* = 193)	Participated (*N* = 159)	Did not participate (*N* = 34)	*P* value
Country or region				
East Asia (%)	101 (52.3)	79 (49.7)	22 (64.7)	0.339[h]
China	37	27	10	
Hong Kong	8	8	0	
Japan	31	25	6	
South Korea	1	0	1	
Taiwan	24	19	5	
Middle East (%)	10 (5.2)	10 (6.3)	0 (0.0)	
Saudi Arabia	9	9	0	
United Arab Emirates	1	1	0	
South Asia (%)	24 (12.4)	21 (13.2)	3 (8.8)	
Bangladesh	12	12	0	
India	8	6	2	
Nepal	4	3	1	
Southeast Asia (%)	58 (30.1)	49 (30.8)	9 (26.5)	
Brunei	1	1	0	
Indonesia	12	10	2	
Laos	1	1	0	
Philippines	8	5	3	
Singapore	11	11	0	
Thailand	24	20	4	
Vietnam	1	1	0	
World Bank income group (2015)				
Low and lower-middle[a] (%)	46 (23.8)	38 (23.9)	8 (23.5)	0.388
Upper-middle[b] (%)	61 (31.6)	47 (29.6)	14 (41.2)	
High[c] (%)	86 (44.6)	74 (46.5)	12 (35.3)	
Median number of hospital beds (IQR)	875 (375–1125)	875 (375–1125)	1125 (375–1125)	0.757
Median number of ICU beds (IQR)	17 (12–23)	17 (12–23)	12 (12–17)	0.175
Type of hospital				
Teaching (public) (%)	113 (58.6)	94 (59.1)	19 (55.9)	0.762
Teaching (private) (%)	32 (16.6)	26 (16.4)	6 (17.7)	
Non-teaching (public) (%)	25 (13.0)	19 (12.0)	6 (17.7)	
Non-teaching (private) (%)	23 (11.9)	20 (12.6)	3 (8.8)	
Type of ICU by patient condition				
Medical (%)	45 (23.3)	36 (22.6)	9 (26.5)	0.805
Surgical (%)	21 (10.9)	17 (10.7)	4 (11.8)	
Mixed (%)	127 (65.8)	106 (66.7)	21 (61.8)	
Type of ICU by patient age				
Adult (%)	137 (71.0)	115 (72.3)	22 (64.7)	0.408
Mixed (%)	56 (29.0)	44 (27.7)	12 (35.3)	
Daily number of new ICU admissions, median (IQR)	3 (2–5)	3 (2–5)	3 (2–4)	0.674
ICU attending coverage intensity				
Ad hoc only (%)	6 (3.1)	5 (3.1)	1 (2.9)	0.242
Office-hour only (%)	35 (18.1)	32 (20.1)	3 (8.8)	
24-hour (%)	152 (78.8)	122 (76.7)	30 (88.2)	
ICU attending coverage model				
Closed[d] (%)	126 (65.3)	107 (67.3)	19 (55.9)	0.443
Mandatory[e] (%)	54 (28.0)	42 (26.4)	12 (35.3)	
Elective[f] (%)	7 (3.6)	5 (3.1)	2 (5.9)	
Nil[g] (%)	6 (3.1)	5 (3.1)	1 (2.9)	

Table 1 (continued)

Characteristics	All (*N* = 193)	Participated (*N* = 159)	Did not participate (*N* = 34)	*P* value
ICU visitation policy for family members				
Fixed hours (%)	152 (78.8)	125 (78.6)	27 (79.4)	1.000
Flexible hours (%)	41 (21.2)	34 (21.4)	7 (20.6)	
ICU visitation hours for family members, median (IQR)	2 (1–4.5)	2 (1–5)	1.75 (0.5–3)	0.038
Median ICU length of stay				
0–2 days (%)	10 (5.2)	9 (5.7)	1 (2.9)	0.559
3–5 days (%)	85 (44.0)	73 (45.9)	12 (35.3)	
6–8 days (%)	58 (30.1)	47 (29.6)	11 (32.4)	
> 8 days (%)	22 (11.4)	17 (10.7)	5 (14.7)	
Unknown (%)	18 (9.3)	13 (8.2)	5 (14.7)	
Hospital survival of ICU patients				
0–24% (%)	6 (3.1)	5 (3.1)	1 (2.9)	0.552
25–49% (%)	16 (8.3)	12 (7.6)	4 (11.8)	
50–74% (%)	58 (30.1)	46 (28.9)	12 (35.3)	
75–100% (%)	80 (41.5)	66 (41.5)	14 (41.2)	
Unknown (%)	33 (17.1)	30 (18.9)	3 (8.8)	

ICU Intensive care unit, *IQR* interquartile range

[a] Includes Bangladesh, India, Indonesia, Laos, Nepal, Philippines, Vietnam

[b] Includes China, Thailand

[c] Includes Brunei, Hong Kong, Japan, Saudi Arabia, Singapore, South Korea, Taiwan, United Arab Emirates

[d] Closed ICU (the intensivist is the primary attending physician)

[e] Mandatory critical care consultation (the intensivist is not the primary attending physician but every patient receives a critical care consultation)

[f] Elective critical care consultation (the intensivist is involved only when the attending physician requests)

[g] No critical care physician (intensivists unavailable)

[h] Fisher exact test done for the following four regional groups: East Asia, Middle East, South Asia and Southeast Asia

Among physicians and nurses, both groups shared similarly high levels of burnout (physicians 50.3%, nurses 52.0%, $P = 0.362$), stress, and possible depression (Table 2). Positive correlations between high burnout and stress/depression existed (all correlation P values < 0.001). For physicians, high burnout had no significant associations with treatment guideline agreement or adherence. Conversely, for nurses, high burnout had significant negative associations with treatment guideline agreement or adherence (Table 2). Among countries or regions, burnout rates ranged from 34.6% (Bangladesh) to 61.5% (Hong Kong), with the upper-middle income group having the highest average burnout rates compared to both the lower and higher income groups (Table 3).

Multivariate random effects logistic regression analysis of predictors for burnout among physicians showed a protective effect (negative association) of religiosity (i.e. having a religious background or belief), years of working in the current department, shift work (versus no shift work) and number of stay-home night calls, and a harmful effect (positive association) of work days per month (Table 4). The same analysis among nurses showed a protective effect of religiosity and better work-life balance, and a harmful effect of having a bachelor's degree (compared to having a non-degree qualification) (Table 5).

Among 992 physicians, 296 (29.8%) of them provided 519 comments. Among 3100 nurses, 954 (30.8%) of them provided 1636 comments. Thematic analysis of the free-text comments converged on six common themes, with high work demand and poor work-life balance being the predominant themes (see eTable 4 of Online Resource). Several comments also revealed suggestions for both individual-level and organizational-level interventions (see eTable 5 of Online Resource). 745 respondents provided English-language comments for lexical analysis. The top five non-conjunctive terms were "work" (177 words), "staff" (103), "salary" (96), "working" (84) and "time" (84) (see eFigure 1 of Online Resource).

Discussion

Our multinational cross-sectional survey among Asian ICUs showed that > 50% of physicians and nurses experienced professional burnout, with similar percentages between the two groups. Among countries or regions, burnout rates ranged from 34.6 to 61.5%. Among physicians, religiosity, years of working in the current

Table 2 Measures of well-being and guideline perception

Measure	All (*N* = 4092)	Physicians (*N* = 992)	Nurses (*N* = 3100)	*P* value
Maslach burnout inventory-human services survey				
EE subscale, score range 0–54				
Mean score (SD)	25.3(11.2)	24.7 (11.0)	25.4 (11.2)	0.099
Score 0–27 (low/moderate burnout) (%)	2413 (59.0)	596 (60.1)	1817 (58.6)	0.436
Score 28–54 (high burnout) (%)	1679 (41.0)	396 (39.9)	1283 (41.4)	–
DP subscale, score range 0–30				
Mean score (SD)	8.9 (6.2)	8.7 (6.0)	9.0 (6.3)	0.104
Score 0–10 (low/moderate burnout) (%)	2580 (63.1)	643 (64.8)	1937 (62.5)	0.186
Score 11–30 (high burnout) (%)	1512 (37.0)	349 (35.2)	1163 (37.5)	–
PA subscale, score range 0–48				
Mean score (SD)	32.3 (9.0)	32.0 (8.9)	32.5 (9.0)	0.119
Score 39–48 (low/moderate burnout) (%)	1913 (46.8)	449 (45.3)	1464 (47.2)	0.289
Score 0–33 (high burnout) (%)	2179 (53.3)	543 (54.7)	1636 (52.8)	–
Overall high burnout[a]				
No (%)	1989 (48.4)	493 (49.7)	1489(48.0)	0.362
Yes (%)	2110 (51.6)	499 (50.3)	1611 (52.0)	–
Cohen's perceived stress scale-10 (score range 0–40)				
Score, mean (SD)	18.1 (5.5)	18.1 (5.2)	18.0 (5.6)	0.906
Score 0–19 (%)	2162 (52.8)	527 (53.1)	1635 (52.7)	0.855
Score 20–40 (high stress) (%)	1930 (47.2)	465 (46.9)[d]	1465 (47.3)[e]	–
Patient health questionnaire-2 (score range 0–6)				
Score, mean (SD)	2.2 (1.5)	2.1 (1.5)	2.2 (1.5)	0.053
Score 1–2 (%)	2779 (67.9)	697 (70.3)	2082(67.2)	0.072
Score 3–6 (possible depression) (%)	1313 (32.1)	295 (29.7)[f]	1018 (32.8)[g]	–
Agreement with treatment guidelines in ICU[b] (Likert scale 0–10), median (IQR)	7 (5–8)	7 (6–8)[h]	7 (5–8)[i]	< 0.001
Quintile categories of agreement with treatment guidelines in ICU[b]				
1st quintile category, mean (median)	4.1 (5)	4.2 (5)	4.0 (5)	NA
2nd quintile category, mean (median)	6 (6)	6 (6)	6 (6)	
3rd quintile category, mean (median)	7 (7)	7 (7)	7 (7)	
4th quintile category, mean (median)	8.4 (8)	8.3 (8)	8.4 (8)	
5th quintile category, mean (median)	10 (10)	10 (8)	10 (10)	
Adherence with treatment guidelines in ICU[c] (Likert scale 0–10), median (IQR)	7 (5–9)	7 (6–9)[j]	7 (5–9)[k]	< 0.001
Quintile categories of adherence with treatment guidelines in ICU[b]				
1st quintile category, mean (median)	4.1 (5)	4.3 (5)	4.0 (5)	NA
2nd quintile category, mean (median)	6.6 (7)	6.6 (7)	6.6 (7)	
3rd quintile category, mean (median)	8 (8)	8 (8)	8 (8)	
4th quintile category, mean (median)	9 (9)	9 (9)	9 (9)	
5th quintile category, mean (median)	10 (10)	10 (10)	10 (10)	

DP Depersonalization, *EE* emotional exhaustion, *NA* not applicable, *PA* personal accomplishment, *SD* standard deviation

[a] Overall high burnout is determined by a high score on the emotional exhaustion or depersonalization subscale of the Maslach Burnout Inventory

[b] Based on the survey question "How much do you agree with the treatment guidelines in your ICU?"

[c] Based on the survey question "How keen are you in following the treatment guidelines in your ICU?"

[d] Positively associated with high burnout (phi coefficient 0.259, $P < 0.001$)

[e] Positively associated with high burnout (phi coefficient 0.332, $P < 0.001$)

[f] Positively associated with high burnout (point-biserial correlation 0.236, $P < 0.001$)

[g] Positively associated with high burnout (point-biserial correlation 0.265, $P < 0.001$)

[h] No significant association with high burnout (point-biserial correlation − 0.018, $P = 0.574$)

[i] Negatively associated with high burnout (point-biserial correlation − 0.054, $P = 0.003$)

[j] No significant association with high burnout (point-biserial correlation − 0.043, $P = 0.172$)

[k] Negatively associated with high burnout (point-biserial correlation − 0.040, $P = 0.025$)

Table 3 Prevalence of burnout by country or region

Characteristics	All (*N* = 4092)	Participants with burnout (*N* = 2110)	*P* value
Country or region, by alphabetical order			
Bangladesh (% within each country/region)	341	118 (34.6)	< 0.001
China (% within each country/region)	855	523 (61.2)	
Hong Kong (% within each country/region)	260	160 (61.5)	
India (% within each country/region)	177	98 (55.4)	
Indonesia (% within each country/region)	61	30 (49.2)	
Japan (% within each country/region)	309	131 (42.4)	
Philippines (% within each country/region)	97	39 (40.3)	
Saudi Arabia (% within each country/region)	799	371 (46.4)	
Singapore (% within each country/region)	354	181 (51.1)	
Taiwan (% within each country/region)	420	267 (63.5)	
Thailand (% within each country/region)	171	81 (47.4)	
Others[1] (% within each country/region)	248	111 (44.8)	
Country or region, by World Bank income group (2015)			
Low and lower-middle			< 0.001
Bangladesh (% within each country/region)	341	118 (34.6)	
India (% within each country/region)	177	98 (55.4)	
Indonesia (% within each country/region)	61	30 (49.2)	
Philippines (% within each country/region)	97	39 (40.3)	
Upper-middle			
China (% within each country/region)	855	523 (61.2)	
Thailand (% within each country/region)	171	81 (47.4)	
High			
Hong Kong (% within each country/region)	260	160 (61.5)	
Japan (% within each country/region)	309	131 (42.4)	
Saudi Arabia (% within each country/region)	799	371 (46.4)	
Singapore (% within each country/region)	354	181 (51.1)	
Taiwan (% within each country/region)	420	267 (63.5)	
Others			
Others[a] (% within each country/region)	248	111 (44.8)	
World Bank income group (2015)			
Low and lower-middle[b] (% within in group)	833	346 (41.5)	< 0.001
Upper-middle[c] (% within in group)	1026	604 (58.9)	
High[d] (% within in group)	2233	1160 (52.0)	

UAE United Arab Emirates

[a] Countries with < 5 participating intensive care units, i.e. Brunei, Laos, Nepal, United Arab Emirates, Vietnam

[b] Includes Bangladesh, India, Indonesia, Laos, Nepal, Philippines, Vietnam

[c] Includes China, Thailand

[d] Includes Brunei, Hong Kong, Japan, Saudi Arabia, Singapore, Taiwan, United Arab Emirates

department, shift work and stay-home night calls were associated with decreased burnout, while work days per month was associated with increased burnout. Among nurses, religiosity and better work-life balance were associated with decreased burnout, while having a bachelor's degree (versus a vocational certification) was associated with increased burnout. Thematic analysis of the free-text comments converged on six common themes, with high work demand and poor work-life balance being the predominant themes. Lexical analysis revealed a predominance of terms related to workload.

As critical care work involves high-stakes decision-making, conflicts over goals of care, and increasing protocol-use (leading to loss of management autonomy), we expected elevated burnout levels among Asian intensive care physicians and nurses [3, 16, 17]. Overall burnout rates among ICU physicians in our survey (50%) were higher than rates among Singaporean and Hong Kong

Table 4 Analysis of predictors for burnout among physicians (*N* = 992)

Characteristics	Univariate[f] OR (95% CI)	Univariate *P* value	Multivariate[f] OR (95% CI)	Multivariate *P* value
Gender				
Male	Reference			
Female	0.78 (0.58–1.06)	0.111	0.81 (0.60–1.11)	0.196
Age in years[a]	1.00 (0.98–1.01)	0.720	–	–
Having a religious background or belief	0.66 (0.48–0.90)	0.009	0.69 (0.49–0.96)	0.027
Marital status				
Single, separated or widowed	Reference			
Attached or married	1.02 (0.74–1.41)	0.892	–	–
Number of children	0.91 (0.81–1.02)	0.105	0.99 (0.87–1.12)	0.822
Highest educational qualification				
Non-degree qualification	Reference			
Bachelor's degree	0.94 (0.51–1.76)	0.853	–	–
Advanced degree	1.19 (0.65–2.17)	0.573	–	–
Monthly salary in thousands of USD[b]	1.03 (0.95–1.11)	0.446	–	–
Smoking status				
Smoker	Reference	0.259		
Ex-smoker	1.39 (0.79–2.45)	0.411	–	–
Never smoker	1.23 (0.75–1.99)		–	–
Hours of sleep per day	1.01 (0.89–1.13)	0.908	–	–
Hours per week engaged in exercise	1.02 (0.99–1.06)	0.193	1.03 (0.99–1.06)	0.166
Hours per week engaged in teaching	1.00 (0.98–1.02)	0.879	–	–
Hours per week engaged in charity work	1.01 (0.99–1.03)	0.523	–	–
Hours per week engaged in research	1.00 (0.98–1.02)	0.726	–	–
Member of an ICU research group	0.92 (0.69–1.22)	0.555	–	–
Personal control over work (Likert scale 0–10)	0.97 (0.91–1.03)	0.295	–	–
Personal control over life outside of work (Likert scale 0–10)	1.00 (0.94–1.05)	0.884	–	–
Vacation days taken per year[c]	0.99 (0.98–1.00)	0.143	1.00 (0.99–1.01)	0.737
Work-life balance[d]	0.92 (0.81–1.04)	0.201	–	–
Primary specialty				
Non-intensive care medicine	Reference			
Intensive care medicine	1.09 (0.82–1.45)	0.569	–	–
Number of years since graduation from medical or nursing school[e]	0.99 (0.97–1.01)	0.280	–	–
Years of intensive care working experience	0.99 (0.97–1.01)	0.547	–	–
Years of work in current institution	0.99 (0.97–1.01)	0.392	–	–
Years of work in current department	0.97 (0.95–0.99)	0.041	0.97 (0.95–1.00)	0.037
Work days per month	1.03 (1.01–1.05)	0.016	1.03 (1.00–1.05)	0.030
Work hours per day	1.02 (0.98–1.07)	0.327	–	–
Percentage of work time spent in ICU	1.00 (1.00–1.01)	0.329	–	–
Average of each ICU rotation				
0–2 weeks	Reference			
> 2 weeks	1.02 (0.77–1.34)	0.895	–	–
Shift work				
No	Reference			
Yes	0.80 (0.59–1.07)	0.135	0.68 (0.49–0.93)	0.016
Stay-in night calls per month	0.99 (0.95-1.02)	0.399	–	–
Stay-home night calls per month	0.98 (0.96-1.00)	0.048	0.98 (0.95–1.00)	0.035
Number of ICU patients cared for per day	0.99 (0.97–1.01)	0.390	–	–
Conflicts with colleagues in past one month				

Table 4 (continued)

Characteristics	Univariate[f] OR (95% CI)	Univariate *P* value	Multivariate[f] OR (95% CI)	Multivariate *P* value
No	Reference	0.661		
Yes	1.07 (0.78–1.48)		–	–

CI Confidence interval, *ICU* intensive care unit, *IQR* interquartile range, *OR* odds ratio, *SD* standard deviation, *USD* United States dollar

[a] Age is taken as 18 years for the age range < 21 years, 62 years for the age range > 60 years, and the middle number for the other age ranges

[b] Monthly salary is taken as USD11,000 if > USD10,000, and the middle number for the other salary ranges

[c] Vacation days per year is taken as 5 if 0–9, 15 if 10–19, 25 if 20–29, 35 if 30–39, and 45 if > 40

[d] Agreement with this statement: "My work schedule leaves me enough time for my personal/family life" (Likert scale 0–4, 0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree, 4 = strongly agree)

[e] Number of years since graduation taken as 0 for < 1, 43 for > 40, and the middle number of the other ranges

[f] Mixed effects logistic regression with high burnout as the outcome variable, a random intercept by intensive care unit, and using ten integration points

general physicians in public practice (31%) ($P < 0.02$ for both comparisons) [18, 19]. Similarly, burnout scores among ICU nurses in our study were higher than scores among general nurses in China (e.g. mean emotional exhaustion score of 25.4 versus 23.9, $P = 0.002$) [20]. Nonetheless, our data suggest that overall burnout levels in Asian ICUs are comparable to those in Western ICUs [3, 4, 6, 7], and comparable to US physicians performing front-line medical care (family medicine, emergency medicine, and general internal medicine) [3, 11].

Compared to ICU physicians, some studies have shown that ICU nurses suffer more from burnout [21], while other studies have shown the opposite [22], perhaps reflecting differences in work intensity and job staffing. Our study clarified that among Asian ICU staff, no significant differences between physicians and nurses exist. The wide variation of burnout rates between countries is reasonable, which reflect the work-related and organization-related differences inherent within different healthcare systems.

Our results also support the known associations of burnout with staff wellbeing and quality of patient care [23]. Burnout in Asian ICU physicians and nurses was positively associated with stress and possible depression. The high levels of stress (physicians 46.9%, nurses 47.3%) and possible depression (physicians 29.7%, nurses 32.8%) call for further action to manage these. In nurses, burnout was additionally associated with decreased agreement and keenness to adhere to treatment guidelines, which might then lead to poorer patient outcomes [24], emphasizing the clinical importance of burnout mitigation.

Several factors may be associated with burnout. Previously published individual-level factors included gender, age, marital status, educational level, number of children, number of vacations, lack of job support, academic responsibilities, participation in ICU research groups, length of work experience, respect between colleagues, and staff conflicts [5, 6, 25–28]. Previously published organizational-level factors included ICU visiting policies, patient-to-nurse ratio, shift work, shift duration, duration of each inpatient rotation, and public ownership of healthcare facilities [29–31]. From our study results, risk factors for burnout in Asian ICUs appear to involve high work load and work-life imbalance. Shift work availability, stay-home calls (but not stay-in calls) and better work-life balance were protective factors against burnout. Conversely, more work days per month predisposed to burnout among ICU physicians.

Burnout rates differed among World Bank income groups, with the upper-middle income group having higher levels of burnout than either the lower or higher income groups ($P < 0.001$ for both comparisons), and the highest income group having more burnout than the lowest group ($P < 0.001$). These associations may be due to an interaction between availability of job resources [32] and societal expectations. We postulate that the lowest income countries may have limited resources aligned with lower societal expectations; higher income countries may have a mismatch between available resources and high expectations. Nonetheless, on an individual level, burnout rates were not associated with personal income for physicians or nurses. It is possible healthcare personnel generally enjoy higher economic status within their respective societal circles and therefore income was not protective against burnout. This latter point was supported by our thematic analysis, which showed that workload was reported more frequently than reward as a theme for burnout.

Having a religious background or belief, compared to none, was a prominent protective factor against burnout in both ICU physicians and nurses in our study. Such an association has only recently been explored. Among Hong Kong mental health workers, higher levels of daily spiritual experience were associated with lower levels of burnout [33]. However, among a relatively small sample of 138 emergency medicine physicians, religion/spirituality had no significant association with burnout [34]. We

Table 5 Analysis of predictors for burnout among nurses (*N* = 3100)

Characteristics	Univariate[f] OR (95% CI)	Univariate *P* value	Multivariate[f] OR (95% CI)	Multivariate *P* value
Gender				
Male	Reference			
Female	1.07 (0.85–1.35)	0.555	–	–
Age in years[a]	1.00 (0.99–1.01)	0.493	–	–
Having a religious background or belief	0.75 (0.62–0.91)	0.004	0.79 (0.65–0.97)	0.023
Marital status				
Single, separated or widowed	Reference			–
Attached or married	0.96 (0.82–1.11)	0.567	–	
Number of children	0.98 (0.90–1.06)	0.640	–	–
Highest educational qualification				
Non-degree qualification	Reference			
Bachelor's degree	1.29 (1.07–1.56)	0.008	1.33 (1.10–1.61)	0.003
Advanced degree	1.34 (0.98–1.81)	0.064	1.34 (0.99–1.82)	0.061
Monthly salary in thousands of USD[b]	1.07 (0.99–1.15)	0.094	1.05 (0.97–1.13)	0.197
Smoking status				
Smoker	Reference			
Ex-smoker	0.72 (0.45–1.14)	0.160	0.71 (0.44–1.13)	0.169
Never smoker	0.84 (0.56–1.24)	0.372	0.84 (0.57–1.25)	0.390
Hours of sleep per day	1.00 (0.95–1.06)	0.891	–	–
Hours per week engaged in exercise	1.01 (1.00–1.02)	0.230	–	–
Hours per week engaged in teaching	1.00 (0.99–1.00)	0.548	–	–
Hours per week engaged in charity work	1.01 (1.00–1.02)	0.102	1.01 (1.00–1.02)	0.068
Hours per week engaged in research	1.01 (0.99–1.02)	0.354	–	–
Member of an ICU research group	0.92 (0.74–1.16)	0.492	–	–
Personal control over work (Likert scale 0–10)	0.97 (0.94–1.00)	0.032	0.97 (0.94–1.01)	0.115
Personal control over life outside of work (Likert scale 0–10)	0.98 (0.95–1.01)	0.302	–	–
Vacation days taken per year[c]	1.00 (0.99–1.01)	0.901	–	–
Work-life balance[d]	0.86 (0.79–0.92)	< 0.001	0.87 (0.81–0.95)	0.001
Primary specialty				
Non-intensive care medicine	Reference			
Intensive care medicine	1.06 (0.89–1.26)	0.518	–	–
Number of years since graduation from medical or nursing school[e]	1.00 (0.99–1.01)	0.914	–	–
Years of intensive care working experience	1.00 (0.99–1.01)	0.626	–	–
Years of work in current institution	1.00 (0.99–1.01)	0.822	–	–
Years of work in current department	1.01 (1.00–1.02)	0.165	–	–
Work days per month	0.99 (0.98–1.01)	0.460	–	–
Work hours per day	0.97 (0.94–1.01)	0.145	0.96 (0.93–1.00)	0.067
Percentage of work time spent in ICU	1.00 (1.00–1.00)	0.431	–	–
Average of each ICU rotation				
0–2 weeks	Reference	0.932	–	–
> 2 weeks	1.01 (0.86–1.18)			
Shift work				
No	Reference			
Yes	1.06 (0.83–1.37)	0.623	–	–
Stay-in night calls per month	1.01 (0.99–1.02)	0.437	–	–
Stay-home night calls per month	0.99 (0.98-1.01)	0.268	–	–
Number of ICU patients cared for per day	1.00 (0.98–1.02)	0.677	–	–

Table 5 (continued)

Characteristics	Univariate[f] OR (95% CI)	Univariate *P* value	Multivariate[f] OR (95% CI)	Multivariate *P* value
Conflicts with colleagues in past 1 month				
No	Reference			
Yes	0.96 (0.80–1.16)	0.676	–	–

CI Confidence interval, *ICU* Intensive Care Unit, *IQR* Interquartile range, *OR* Odds ratio, *SD* Standard deviation, *USD* United States Dollar

[a] Age is taken as 18 years for the age range < 21 years, 62 years for the age range > 60 years, and the middle number for the other age ranges

[b] Monthly salary is taken as USD11,000 if > USD10,000, and the middle number for the other salary ranges

[c] Vacation days per year is taken as 5 if 0–9, 15 if 10–19, 25 if 20–29, 35 if 30–39, and 45 if > 40

[d] Agreement with this statement: "My work schedule leaves me enough time for my personal/family life" (Likert scale 0–4, 0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree, 4 = strongly agree)

[e] Number of years since graduation taken as 0 for < 1, 43 for > 40, and the middle number of the other ranges

[f] Mixed effects logistic regression with high burnout as the outcome variable, a random intercept by intensive care unit, and using ten integration points

believe that further work studying the protective mechanisms of religiosity/spirituality would be important in mitigating burnout. A possible mechanism could be improved mindfulness [35], though the effect of religiosity/spirituality could also be mediated by observance of a rest day, worship attendance or healthy lifestyle practices [34].

Among ICU physicians, more years of work in the current department, unlike years of ICU experience or years of work in the current institution, was protective against burnout. This association might be due to either individuals with less burnout being more inclined to continue working in the same department, or a more constant working environment being protective against burnout, or both. Interestingly, among both ICU physicians and nurses, years of work in the current department was not significantly correlated with either age or educational status, suggesting that healthcare staff have occupational mobility. Nonetheless, the association between years of work in the current department and burnout was relatively small (odds ratio 0.95–1.00), and might not be worth further exploration.

A higher educational status among ICU nurses was associated with worse burnout scores in our study. This is in line with recent data showing that among all nurses at a tertiary hospital, nurses with diploma and advanced diploma educational qualification were more likely to experience high emotional exhaustion and depersonalization compared to those with only vocational training [36]. In the latter study, it was postulated that higher academic qualifications were associated with greater work responsibility, which was probably the case in our survey population. Since more highly educated (and presumably senior) nurses could be still be susceptible to burnout, potential screening and therapeutic interventions should not focus on just the junior ranks.

Our study has several strengths. To our knowledge, this is the largest study of burnout in Asian ICUs. It is also the first study that simultaneously compared burnout among different Asian countries and regions across disparate income groups. Furthermore, we were able to verify our quantitative results with qualitative analyses.

Nevertheless, we acknowledge certain limitations. Firstly, Asian or national registries of ICUs were not available in many countries, so we had to use a snowball method via national coordinators. Our sampling method might have selected ICU directors with a greater interest in burnout and was vulnerable to gatekeeper bias. However, we believe that our large sample size should mitigate both selection and gatekeeper biases. Secondly, due to logistic reasons, we could not survey all the ICUs and countries in Asia. The countries invited to participate were predominantly in Southern and Eastern Asia, and several other Asian countries (e.g. the old Soviet republics of central Asia) were regrettably not included. Nonetheless, we had a reasonable overall response rate of 66.1%, from a good spread of ICUs and participants. Our results also showed a consistently high level of burnout among all countries, and it would be reasonable to assume that other countries and ICUs would be similarly affected. Thirdly, we conducted our survey over a period of 6 months in order to accrue an optimal participation rate (our target was > 60%). Although this would mean that our results would be subject to temporal variation, aggregate data over a longer period would lessen the transient impact of events (e.g. public holidays, natural disasters). Fourthly, a cross-sectional study design precluded causal inference, but our quantitative findings of protective/risk factors for burnout corresponded well with our qualitative analysis, showing work load and work-life balance being the predominant themes. Fifthly, even though the Maslach Burnout Inventory is the most commonly used instrument for burnout, we acknowledge that it may be variably interpreted. For comparability, we employed the instrument using the same definition as one of the largest studies in burnout [11]. Sixthly, we

have not fully explored organizational factors such as the impact of technology and guidelines [37].

We hope that our results would lead to greater awareness of burnout among Asian intensive care personnel, and by extrapolation, Asian healthcare personnel. For the wellbeing of healthcare staff, it is vital for policy makers, professional societies, funding agencies, healthcare organizations, and ICU leaders to address burnout. Reducing burnout is also likely to have favorable effects on quality of care, staff turnover, and healthcare costs [3].

A large number of possible intervention methods exist [3, 35]. Individual-level methods include physician well-being programs, programs to improve interprofessional communications about end-of-life care, activities to prevent or mitigate staff conflicts, stress management workshops, life-skills programs, individual training in mindfulness practice, breathing exercises, yoga classes and topical application of essential oils. At the organizational level, a 24/7 intensivist staffing model implemented through shiftwork may lessen burnout compared to a standard daytime coverage model [38]. Similarly, allowing weekend intensivist cross-coverage and work respite, compared to uninterrupted daily coverage within half-month rotations, resulted in improved burnout and work-life balance, while not affecting patient safety [31]. Additionally, promotion of a supporting work atmosphere, good teamwork and a culture of respect can enhance staff empowerment, reduce staff conflicts, and ameliorate both stress and burnout [25, 39, 40].

Our study presents the first step towards identifying the focus areas for change. A more important second step would be effective implementation of interventions against burnout. Implementation needs to be sensitive to the social, cultural and economic environment of different countries. For instance, a society that values long working hours as a sign of productivity would disagree with shortened work hours *per se*. Rather, improving staffing and cross-coverage may be more acceptable.

In conclusion, a large proportion of Asian ICU physicians and nurses experience professional burnout. Based on quantitative risk factor analysis and qualitative thematic analysis in our study, work demand and work-life imbalance appear to be the predominant risk factors. Possible individual-level interventions include religious/spiritual practice, and possible organizational-level interventions include employing shift-based coverage, stay-home night calls, and regulating the number of work days per month. Given the high burnout rates found in our study, screening for burnout among Asian ICU physicians and nurses would be important [37]. Interventions focusing on reducing work load and promoting work-life balance need to be prioritized in Asian ICUs, with organization-level changes urgently needed.

Electronic supplementary material
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Compliance with ethical standards

Human participants
All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards

Ethical approval
Ethical approval was obtained for the overall study in Singapore (NHG-DSRB 2014/01032), and by institutional review boards according to local regulations in each participating centre and country.

Informed consent
Informed consent was obtained from all individual participants included in the study.

Conflict of interest
All authors do not have any conflicts of interests to declare. Survey instruments and software were purchased using the authors' personal funds.

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