BMJ Open

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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-032779
Article Type:	Research
Date Submitted by the Author:	05-Jul-2019
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Keywords:	Work-related burnout, Combined lifestyle factors, Weekend catch-up sleep

Modifiable Risk Factors Related to Burnout levels in the Medical Workplace in Taiwan

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Word count: 3095

ABSTRACT

Objectives: To detect the combined lifestyle factors effects concerning work-related burnout(WB) and analyze the burnout risk according to the number of weekend catch-up sleep hours in the medical workplace.

Design: Cross-sectional study.

Setting: Hospital-based survey in Taiwan.

Participants: In total, 2746 participants completed the questionnaire on the Overload Health Control System of the hospital from the first day of January 2016 through the end of December 2016, with a response rate of 70.5% (2746/3894). These voluntary participants included 358 physicians, 1406 nurses, physician assistants, 570 nurses, 367 medical technicians and 615 administrative staffs.

Primary and secondary outcome measures: All factors with significant associations to WB were entered into multinomial logistic regression after adjustment by other factors. The dose-response relationship of combined lifestyle factors and catch-up sleep hours associated with WB were explored by logistic regression mode, respectively.

Results: After adjustments, five unhealthy factors (Abnormal meal times, Often eating out, Lack of sleep, No exercise, Work hours>40hours) were independently associated with WB. As the number of risk factors increased, so did the proportion of medium and high levels in WB. A lack of sleep was found to be the most significant factor related to WB (Adjusted OR=5.13, 95% CI 3.94 to 6.69, for high level as compared to low level). For those with workday sleep hours less than seven, weekend catch-up sleep was found to be related to a reduction in burnout risk.

Conclusions: This study demonstrated the cumulative effects of combined unhealthy lifestyle factors on WB in the medical workplace. Weekend catch-up sleep may correlated to a lower burnout risk for those with a short workday sleep duration (less than 7). Clinicians should pay attention to people with combined unhealthy lifestyle factors, especially for short sleep duration without weekend catch-up sleep in the future.

Keywords: Work-related burnout; Combined lifestyle factors; Weekend catch-up sleep.

Article Summary

Strengths and limitations of this study:

- This is the first study to assess the cumulative effect of combined unhealthy lifestyle factors on work-related burnout(WB) and the associations between weekend catch-up sleep and WB in the medical workplace.
- The modifiable risk factors included in our study were selected from the questionnaire based upon an legally authorized and official program, therefore culturally representative to local medical workplace .
- The study design is cross-sectional, therefore a causal relationship could not be established.
- The associations between weekend catch-up sleep and work-related burnout can only be applied to staff experiencing a lack of sleep, because there is no information regarding the amount of sleep hours for whom with enough sleep.
- Information of this study is mainly based on self-report measures, and the influence of information bias still remain.

INTRODUCTION

In recent years, the issue of burnout in medical profession employees has received increasing attention, due to its physical, psychological, and occupational consequences.[1] Previous research has demonstrated that burnout is an important factor when assessing mental health in workplace.[2] Physician burnout represents a public health crisis by having a negative impact on individual physicians, their patient's care and the healthcare system.[3]

Many previous studies have pointed out that some non-modifiable factors, such as gender, age, marriage status, seniority, job category, and shift work type, were related to burnout.[2 4] We believed

that the modifiable factors is more important than the non-modifiable factors, because the former can be improved through on-site health services. Although, few studies explored the modifiable factors related to workplace burnout, such as a higher consumption of fast food, infrequent exercise, long working hours, and fewer sleep hours,[5-7] there has been no research to identify the factors most relevant to burnout, nor the cumulative effects of the various factors involved.

Several studies have shown that combined healthy lifestyle factors has a greater health impact than any single lifestyle factor on some health outcomes (include mortality in cancer patient, disability-free survival, and depression).[8-11] Individual lifestyle behaviors have been associated with elevated burnout level, but there was no studies focusing on the association between combined lifestyle behaviors and work-related burnout in medical workplace.

Weekend catch-up sleep is one way to cope with insufficient sleep during workdays by increasing the sleep duration during weekend.[12] Previous studies had demonstrated the association between weekend catch-up sleep and some health outcome (include obesity, hypertension, and health-related quality of life). [12-14] However, no research analyzed the association between weekend catch-up sleep and work-related burnout for medical staff.

Thus, the object of the present study are : (1) to detect the most relevant modifiable factors, and the combined lifestyle factors concerning work-related burnout in the medical workplace and (2) to analyze the work-related burnout risk according to the number of weekend catch-up sleep hours under different workdays sleep hours.

METHODS

Participants and study design

This study was approved by the Institutional Review Board I & II, Taichung Veterans General Hospital (Case no. CE18353A). The study design is cross-sectional. After reading the informed consent, all the voluntary participants completed an electronic questionnaire on the Overload Health

Control System of the Taichung Veterans General Hospital from the first day of January 2016 through the end of December 2016. In total, 2746 participants completed the questionnaire, with a response rate of 70.5% (2746/3894). The type of data is delinked anonymous information. There are no health impact on individuals and no risk of personal data leakage.

Factors in the questionnaire

In Taiwan, the publication "Guideline for Preventing Diseases Caused by Exceptional Workload" was released by the Occupational Safety and Health Administration of the Ministry of Labor in 2014. According to the guideline, laborers must fill out the overwork assessment questionnaire, which contains their sociodemographic information (gender, age, and marital status), working conditions (current profession, length of employment, and self-reporting work type), lifestyle factors (smoking/alcohol/betel nut use status, sleep condition, meal times, frequency of eating out, exercise habits, and self-reporting working hours per week). These factors were set by an expert consensus of the Occupational Safety and Health Administration of the Ministry of Labor of Taiwan. When participants chose "lack of sleep" or "regular physical exercise", they needed to fill in the number of sleep hours on workdays and free days, as well as their total weekly exercise time. Weekend catch-up sleep hours were calculated according to the following formula: Weekend sleep hours minus the workdays sleep hours.[15] Workday sleep duration was categorized into 3 groups: <6 hours, ≧6 to <7 hours, ≧7 hours. Weekend sleep duration was categorized into 3 groups: ≤0 hours, >0 to ≤2 hours, >2 hours.

Burnout

The newly developed Copenhagen Burnout Inventory (CBI) by Kristensen et al.[16] is a more straightforward measurement of burnout in the population of medical professionals, as compared to the standard Maslach Burnout Inventory (MBI).[17] The CBI assesses burnout status through the use of

three criteria: personal burnout, work-related burnout, and client-related burnout. Additionally, a Chinese version of the Copenhagen Burnout Inventory (C-CBI) was constructed based upon the CBI, which displayed good validity and reliability.[18 19] In this study, we adopted 'Work-related Burnout (WB)' subscales of the C-CBI to assess burnout risk in the workplace. The C-CBI 'work-related burnout' subscales consist of 7 items.[18] All items used a Likert-type, five-response category scale. The responses were rescaled to a 0–100 metric. According to the previous study,[18] the C-CBI WB had a Cronbach's α coefficient of 0.87. For work-related burnout scores, a burnout score ≧45 and >60 indicates medium and high burnout, respectively, in the analysis.

Statistical analysis

Data from the C-CBI WB subscales were analyzed for internal consistency using Cronbach's α. The WB score was categorized into three levels: Low, Medium, and High. Demographic information, working conditions, and lifestyle factors were expressed by the category variable and were recorded as numbers (%). Differences in the distribution of categorical variables for WB level were tested using the $\chi 2$ test. All factors with significant associations to WB were entered into multinomial logistic regression after adjustment by other factors to calculate Odds Ratios (ORs) (95% CIs). All calculations were performed using the software SPSS V.23, with the level of significance set at $p<0.05$. We used the STROBE cross sectional checklist when writing our report.[20]

RESULTS

Characteristics of the participants

The demographic information, working conditions, and lifestyle factors of the participants are summarized in Table 1. Most participants were female (78.55%), 48.83% were married while 48.73% were single. More than half of the participants were nurses (51.20%) and on day shift (64.64%). Nearly half of the participants were aged between 21 and 34 years (47.34%), and had worked for less than 5 years (34.38%). Most participants denied any smoking/alcohol/betel nut use (98.40%/97.45%/95.41%) and had normal BMI (68.79%). Analysis of employee lifestyles revealed

abnormal meal times (55.13%), high eating out rates (93.26% for at least one meal per day), lack of sleep (59.07%), non-regular physical exercise (60.74%), and working overtime (>40 hours)(58.56%).

Table 1. Characteristics of participants (N=2746)

Factors	N	%	Factors	N	%
Profession			**Mealtime**		
Doctor (V.S.)	167	(6.08%)	Normal	1232	(44.87%)
Doctor (R)	191	(6.96%)	Abnormal	1514	(55.13%)
Nurse	1406	(51.20%)	**Eat out**		
Medical technician	367	(13.36%)	0 meal	185	(6.74%)
Administrative staff (Head)	16	(0.58%)	1 meal	663	(24.14%)
Administrative staff (Other)	599	(21.81%)	2 meals	832	(30.30%)
Age (years)			3 meals	1066	(38.82%)
21-34	1300	(47.34%)	**Lack of sleep**		
35-44	603	(21.96%)	No	1124	(40.93%)
45-54	625	(22.76%)	Yes	1622	(59.07%)
55-66	218	(7.94%)	Workday sleep hours <6 hrs		
Gender			Catch-up sleep hours ≦0 hrs	66	(2.40%)
Male	589	(21.45%)	Catch-up sleep hours >0 and ≦2 hrs	243	(8.85%)
Female	2157	(78.55%)	Catch-up sleep hours >2 hrs	303	(11.03%)
Length of service (years)			Workday sleep hours ≧6 and <7 hrs		
< 5 years	944	(34.38%)	Catch-up sleep hours ≦0 hrs	115	(4.19%)
5-14 years	685	(24.95%)	Catch-up sleep hours >0 and ≦2 hrs	452	(16.46%)
15-24 years	523	(19.05%)	Catch-up sleep hours >2 hrs	211	(7.68%)
>24 years	443	(16.13%)	Workday sleep hours ≧7 hrs		
Missing	151	(5.50%)	Catch-up sleep hours ≦0 hrs	62	(2.26%)
Marital status			Catch-up sleep hours >0 and ≦2 hrs	102	(3.71%)
Single	1338	(48.73%)	Catch up sleep hours >2 hrs	62	(2.26%)
Married	1341	(48.83%)	Missing	6	(0.22%)
Divorced	51	(1.86%)	**Physical exercise**		
Widowed	16	(0.58%)	None	1668	(60.74%)
BMI			Regular	1078	
≦24	1889	(68.79%)	<90 minutes/week	497	(18.10%)
>24	820	(29.86%)	≧90 and <150 minutes/week	289	(10.52%)
Missing	37	(1.35%)	≧150 minutes/week	281	(10.23%)
Smoking			Missing	11	(0.40%)
No	2702	(98.40%)	**Weekly work hours**		
Yes	26	(0.95%)	20-40 hours	1131	(41.19%)
Missing	18	(0.66%)	41-60 hours	1379	(50.22%)
Betel Nut Usage			>60 hours	229	(8.34%)
No	2676	(97.45%)	Missing	7	(0.25%)
Yes	2	(0.07%)	**Lifestyle factors***		

Missing	68	(2.48%)		None	105	(3.8%)
Alcohol Consumption				One	369	(13.5%)
No	2620	(95.41%)		Two	593	(21.7%)
Yes	126	(4.59%)		Three	736	(26.9%)
Work type				Four	734	(26.8%)
Day shift	1775	(64.64%)		Five	202	(7.4%)
Night shift	184	(6.70%)				
Graveyard shift	139	(5.06%)				
Rotating shift	648	(23.60%)				

* Lifestyle factors: Abnormal meal times, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Factors associated with work-related burnout

The reliability of the WB questionnaire was assessed by Cronbach's α for each item, with resulting scores of 0.866, indicating a high internal consistency.

Table 2 displays the distribution of WB levels according to sociodemographic, working, and lifestyle factors. The percentage of the respondents with a low/medium/high level of WB was 38.71%/36.64%/24.65%, respectively.

Women displayed significantly higher scores (65.6%) in the medium and high levels of WB than did men (45.5%). Those who were single had higher WB scores than those married. The 55-66 age group had the lowest percentage in the high level of WB, with the 21-34 age group having the highest percentage. Those with 15-24 years of employed service showed a significantly higher percentage (68.9%) in the medium and high levels of WB. Amongst medical professions, nurses had the highest WB scores, while the administrative supervisors had the lowest scores. The non-day shift workers had higher WB scores than the day shift workers did. There was a significant effect on WB levels by the total weekly hours of work.

Smokers had lower WB scores than non-smokers, but there was no difference in the WB scores amongst alcohol drinkers and betel nut users. There was no significant effect on WB levels by a worker's BMI status. Abnormal meal times, frequently eating out, lack of sleep, no exercise, and weekly work hours > 40 were positively correlated with WB levels.

Table 2. Distribution of work-related burnout levels according to sociodemographic, working, and lifestyle factors

Factors	Work-related burnout						Total (n=2746)		*p*-value
	Low (n=1063)		Medium (n=1006)		High (n=677)				
Profession									
Doctor (V.S.)	75	(44.9%)	65	(38.9%)	27	(16.2%)	167	(6.1%)	<0.001**
Doctor (R)	77	(40.3%)	65	(34.0%)	49	(25.7%)	191	(7.0%)	
Nurse	350	(24.9%)	568	(40.4%)	488	(34.7%)	1,406	(51.2%)	
Medical technician	165	(45.0%)	140	(38.1%)	62	(16.9%)	367	(13.4%)	
Administrative supervisor	14	(87.5%)	1	(6.3%)	1	(6.3%)	16	(0.6%)	
Administrative staff	382	(63.8%)	167	(27.9%)	50	(8.3%)	599	(21.8%)	
Age (years)									
21-34	458	(35.2%)	448	(34.5%)	394	(30.3%)	1,300	(47.3%)	<0.001**
35-44	226	(37.5%)	240	(39.8%)	137	(22.7%)	603	(22.0%)	
45-54	246	(39.4%)	251	(40.2%)	128	(20.5%)	625	(22.8%)	
55-66	133	(61.0%)	67	(30.7%)	18	(8.3%)	218	(7.9%)	
Gender									
Male	321	(54.5%)	181	(30.7%)	87	(14.8%)	589	(21.4%)	<0.001**
Female	742	(34.4%)	825	(38.2%)	590	(27.4%)	2,157	(78.6%)	
Length of service (years) (n=2,595)									
< 5 years	334	(35.4%)	333	(35.3%)	277	(29.3%)	944	(36.4%)	<0.001**
5-14 years	254	(37.1%)	258	(37.7%)	173	(25.3%)	685	(26.4%)	
15-24 years	163	(31.2%)	219	(41.9%)	141	(27.0%)	523	(20.2%)	
>24 years	231	(52.1%)	154	(34.8%)	58	(13.1%)	443	(17.1%)	
Marital status									
Single	451	(33.7%)	494	(36.9%)	393	(29.4%)	1338	(48.7%)	<0.001**
Married	581	(43.3%)	489	(36.5%)	271	(20.2%)	1341	(48.8%)	
Divorced	23	(45.1%)	17	(33.3%)	11	(21.6%)	51	(1.9%)	
Widowed	8	(50.0%)	6	(37.5%)	2	(12.5%)	16	(0.6%)	
Smoking (n=2728)									
No	1038	(38.4%)	991	(36.7%)	673	(24.9%)	2702	(99.0%)	0.014*
Yes	17	(65.4%)	7	(26.9%)	2	(7.7%)	26	(1.0%)	
Betel Nut Usage (n=2678)									
No	1032	(38.6%)	984	(36.8%)	660	(24.7%)	2,676	(99.9%)	0.500
Yes	0	(0.0%)	1	(50.0%)	1	(50.0%)	2	(0.1%)	
Alcohol Consumption									
No	1011	(38.6%)	958	(36.6%)	651	(24.8%)	2620	(95.4%)	0.558
Yes	52	(41.3%)	48	(38.1%)	26	(20.6%)	126	(4.6%)	
Meal time									
Normal	677	(55.0%)	407	(33.0%)	148	(12.0%)	1232	(44.9%)	<0.001**
Abnormal	386	(25.5%)	599	(39.6%)	529	(34.9%)	1514	(55.1%)	
Eat out									<0.001**

0-1 meal	415	(48.9%)	304	(35.8%)	129	(15.2%)	848	(30.9%)	
2-3 meals	648	(34.1%)	702	(37.0%)	548	(28.9%)	1898	(69.1%)	
Lack of sleep									
No	677	(60.2%)	329	(29.3%)	118	(10.5%)	1124	(40.9%)	<0.001**
Yes	386	(23.8%)	677	(41.7%)	559	(34.5%)	1622	(59.1%)	
Physical exercise									
None	562	(33.7%)	633	(37.9%)	473	(28.4%)	1,668	(60.7%)	<0.001**
Regular	501	(46.5%)	373	(34.6%)	204	(18.9%)	1,078	(39.3%)	
BMI (n=2,709)									
≦24	704	(37.3%)	700	(37.1%)	485	(25.7%)	1,889	(69.7%)	0.052
>24	345	(42.1%)	288	(35.1%)	187	(22.8%)	820	(30.3%)	
Weekly work hours (n=2,739)									
20-40 hours	620	(54.8%)	372	(32.9%)	139	(12.3%)	1,131	(41.3%)	<0.001**
>40 hours	439	(27.3%)	632	(39.3%)	537	(33.4%)	1,608	(58.7%)	
Work type									
Day shift	802	(45.2%)	636	(35.8%)	337	(19.0%)	1,775	(64.6%)	<0.001**
Non-day shift	261	(26.9%)	370	(38.1%)	340	(35.0%)	971	(35.4%)	
Lifestyle factors#									
None	71	(67.6%)	30	(28.6%)	4	(3.8%)	105	(3.8%)	
One	248	(67.2%)	99	(26.8%)	22	(6.0%)	369	(13.5%)	
Two	321	(54.1%)	197	(33.2%)	75	(12.6%)	593	(21.7%)	<0.001**
Three	243	(33.0%)	304	(41.3%)	189	(25.7%)	736	(26.9%)	
Four	143	(19.5%)	297	(40.5%)	294	(40.1%)	734	(26.8%)	
Five	33	(16.3%)	77	(38.1%)	92	(45.5%)	202	(7.4%)	
Sleep hours (n=2740)									
No lack of sleep	677	(60.2%)	329	(29.3%)	118	(10.5%)	1124	(41.0%)	
Lack of sleep									
Workday sleep hours <6 hrs									
Catch-up sleep hours ≦0 hrs	13	(19.7%)	26	(39.4%)	27	(40.9%)	66	(2.4%)	
Catch-up sleep hours >0 and ≦2 hrs	60	(24.7%)	110	(45.3%)	73	(30.0%)	243	(8.9%)	
Catch-up sleep hours >2 hrs	88	(29.0%)	114	(37.6%)	101	(33.3%)	303	(11.1%)	
Workday sleep hours ≧6 and <7 hrs									<0.001**
Catch-up sleep hours ≦0 hrs	22	(19.1%)	53	(46.1%)	40	(34.8%)	115	(4.2%)	
Catch-up sleep hours >0 and ≦2 hrs	106	(23.5%)	193	(42.7%)	153	(33.8%)	452	(16.5%)	
Catch-up sleep hours >2 hrs	53	(25.1%)	81	(38.4%)	77	(36.5%)	211	(7.7%)	
Workday sleep hours ≧7 hrs									
Catch-up sleep hours ≦0 hrs	12	(19.4%)	24	(38.7%)	26	(41.9%)	62	(2.3%)	
Catch-up sleep hours >0 and ≦2 hrs	18	(17.6%)	51	(50.0%)	33	(32.4%)	102	(3.7%)	
Catch-up sleep hours >2 hrs	10	(16.1%)	24	(38.7%)	28	(45.2%)	62	(2.3%)	

Exercise time per week (n=2735)									
No physical exercise	562	(33.7%)	633	(37.9%)	473	(28.4%)	1,668	(61.0%)	<0.001**
Regular physical exercise									
<90 minutes/week	224	(45.1%)	195	(39.2%)	78	(15.7%)	497	(18.2%)	
≧90 and <150 minutes/week	133	(46.0%)	86	(29.8%)	70	(24.2%)	289	(10.6%)	
≧150 minutes/week	135	(48.0%)	90	(32.0%)	56	(19.9%)	281	(10.3%)	

Chi-Square test. *p<0.05, **p<0.01.
Lifestyle factors: Abnormal meal times, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Independent factors associated with work-related burnout

As detailed in Table 3, multinomial logistic regression demonstrated that administrative staff had the lowest risk for WB when compared to nurses (Adjusted OR: 0.45/0.33, for medium/high level compared to low level). Women had adjusted ORs of 1.41/1.59 for WB (Medium/high level compared with low level) when compared with men. The effects of age, length of service and non-day shift work turned insignificant after adjustments.

For lifestyle factors, abnormal meal time (Adjusted OR: 1.47/2.41), frequently eating out (Adjusted OR: 1.17/1.49), lack of sleep (Adjusted OR: 2.86/5.13), no exercise (Adjusted OR: 1.27/1.41) and work hours >40 (Adjusted OR: 1.56/2.72) were independently associated with work-related burnout (for medium/high level compared to low level).

Table 3. Multinomial logistic regression of factors associated with Work-related burnout.

	Work-related burnout					
	Medium vs Low			High vs Low		
Factors	**OR**	**95% CI**	***p* value**	**OR**	**95% CI**	***p* value**
Gender (M vs F)	1.41	(1.08- 1.85)	0.013*	1.59	(1.11- 2.29)	0.012*
Age (years)						
21-34	ref.			ref.		
35-44	1.17	(0.86- 1.59)	0.323	0.82	(0.56- 1.20)	0.301
45-54	1.23	(0.76- 1.98)	0.403	0.74	(0.41- 1.34)	0.322
55-66	1.19	(0.64- 2.19)	0.583	0.62	(0.26- 1.46)	0.275
Length of service (years)						
< 5 years	ref.			ref.		
5-14 years	0.90	(0.68- 1.19)	0.463	0.85	(0.61- 1.18)	0.342
15-24 years	1.21	(0.77- 1.89)	0.404	1.64	(0.95- 2.82)	0.074

>24 years	0.95	(0.56- 1.61)	0.856	1.02	(0.51- 2.02)	0.960
Profession						
Nurse	ref.			ref.		
Doctor (V.S.)	0.63	(0.39- 1.00)	0.052	0.47	(0.26- 0.87)	0.015*
Doctor (R)	0.64	(0.40- 1.02)	0.063	0.57	(0.34- 0.97)	0.038*
Medical technician	0.83	(0.60- 1.15)	0.268	0.74	(0.49- 1.11)	0.150
Administrative staff supervisor	0.11	(0.01- 0.88)	0.037*	0.45	(0.05- 3.80)	0.462
Administrative staff	0.45	(0.33- 0.61)	<0.001**	0.33	(0.22- 0.50)	<0.001**
Day shift (No vs Yes)	1.04	(0.81- 1.34)	0.753	1.18	(0.88- 1.57)	0.268
Lack of sleep	2.86	(2.33- 3.50)	<0.001**	5.13	(3.94- 6.69)	<0.001**
No physical exercise	1.27	(1.03- 1.55)	0.024*	1.41	(1.10- 1.81)	0.006**
Abnormal meal time	1.47	(1.19- 1.82)	<0.001**	2.41	(1.85- 3.15)	<0.001**
Often eat out	1.17	(0.94- 1.46)	0.152	1.49	(1.12- 1.97)	0.006**
Weekly work hours >40 hours	1.56	(1.26- 1.94)	<0.001**	2.72	(2.08- 3.57)	<0.001**
Lifestyle factors$#						
None	ref.			ref.		
One	0.91	(0.54- 1.52)	0.717	1.39	(0.45- 4.27)	0.564
Two	1.34	(0.82- 2.19)	0.246	3.37	(1.17- 9.72)	0.025*
Three	2.53	(1.55- 4.14)	<0.001**	9.58	(3.36- 27.31)	<0.001**
Four	3.95	(2.37- 6.58)	<0.001**	21.73	(7.58- 62.31)	<0.001**
Five	4.99	(2.64- 9.43)	<0.001**	32.98	(10.78- 100.87)	<0.001**
p for trend			<0.001**			<0.001**

Multinomial logistic regression. *$p<0.05$, **$p<0.01$.
$ Adjusted for Gender, Age, Length of service, Profession, Day shift
# Lifestyle factors: Abnormal meal time, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Cumulative effects of independent lifestyle factors associated with work-related burnout

The cumulative effect on the WB levels of the five independent factors (Abnormal meal times, Frequently eating out, Lack of sleep, No exercise, and Work hours >40) is displayed in Table 2. As the number of risk factors increases, the proportion of medium and high levels of WB increases (32.4%, 32.8%, 45.9%, 67.0%, 80.5%, 83.7%), revealing the dose-response effect.

Table 3 reveals the multinomial logistic regression of the number of lifestyle factors associated with WB. The Adjusted OR (medium level compared to low level) of the participants with factor numbers from 1 to 5 were 0.91 (95% CI: 0.54 to 1.52), 1.34 (95% CI: 0.82~2.19), 2.53 (95% CI: 1.55~4.14), 3.95 (95% CI: 2.37~6.58), 4.99 (95% CI: 2.64~9.43), compared to those without any

factors. The Adjusted OR (high level compared to low level) of the participants with factor numbers from 1 to 5 were 1.39 (95% CI: 0.45 to 4.27), 3.37 (95% CI: 1.17~9.72), 9.58 (95% CI: 3.36~27.31), 21.73 (95% CI: 7.58~62.31), 32.98 (95% CI: 10.78~100.87), compared to those without any factors. The significant effects of WB (high level compared to low level) can be found in participants with at least two factors, when compared to those without any factors.

Association between weekend catch-up sleep hours and work-related burnout.

The participants who experienced a lack of sleep were categorized into groups based upon their workday sleep hours and weekend catch-up sleep hours. The numbers of each group are shown in Table 1. The distribution of WB levels according to the different groups is shown in Table 2.

In Table 4, multinomial logistic regression model demonstrates trend over different groups. In the "workday sleep hours <6 hours" group, those with more weekend catch-up sleep hours had lower WB scores (Adjusted OR: 7.17/4.88/ 4.29 for ≦0/ >0 and ≦2 / >2 hours, compared to those with enough sleep). In the "workday sleep hours ≧6 and <7 hours" group, those with more weekend catch-up sleep hours also had lower WB scores (Adjusted OR: 6.26/ 5.90/4.16 for ≦0, >0 and ≦2, >2 hours, compared to those with enough sleep). However, in the "workday sleep hours ≥ 7 hours" group, those with more catch up sleep hours had higher WB scores (Adjusted OR: 4.91/4.94/6.74 for ≦0/>0 and ≦2/>2 hours, compared to those with enough sleep) (Figure 1).

Table 4. Subgroup analysis: Multinomial logistic regression of sleep hours associated with Work-related burnout.

Factors	Multivariate model					
	Medium vs Low			High vs Low		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Workdays and weekend catch-up sleep hours [$]						
No lack of sleep	ref.			ref.		
Lack of sleep						
Workday sleep hours <6 hrs						
Catch-up sleep hours ≦0 hrs	2.90	(1.38- 6.09)	0.005**	7.17	(3.31- 15.53)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.09	(2.14- 4.47)	<0.001**	4.88	(3.14- 7.61)	<0.001**
Catch-up sleep hours >2 hrs	2.13	(1.52- 2.98)	<0.001**	4.29	(2.89- 6.37)	<0.001**
Workday sleep hours ≧6 and <7 hrs						

Catch-up sleep hours ≦0 hrs	3.74	(2.12- 6.57)	<0.001**	6.26	(3.33- 11.76)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.38	(2.50- 4.57)	<0.001**	5.90	(4.10- 8.47)	<0.001**
Catch-up sleep hours >2 hrs	2.33	(1.54- 3.51)	<0.001**	4.16	(2.63- 6.60)	<0.001**
Workday sleep hours ≧ 7 hrs						
Catch-up sleep hours ≦0 hrs	2.40	(1.13- 5.08)	0.022*	4.91	(2.24- 10.75)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.77	(2.10- 6.77)	<0.001**	4.94	(2.54- 9.63)	<0.001**
Catch-up sleep hours >2 hrs	2.98	(1.32- 6.71)	0.008**	6.74	(2.94- 15.46)	<0.001**
Exercise time per week #						
No physical exercise	ref			ref		
Regular physical exercise						
<90 minutes/week	0.96	(0.74- 1.26)	0.786	0.62	(0.44- 0.89)	0.008**
≧90 and <150 minutes/week	0.72	(0.52- 1.01)	0.057	0.85	(0.58- 1.25)	0.413
≧150 minutes/week	0.75	(0.54- 1.05)	0.092	0.77	(0.51- 1.16)	0.209

Multinomial logistic regression. *p<0.05, **p<0.01.
$ Adjusted for gender, age, length of service, profession, day shift, exercise, meal time, eat out, work hours.
# Adjusted for gender, age, length of service, profession, day shift, lack of sleep, mealtime, eat out, work hours.

We also attempted to categorize the participants who with regular physical exercise by total weekly exercise hours. The numbers for each subgroup and the distribution of WB levels according to the different subgroups are shown in Tables 1 and 2. However, we could not determine the dose-response relationship between weekly exercise hours and WB levels after adjustments (Table 4).

DISCUSSION

To our knowledge, this is the first study to assess the cumulative effect of combined unhealthy lifestyle factors on WB and the associations between weekend catch-up sleep and WB in the medical workplace. Our findings show that five key modifiable lifestyle factors, including abnormal meal times, often eating out, lack of sleep, no exercise, and weekly work hours >40, were independently associated with WB levels. The cumulative effects of these combined unhealthy lifestyle factors were demonstrated: As the numbers of the above lifestyle factors increase, the proportion of the medium and high levels of WB elevate. Amongst the above factors, a lack of sleep is the most relevant to WB in the medical workplace. In the subgroup analysis of sleep hours, for those with workday sleep hours less than 7 hours, weekend catch-up sleep is related to reducing burnout risk.

However, for those with workday sleep hours greater than 7 hours, weekend catch-up sleep is related to elevating burnout risk.

For non-modifiable factors, our findings remain consistent with previous studies which concluded that females were independently associated with higher burnout levels.[2 21] Our study also confirmed a previous study that being a nurse was associated with higher burnout levels.[2] However, the occupational effect of nursing became insignificant after adjustments, except for comparison with administrative staff. Differently from previous studies,[2 4 21 22] one's length of service and age were not significant risk factors for WB after adjustments in our study. The possible explanation for this is that our results have been adjusted by additional lifestyle factors when compared to previous studies.[2 4 21]

For other modifiable factors, our study has also revealed that obesity is not an independent risk factor for WB, as those in our study exhibiting a higher BMI displayed lower burnout scores, which was consistent with previous research.[23] The possible explanation for this is that hypercortisolism is commonly associated with increased food intake and body weight gain.[24] However, burnout was more consistently associated with hypocortisolism,[25] which leads to the inhibition of food consumption. In contrast to other studies,[26 27] our results disclosed that smokers have lower WB scores compared to non-smokers, while there was no difference in the WB scores amongst alcohol drinkers and betel nut users. This may be due to the characteristics of the study population in the Taiwan workplace, in which less than 5% of the participants possessed a 'smoking', 'drinking', or 'betel nut use' habit.[28 29]

For the five key modifiable factors in our study, ''normal meal times'' and ''less eating out'' were significantly associated with a lower risk of WB levels. Although no previous studies have directly investigated the relationship between these two factors and burnout, a similar finding was reported that higher levels of fast-food consumption was to be positively associated with burnout.[7] Moreover, we confirmed the protective effects of being "physically active" in the prevention of burnout, which

is consistent with previous studies.[5 7 30 31] Burnout prevalence was lower amongst students who exercised consistently following CDC recommendations, compared with those who exercised less.[5 30] Previous studies did not find the dose-response relationship for exercise hours, which is similar to our findings.[22] Additionally, we found that long work hours were a risk factor for higher WB levels. Previous studies also demonstrated that "Working more than 14 consecutive hours" and "Working over 40 hours per week" were independent risk factors associated with burnout.[5 21]

For the most relevant factor to WB, lack of sleep, our result was similar with previous studies.[6 22 31] Weishan Chin, et al. found that when compared to those who slept more than 7 hours, the nurse who slept less than 6 hours per working day had a higher risk for WB.[6] In addition, Megan R. Wolf, et al. also found that sleeping less than 7 hours was an independent predictor of burnout amongst medical students.[31] Although certain studies focused on the relationship between chronotype/social jetlag and burnout,[15] no previous studies had directly investigated the association between weekend catch-up sleep hours and burnout.

Our result revealed that weekend catch-up sleep may correlate to a lower burnout risk for those with a short workday sleep duration (less than 7). This finding is similar to the previous report of Yun Hwan Oh, et al.[12] They found that participants with a short workday sleep duration (less than 7 hours) showed significant differences in the health-related quality of life between weekend catch-up sleep group and non-catch-up sleep group. The possible mechanisms might be that participants with short workday sleep duration have more sleep debt than do others. It can be explained by compensating role of weekend catch-up sleep for sleep debt caused by lack of workday sleep duration.[12] But it is hard to confirm the causal relationship between weekend catch-up sleep and WB, because of limitation of the study design.

Although there have been some studies which focused on the association between combined healthy lifestyles and risk of depressive symptoms,[11] there is no similar study design for burnout. As a result, our report is the first study to assess the cumulative effect of multiple unhealthy lifestyle

factors on the burnout level. Considering that the impact of lifestyle factors on burnout may vary from culture to culture, we chose lifestyle factors from the questionnaire released by the Occupational Safety and Health Administration of the Ministry of Labor in Taiwan. Finally, only factors independently associated with burnout were included in the calculation of the cumulative effects.

Our study has particular strengths. First, the modifiable risk factors included in our study were selected from the questionnaire based upon an legally authorized program released by an official department. Therefore, these factors are both culturally representative and suitable indicators to assess the local medical workplace. Second, we conducted a stratified analysis of "workday sleep hours" and "weekend catch-up sleep hours", in order to provide an overall risk assessment of weekend catch-up sleep for WB, according to different workday sleep hours.

This study also has several limitations. First, the study design is cross-sectional, therefore a causal relationship could not be established. However, we can conclude that there is an association between these modifiable risk factors and WB. Second, there is no information regarding the amount of sleep hours for workers who have enough sleep in this questionnaire. Therefore, our recommendations on the burnout risk for "weekend catch-up sleep hours" and "workday sleep hours", can only be applied to staff experiencing a lack of sleep. Third, the purpose of the program was to select a high-risk group experiencing burnout and then introduced workplace health promotion program and physician interviews. These measures will inevitably take up part of the weekly working hours and may affect the consistency of the questionnaire. Besides, information of this study is mainly based on self-report measures, and the influence of information bias still remain. However, the results of our questionnaire were assessed, and given a Cronbach's α score of 0.866, indicating it ensures a high level of reliability.

CONCLUSION

This study found the associations between five modifiable risk factors and work-related burnout in the medical workplace in Taiwan, and demonstrated the cumulative effects of the stated factors. Weekend catch-up sleep may correlate to a lower burnout risk for those with a short workday sleep duration (less than 7), but to higher burnout risk for those with more than seven. Clinicians should pay attention to people with combined unhealthy lifestyle factors, especially for short sleep duration without weekend catch-up sleep in the future. Modifiable risk factors reduction should be reinforced in workplace health promotion for on-site health service physicians, although further prospective studies is necessary to establish the causal relationship.

Acknowledgements

The authors thank TCVGH-1077202C and TCVGH-1077203D from Taichung Veterans General Hospital for the support and Biostatistics Task Force of Taichung Veterans General Hospital, Taichung, Taiwan, ROC for statistical analysis.

Author Contributions Y-T T conceived of the study and supervised all aspects of its implementation. Y-L L completed the analyses and drafted the content. Y-SL and S-YH assisted with the study design and revised the content. W-MC, C-HC and Y-CY assisted with the statistical analysis and revised the content. All authors helped to conceptualize ideas, interpret findings, and review drafts of the manuscript.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None.

Patient consent Not required.

Ethical approval Institutional Review Board I & II, Taichung Veterans General Hospital (Case no. CE18353A).

Data sharing statement All data generated or analyzed during this study are included in this

published article.

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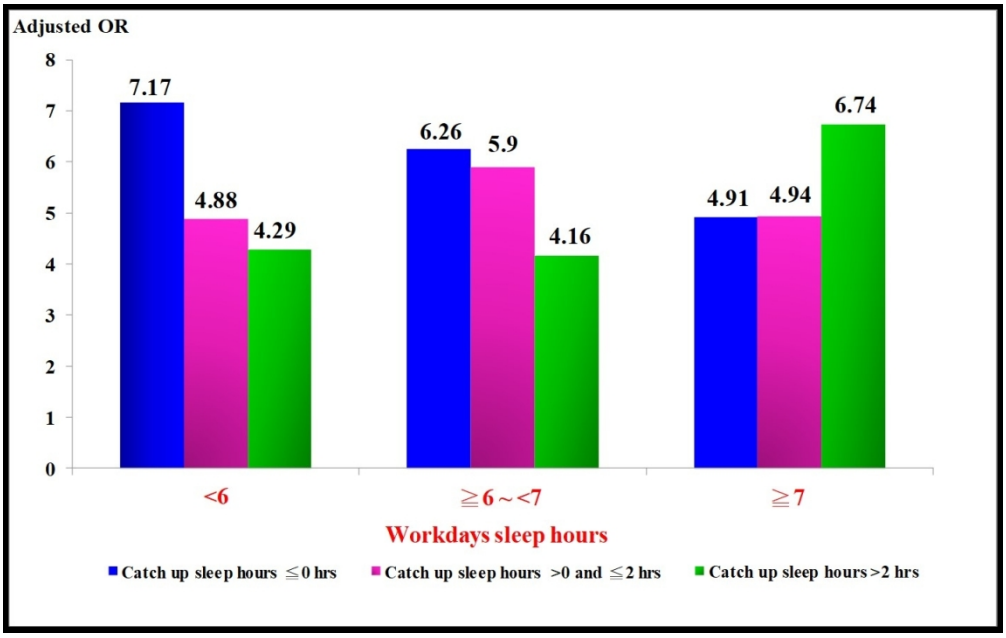

Weekend catch-up sleep hours associated with work-related burnout

241x151mm (150 x 150 DPI)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of	5

		recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5,6
Bias	#9	Describe any efforts to address potential sources of bias	5
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	6
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	6
Statistical methods	#12c	Explain how missing data were addressed	6
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	6
Statistical methods	#12e	Describe any sensitivity analyses	6
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	6
Participants	#13b	Give reasons for non-participation at each stage	6
Participants	#13c	Consider use of a flow diagram	6

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	6
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
Main results	#16b	Report category boundaries when continuous variables were categorized	8~14
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8~14
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	8~14
Discussion			
Key results	#18	Summarise key results with reference to study objectives	14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	15~17
Generalisability	#21	Discuss the generalisability (external validity) of the study results	15~17
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

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Modifiable Risk Factors Related to Burnout Levels in the Medical Workplace in Taiwan: a Cross-sectional Study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-032779.R1
Article Type:	Original research
Date Submitted by the Author:	13-Sep-2019
Complete List of Authors:	Lin, Yu-Li; Taichung Veterans General Hospital, Department of Family Medicine Chen, Cing-Hua; Taichung Veterans General Hospital, Department of Nursing and Occupational Safety and Health Office Chu, Wei-Min ; Taichung Veterans General Hospital, Division of Occupational Medicine, Department of Emergency Medicine; Chung Shan Medical University, Institute of Medicine Hu, Sung-Yuan; Taichung Veterans General Hospital, Division of Occupational Medicine, Department of Emergency Medicine; National Taichung University of Science and Technology, Department of Nursing, College of Health Liou, Yi-Sheng; Taichung Veterans General Hospital, Department of Family Medicine; National Defense Medical Center, School of Public Health Yang, Yi-Chien ; China Medical University Hospital, Department of Neurology Tsan, Yu-Tse ; Taichung Veterans General Hospital, Division of Occupational Medicine, Department of Emergency Medicine; Chung Shan Medical University, School of Medicine
Primary Subject Heading:	Occupational and environmental medicine
Secondary Subject Heading:	Public health, Global health
Keywords:	Work-related burnout, Combined lifestyle factors, Weekend catch-up sleep

Modifiable Risk Factors Related to Burnout Levels in the Medical Workplace in Taiwan: a Cross-sectional Study

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Word count: 3860

ABSTRACT

Objectives: To detect the combined effects of lifestyle factors on work-related burnout (WB) and to analyze the impact of the number of weekend catch-up sleep hours on burnout risk in a medical workplace.

Design: Cross-sectional study.

Setting: Hospital-based survey in Taiwan.

Participants: In total, 2746 participants completed the hospital's Overload Health Control System questionnaire for the period from the first day of January 2016 through to the end of December 2016, with a response rate of 70.5%. The voluntary participants included 358 physicians, 1406 nurses, 367 medical technicians, and 615 administrative staff.

Primary and secondary outcome measures: All factors that correlated significantly with WB were entered into a multinomial logistic regression after adjustment for other factors. The dose-response relationship of combined lifestyle factors and catch-up sleep hours associated with WB was explored by logistic regression.

Results: After adjustment, five unhealthy factors (abnormal meal times, often eating out, lack of sleep, no exercise, and weekly work duration >40 hours) were independently associated with WB. As the number of risk factors increased, so did the proportion of medium and high severity of WB. A lack of sleep was found to be the most significant factor related to WB (Adjusted OR=5.13, 95% CI 3.94 to 6.69). For those with less than seven hours' sleep on workdays, weekend catch-up sleep was found to be related to a reduction in burnout risk.

Conclusions: This study demonstrated that WB in the medical workplace was affected by five unhealthy lifestyle factors, and combinations of these factors were associated with greater severity of WB. Weekend catch-up sleep was correlated with

lower burnout risk in those with a short workday sleep duration (less than 7 hours). Clinicians should pay particular attention to medical staff with a combination of unhealthy lifestyle factors, especially short sleep duration without weekend catch-up sleep.

Keywords: Work-related burnout; Combined lifestyle factors; Weekend catch-up sleep.

Article Summary

Strengths and limitations of this study:

- This is the first study to assess the combined effect of unhealthy lifestyle factors on work-related burnout (WB) and to determine the associations between weekend catch-up sleep and WB in the medical workplace.
- The modifiable risk factors included in our study were identified according to the contents of a questionnaire based on a legally authorized and official program, and were therefore culturally representative of the local medical workplace.
- The study design was cross-sectional, and therefore a causal relationship could not be established.
- The associations between weekend catch-up sleep and work-related burnout could only be applied to staff experiencing a lack of sleep, because there was no information regarding the number of sleep hours in staff who reported having enough sleep.
- Information in this study mainly comprised self-reported measures, and thus information bias may have existed.

INTRODUCTION

In recent years, the issue of burnout among employees in the medical profession

has received increasing attention, as it can result in a number of deleterious physical, psychological, and occupational consequences.[1] Previous research has demonstrated that burnout is an important factor when assessing mental health in the workplace.[2] Physician burnout is increasingly being recognized as a public health crisis, which is having a range of negative effects on individual physicians, their patients' care, and the healthcare system as a whole.[3] Moreover, the prevalence of burnout is greater among residents and fellows than among early career physicians.[4] A meta-analytic study revealed that high emotional exhaustion was found in the 31% of the nurses, as well as high depersonalisation and low personal accomplishment in 24% and 38% of the subjects, respectively.[5] Compared to other professions (registered nurses, and respiratory therapists), physicians and nurse practitioners were more likely to report work-life conflict, irregular work hours, and heavy work pressure.[6] Another study noted that physician assistants (61.8%) and nurses (66%) had higher prevalence of high work-related burnout than other medical professions, including physicians (38.6%), administrative staff (36.1%), and medical technicians (31.9%), in a regional hospital in Taiwan.[2]

Many previous studies have found that certain non-modifiable factors, such as gender, age, marriage status, seniority, job category, and shift work, were related to burnout.[2 7] The authors of the present study believe that modifiable factors are more important than non-modifiable factors, because the former can be improved through on-site health services. A few studies have explored modifiable factors related to workplace burnout, such as higher consumption of fast food, infrequent exercise, long working hours, and fewer sleep hours.[8-10] However, to date, no research has been conducted to identify the factors most relevant to burnout, or to assess the combined effects of these factors.

Several studies have shown that the total number of health related lifestyle factors has a greater impact on health outcomes (including mortality in cancer patients, disability-free survival, and depression) than any single lifestyle factor.[11-14] Individual lifestyle behaviors have been associated with elevated burnout level, but to the best of our knowledge, the association between combined lifestyle behaviors and work-related burnout in the medical workplace has not been investigated.

One method of coping with insufficient sleep during the workweek is to increase the sleep duration during the weekend.[15] Previous studies have demonstrated an association between weekend catch-up sleep and various health outcomes, including obesity, hypertension, and health-related quality of life. [15-17] However, there are currently no data in the literature on the association between weekend catch-up sleep and work-related burnout among medical staff.

Thus, the aims of the present study were : (1) to identify modifiable factors associated with work-related burnout in the medical workplace, and to assess the effects of combined lifestyle factors on WB; (2) to determine the risk of work-related burnout based on the number of weekend catch-up sleep hours in patients with varying degrees of sleep insufficiency during the workweek.

METHODS

Participants and study design

This study was approved by the Institutional Review Board I & II of Taichung Veterans General Hospital (Case no. CE18353A). The study design was cross-sectional. The subjects were asked to complete an electronic questionnaire on the Overload Health Control System of Taichung Veterans General Hospital from the first day of January 2016 through the end of December 2016. In total, 2746

participants completed the questionnaire, with a response rate of 70.5% (2746/3894). The voluntary participants included 167 visiting doctors, 191 resident doctors, 1406 nurses, 367 medical technicians, and 615 administrative staff (including 16 supervisors). The data were anonymized prior to analysis to protect the subjects' privacy. Participation in the study did not involve any health risks and all subjects' personal data were secured.

Factors in the questionnaire

In Taiwan, the publication "Guideline for Preventing Diseases Caused by Exceptional Workload" was released by the Occupational Safety and Health Administration of the Ministry of Labor in 2014. According to the guideline, laborers must fill out the overwork assessment questionnaire, which contains items related to sociodemographics (gender, age, and marital status), working conditions (current profession, length of employment, and self-reported type of work), lifestyle factors (smoking/alcohol/betel nut use status, sleep condition, meal times, frequency of eating out, exercise habits, and self-reported working hours per week). The items in the questionnaire were selected by an expert consensus of the Occupational Safety and Health Administration of the Ministry of Labor of Taiwan. If participants selected "lack of sleep" or "regular physical exercise" in the questionnaire, they were required to provide their number of sleep hours on workdays and free days, as well as their total duration of weekly exercise. Weekend catch-up sleep hours were calculated according to the following formula: Weekend sleep hours minus the workday sleep hours.[18] Workday sleep duration was categorized into 3 groups: <6 hours, ≧6 to <7 hours, ≧7 hours. Weekend catch-up sleep duration was categorized into 3 groups: ≤0 hours, >0 to ≤2 hours, >2 hours.

Burnout

The newly developed Copenhagen Burnout Inventory (CBI) by Kristensen et al.[19] is a more straightforward measurement of burnout in medical professionals, as compared to the standard Maslach Burnout Inventory (MBI).[20] The CBI assesses burnout status through the use of three criteria: personal burnout, work-related burnout, and client-related burnout. Additionally, a Chinese version of the Copenhagen Burnout Inventory (C-CBI) was constructed based upon the CBI, which displayed good validity and reliability.[21 22] In this study, we adopted 'Work-related Burnout (WB)' subscales of the C-CBI to assess burnout risk in the workplace. The C-CBI 'work-related burnout' subscales consist of 7 items.[21] All items used a Likert-type, five-response category scale. The responses were rescaled to a 0–100 metric. According to a previous study,[21] the C-CBI WB had a Cronbach's α coefficient of 0.87. For work-related burnout scores, burnout scores of ≧45 and >60 indicated medium and high burnout, respectively, in the analysis.

Statistical analysis

Data from the C-CBI WB subscales were analyzed for internal consistency using Cronbach's α. The WB score was categorized into three levels: Low, Medium, and High. Demographic information, working conditions, and lifestyle factors were expressed by the category variable and were recorded as numbers (%). Differences in the distribution of categorical variables for WB level were tested using the $\chi 2$ test. All factors with significant associations with WB were entered into multinomial logistic regression after adjustment for other factors to calculate the odds ratios (ORs) (95% CIs). All calculations were performed using the statistical software program SPSS version 23, with the level of significance set at $p<0.05$. We used the STROBE

cross-sectional checklist when writing this report.[23]

RESULTS

Characteristics of the participants

The demographic information, working conditions, and lifestyle factors of the participants are summarized in Table 1. Most participants were female (78.55%), 48.83% were married, and 48.73% were single. More than half of the participants were nurses (51.20%) and on day shift (64.64%). Nearly half of the participants were young (between 21 to 34 years old, 47.34%), and around one third were employed for less than 5 years (34.38%). Most participants denied any smoking/alcohol/betel nut use (98.40%/97.45%/95.41%) and had normal BMI (68.79%). Analysis of employees' lifestyle habits revealed abnormal meal times (55.13%), high eating out rates (93.26% reported eating out for at least one meal per day), lack of sleep (59.07%), non-regular physical exercise (60.74%), and working overtime (>40 hours)(58.56%).

Table 1. Characteristics of participants (N=2746)

Factors	N	%	Factors	N	%
Profession			**Mealtime**		
Doctor (visiting physician)	167	(6.08%)	Normal	1232	(44.87%)
Doctor (resident)	191	(6.96%)	Abnormal	1514	(55.13%)
Nurse	1406	(51.20%)	**Eat out**		
Medical technician	367	(13.36%)	0 meal	185	(6.74%)
Administrative staff (supervisors)	16	(0.58%)	1 meal	663	(24.14%)
Administrative staff (other)	599	(21.81%)	2 meals	832	(30.30%)
Age (years)			3 meals	1066	(38.82%)
21-34	1300	(47.34%)	**Lack of sleep**		
35-44	603	(21.96%)	No	1124	(40.93%)
45-54	625	(22.76%)	Yes	1622	(59.07%)
55-66	218	(7.94%)	Workday sleep hours <6 hrs		
Gender			Catch-up sleep hours ≦0 hrs	66	(2.40%)
Male	589	(21.45%)	Catch-up sleep hours >0 and ≦2 hrs	243	(8.85%)
Female	2157	(78.55%)	Catch-up sleep hours >2 hrs	303	(11.03%)
Length of service (years)			Workday sleep hours ≧6 and <7 hrs		
< 5 years	944	(34.38%)	Catch-up sleep hours ≦0 hrs	115	(4.19%)
5-14 years	685	(24.95%)	Catch-up sleep hours >0 and ≦2 hrs	452	(16.46%)

15-24 years	523	(19.05%)	Catch-up sleep hours >2 hrs	211	(7.68%)
>24 years	443	(16.13%)	Workday sleep hours ≧7 hrs		
Missing	151	(5.50%)	Catch-up sleep hours ≦0 hrs	62	(2.26%)
Marital status			Catch-up sleep hours >0 and ≦2 hrs	102	(3.71%)
Single	1338	(48.73%)	Catch up sleep hours >2 hrs	62	(2.26%)
Married	1341	(48.83%)	Missing	6	(0.22%)
Divorced	51	(1.86%)	**Physical exercise**		
Widowed	16	(0.58%)	None	1668	(60.74%)
BMI			Regular	1078	
≦24	1889	(68.79%)	<90 minutes/week	497	(18.10%)
>24	820	(29.86%)	≧90 and <150 minutes/week	289	(10.52%)
Missing	37	(1.35%)	≧150 minutes/week	281	(10.23%)
Smoking			Missing	11	(0.40%)
No	2702	(98.40%)	**Weekly work hours**		
Yes	26	(0.95%)	20-40 hours	1131	(41.19%)
Missing	18	(0.66%)	41-60 hours	1379	(50.22%)
Betel Nut Usage			>60 hours	229	(8.34%)
No	2676	(97.45%)	Missing	7	(0.25%)
Yes	2	(0.07%)	**Lifestyle factors***		
Missing	68	(2.48%)	None	105	(3.8%)
Alcohol Consumption			One	369	(13.5%)
No	2620	(95.41%)	Two	593	(21.7%)
Yes	126	(4.59%)	Three	736	(26.9%)
Work type			Four	734	(26.8%)
Day shift	1775	(64.64%)	Five	202	(7.4%)
Night shift	184	(6.70%)			
Graveyard shift	139	(5.06%)			
Rotating shift	648	(23.60%)			

* Lifestyle factors: Abnormal meal times, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Factors associated with work-related burnout

The reliability of the WB questionnaire was assessed by Cronbach's α for each item, with a resulting score of 0.866, indicating a high internal consistency.

Table 2 displays the distribution of WB levels according to sociodemographic, working, and lifestyle factors. The percentages of the respondents with a low, medium, or high level of WB were 38.71%, 36.64%, and 24.65%, respectively.

Significantly more women than men (65.6% vs. 45.5%, respectively) had a high

WB score, i.e., medium and high levels of WB. Respondents who were single had higher WB scores than those who were married. The 55-66 years age group accounted for the lowest percentage among respondents with a high level of WB, whereas the 21-34 years age group comprised the highest percentage. Among respondents with a medium or high level of WB, those with 15-24 years of employed service constituted the largest percentage (68.9%). With respect to the types of medical professions, nurses had the highest WB scores, while the administrative supervisors had the lowest scores. The non-day shift workers had higher WB scores compared with the day shift workers. The total number of weekly hours of work was significantly correlated with WB level.

Smokers had lower WB scores than non-smokers, but there were no differences in WB scores between alcohol drinkers and non-drinkers or between betel nut users and non-users. There were no significant correlations between WB levels and BMI status. Abnormal meal times, frequently eating out, lack of sleep, no exercise, and > 40 weekly work hours were positively correlated with WB levels.

Table 2. Distribution of work-related burnout levels according to sociodemographics, working, and lifestyle factors

Factors	Work-related burnout						Total (n=2746)		*p*-value
	Low (n=1063)		Medium (n=1006)		High (n=677)				
Profession									
Doctor (visiting physician)	75	(44.9%)	65	(38.9%)	27	(16.2%)	167	(6.1%)	<0.001**
Doctor (resident)	77	(40.3%)	65	(34.0%)	49	(25.7%)	191	(7.0%)	
Nurse	350	(24.9%)	568	(40.4%)	488	(34.7%)	1,406	(51.2%)	
Medical technician	165	(45.0%)	140	(38.1%)	62	(16.9%)	367	(13.4%)	
Administrative staff (supervisor)	14	(87.5%)	1	(6.3%)	1	(6.3%)	16	(0.6%)	
Administrative staff (other)	382	(63.8%)	167	(27.9%)	50	(8.3%)	599	(21.8%)	
Age (years)									
21-34	458	(35.2%)	448	(34.5%)	394	(30.3%)	1,300	(47.3%)	<0.001**
35-44	226	(37.5%)	240	(39.8%)	137	(22.7%)	603	(22.0%)	
45-54	246	(39.4%)	251	(40.2%)	128	(20.5%)	625	(22.8%)	
55-66	133	(61.0%)	67	(30.7%)	18	(8.3%)	218	(7.9%)	
Gender									<0.001*

Male	321	(54.5%)	181	(30.7%)	87	(14.8%)	589	(21.4%)	*
Female	742	(34.4%)	825	(38.2%)	590	(27.4%)	2,157	(78.6%)	
Length of service (years) (n=2,595)									
< 5 years	334	(35.4%)	333	(35.3%)	277	(29.3%)	944	(36.4%)	<0.001*
5-14 years	254	(37.1%)	258	(37.7%)	173	(25.3%)	685	(26.4%)	*
15-24 years	163	(31.2%)	219	(41.9%)	141	(27.0%)	523	(20.2%)	
>24 years	231	(52.1%)	154	(34.8%)	58	(13.1%)	443	(17.1%)	
Marital status									
Single	451	(33.7%)	494	(36.9%)	393	(29.4%)	1338	(48.7%)	<0.001*
Married	581	(43.3%)	489	(36.5%)	271	(20.2%)	1341	(48.8%)	*
Divorced	23	(45.1%)	17	(33.3%)	11	(21.6%)	51	(1.9%)	
Widowed	8	(50.0%)	6	(37.5%)	2	(12.5%)	16	(0.6%)	
Smoking (n=2728)									
No	1038	(38.4%)	991	(36.7%)	673	(24.9%)	2702	(99.0%)	0.014*
Yes	17	(65.4%)	7	(26.9%)	2	(7.7%)	26	(1.0%)	
Betel Nut Usage (n=2678)									
No	1032	(38.6%)	984	(36.8%)	660	(24.7%)	2,676	(99.9%)	0.500
Yes	0	(0.0%)	1	(50.0%)	1	(50.0%)	2	(0.1%)	
Alcohol Consumption									
No	1011	(38.6%)	958	(36.6%)	651	(24.8%)	2620	(95.4%)	0.558
Yes	52	(41.3%)	48	(38.1%)	26	(20.6%)	126	(4.6%)	
Meal time									<0.001*
Normal	677	(55.0%)	407	(33.0%)	148	(12.0%)	1232	(44.9%)	*
Abnormal	386	(25.5%)	599	(39.6%)	529	(34.9%)	1514	(55.1%)	
Eat out									<0.001*
0-1 meal	415	(48.9%)	304	(35.8%)	129	(15.2%)	848	(30.9%)	*
2-3 meals	648	(34.1%)	702	(37.0%)	548	(28.9%)	1898	(69.1%)	
Lack of sleep									<0.001*
No	677	(60.2%)	329	(29.3%)	118	(10.5%)	1124	(40.9%)	*
Yes	386	(23.8%)	677	(41.7%)	559	(34.5%)	1622	(59.1%)	
Physical exercise									<0.001*
None	562	(33.7%)	633	(37.9%)	473	(28.4%)	1,668	(60.7%)	*
Regular	501	(46.5%)	373	(34.6%)	204	(18.9%)	1,078	(39.3%)	
BMI (n=2,709)									
≦24	704	(37.3%)	700	(37.1%)	485	(25.7%)	1,889	(69.7%)	0.052
>24	345	(42.1%)	288	(35.1%)	187	(22.8%)	820	(30.3%)	
Weekly work hours (n=2,739)									<0.001*
20-40 hours	620	(54.8%)	372	(32.9%)	139	(12.3%)	1,131	(41.3%)	*
>40 hours	439	(27.3%)	632	(39.3%)	537	(33.4%)	1,608	(58.7%)	
Work type									<0.001*
Day shift	802	(45.2%)	636	(35.8%)	337	(19.0%)	1,775	(64.6%)	

Non-day shift	261	(26.9%)	370	(38.1%)	340	(35.0%)	971	(35.4%)	*
Lifestyle factors#									
None	71	(67.6%)	30	(28.6%)	4	(3.8%)	105	(3.8%)	
One	248	(67.2%)	99	(26.8%)	22	(6.0%)	369	(13.5%)	<0.001*
Two	321	(54.1%)	197	(33.2%)	75	(12.6%)	593	(21.7%)	*
Three	243	(33.0%)	304	(41.3%)	189	(25.7%)	736	(26.9%)	
Four	143	(19.5%)	297	(40.5%)	294	(40.1%)	734	(26.8%)	
Five	33	(16.3%)	77	(38.1%)	92	(45.5%)	202	(7.4%)	
Sleep hours (n=2740)									
No lack of sleep	677	(60.2%)	329	(29.3%)	118	(10.5%)	1124	(41.0%)	
Lack of sleep									
Workday sleep hours <6 hrs									
Catch-up sleep hours ≦0 hrs	13	(19.7%)	26	(39.4%)	27	(40.9%)	66	(2.4%)	
Catch-up sleep hours >0 and ≦2 hrs	60	(24.7%)	110	(45.3%)	73	(30.0%)	243	(8.9%)	
Catch-up sleep hours >2 hrs	88	(29.0%)	114	(37.6%)	101	(33.3%)	303	(11.1%)	<0.001*
Workday sleep hours ≧6 and <7 hrs									*
Catch-up sleep hours ≦0 hrs	22	(19.1%)	53	(46.1%)	40	(34.8%)	115	(4.2%)	
Catch-up sleep hours >0 and ≦2 hrs	106	(23.5%)	193	(42.7%)	153	(33.8%)	452	(16.5%)	
Catch-up sleep hours >2 hrs	53	(25.1%)	81	(38.4%)	77	(36.5%)	211	(7.7%)	
Workday sleep hours ≧7 hrs									
Catch-up sleep hours ≦0 hrs	12	(19.4%)	24	(38.7%)	26	(41.9%)	62	(2.3%)	
Catch-up sleep hours >0 and ≦2 hrs	18	(17.6%)	51	(50.0%)	33	(32.4%)	102	(3.7%)	
Catch-up sleep hours >2 hrs	10	(16.1%)	24	(38.7%)	28	(45.2%)	62	(2.3%)	
Exercise per week (n=2735)									
No physical exercise	562	(33.7%)	633	(37.9%)	473	(28.4%)	1,668	(61.0%)	
Regular physical exercise									<0.001*
<90 minutes/week	224	(45.1%)	195	(39.2%)	78	(15.7%)	497	(18.2%)	*
≧90 and <150 minutes/week	133	(46.0%)	86	(29.8%)	70	(24.2%)	289	(10.6%)	
≧150 minutes/week	135	(48.0%)	90	(32.0%)	56	(19.9%)	281	(10.3%)	

Chi-Square test. *p<0.05, **p<0.01.
Lifestyle factors: Abnormal meal times, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Independent factors associated with work-related burnout

As detailed in Table 3, multinomial logistic regression demonstrated that administrative staff had the lowest risk for WB when compared to nurses (Adjusted OR: 0.45/0.33, for medium/high level compared to low level). Women had adjusted

ORs of 1.41/1.59 for WB (Medium/high level compared with low level) when compared with men. The effects of age, length of service, and non-day shift work were non-significant after adjustments.

In terms of lifestyle factors, abnormal meal time (adjusted OR: 1.47/2.41), frequently eating out (adjusted OR: 1.17/1.49), lack of sleep (adjusted OR: 2.86/5.13), no exercise (adjusted OR: 1.27/1.41), and work hours >40 (adjusted OR: 1.56/2.72) were independently associated with work-related burnout (for medium/high level compared to low level).

Table 3. Multinomial logistic regression of factors associated with work-related burnout.

	Work-related burnout					
	Medium vs Low			High vs Low		
Factors	**OR**	**95% CI**	***p* value**	**OR**	**95% CI**	***p* value**
Gender (M vs F)	1.41	(1.08- 1.85)	0.013*	1.59	(1.11- 2.29)	0.012*
Age (years)						
21-34	ref.			ref.		
35-44	1.17	(0.86- 1.59)	0.323	0.82	(0.56- 1.20)	0.301
45-54	1.23	(0.76- 1.98)	0.403	0.74	(0.41- 1.34)	0.322
55-66	1.19	(0.64- 2.19)	0.583	0.62	(0.26- 1.46)	0.275
Length of service (years)						
< 5 years	ref.			ref.		
5-14 years	0.90	(0.68- 1.19)	0.463	0.85	(0.61- 1.18)	0.342
15-24 years	1.21	(0.77- 1.89)	0.404	1.64	(0.95- 2.82)	0.074
>24 years	0.95	(0.56- 1.61)	0.856	1.02	(0.51- 2.02)	0.960
Profession						
Nurse	ref.			ref.		
Doctor (visiting physician)	0.63	(0.39- 1.00)	0.052	0.47	(0.26- 0.87)	0.015*
Doctor (resident)	0.64	(0.40- 1.02)	0.063	0.57	(0.34- 0.97)	0.038*
Medical technician	0.83	(0.60- 1.15)	0.268	0.74	(0.49- 1.11)	0.150
Administrative staff (supervisor)	0.11	(0.01- 0.88)	0.037*	0.45	(0.05- 3.80)	0.462
Administrative staff (other)	0.45	(0.33- 0.61)	<0.001**	0.33	(0.22- 0.50)	<0.001**
Day shift (No vs Yes)	1.04	(0.81- 1.34)	0.753	1.18	(0.88- 1.57)	0.268
Lack of sleep	2.86	(2.33- 3.50)	<0.001**	5.13	(3.94- 6.69)	<0.001**
No physical exercise	1.27	(1.03- 1.55)	0.024*	1.41	(1.10- 1.81)	0.006**
Abnormal meal time	1.47	(1.19- 1.82)	<0.001**	2.41	(1.85- 3.15)	<0.001**
Often eat out	1.17	(0.94- 1.46)	0.152	1.49	(1.12- 1.97)	0.006**

Weekly work hours >40 hours	1.56	(1.26- 1.94)	<0.001**	2.72	(2.08- 3.57)	<0.001**
Lifestyle factors$#						
None	ref.			ref.		
One	0.91	(0.54- 1.52)	0.717	1.39	(0.45- 4.27)	0.564
Two	1.34	(0.82- 2.19)	0.246	3.37	(1.17- 9.72)	0.025*
Three	2.53	(1.55- 4.14)	<0.001**	9.58	(3.36- 27.31)	<0.001**
Four	3.95	(2.37- 6.58)	<0.001**	21.73	(7.58- 62.31)	<0.001**
Five	4.99	(2.64- 9.43)	<0.001**	32.98	(10.78- 100.87)	<0.001**
p for trend			<0.001**			<0.001**

Multinomial logistic regression. *p<0.05, **p<0.01.
$ Adjusted for Gender, Age, Length of service, Profession, Day shift
# Lifestyle factors: Abnormal meal time, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Combined effects of independent lifestyle factors associated with work-related burnout

The combined effect of the five independent factors (abnormal meal times, frequently eating out, lack of sleep, no exercise, and >40 work hours) is displayed in Table 2. As the number of risk factors increases, the proportion of subjects with medium and high levels of WB increases (32.4%, 32.8%, 45.9%, 67.0%, 80.5%, 83.7% for subjects with 0-5 factors, respectively), in a dose-response manner.

Table 3 reveals the results of the analysis of the number of lifestyle factors associated with WB by multinomial logistic regression. The adjusted OR (medium level compared to low level) of the participants with 1 to 5 lifestyle factors were 0.91 (95% CI: 0.54 to 1.52), 1.34 (95% CI: 0.82~2.19), 2.53 (95% CI: 1.55~4.14), 3.95 (95% CI: 2.37~6.58), 4.99 (95% CI: 2.64~9.43), respectively,, compared to those without any factors. The adjusted OR (high level compared to low level) of the participants with 1 to 5 lifestyle factors were 1.39 (95% CI: 0.45 to 4.27), 3.37 (95% CI: 1.17~9.72), 9.58 (95% CI: 3.36~27.31), 21.73 (95% CI: 7.58~62.31), 32.98 (95% CI: 10.78~100.87), compared to those without any factors. There was a significant difference in WB (high level compared to low level) among participants with at least

two factors, when compared to those without any factors.

Association between weekend catch-up sleep hours and work-related burnout.

The participants who experienced a lack of sleep were categorized into groups based upon their workday sleep hours and weekend catch-up sleep hours. The numbers of each group are shown in Table 1. The distribution of WB levels according to the different groups is shown in Table 2.

In Table 4, the multinomial logistic regression model demonstrates the trends observed in the different groups. In the "workday sleep hours <6 hours" group, those with more weekend catch-up sleep hours had lower WB scores (adjusted OR: 7.17/4.88/ 4.29 for ≦0/ >0 and ≦2 / >2 hours, compared to those with enough sleep). In the "workday sleep hours ≧6 and <7 hours" group, those with more weekend catch-up sleep hours also had lower WB scores (adjusted OR: 6.26/ 5.90/4.16 for ≦0, >0 and ≦2, >2 hours, compared to those with enough sleep). However, in the "workday sleep hours ≥ 7 hours" group, those with more catch up sleep hours had higher WB scores (adjusted OR: 4.91/4.94/6.74 for ≦0/>0 and ≦ 2/>2 hours, compared to those with enough sleep) (Figure 1).

Table 4. Subgroup analysis: multinomial logistic regression of sleep hours associated with work-related burnout.

Factors	Multivariate model					
	Medium vs. Low			High vs. Low		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Workday and weekend catch-up sleep hours [$]						
No lack of sleep	ref.			ref.		
Lack of sleep						
Workday sleep hours <6 hrs						
Catch-up sleep hours ≦0 hrs	2.90	(1.38- 6.09)	0.005**	7.17	(3.31- 15.53)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.09	(2.14- 4.47)	<0.001**	4.88	(3.14- 7.61)	<0.001**
Catch-up sleep hours >2 hrs	2.13	(1.52- 2.98)	<0.001**	4.29	(2.89- 6.37)	<0.001**
Workday sleep hours ≧6 and <7 hrs						
Catch-up sleep hours ≦0 hrs	3.74	(2.12- 6.57)	<0.001**	6.26	(3.33- 11.76)	<0.001**

Catch-up sleep hours >0 and ≦2 hrs	3.38	(2.50- 4.57)	<0.001**	5.90	(4.10- 8.47)	<0.001**
Catch-up sleep hours >2 hrs	2.33	(1.54- 3.51)	<0.001**	4.16	(2.63- 6.60)	<0.001**
Workday sleep hours ≧ 7 hrs						
Catch-up sleep hours ≦0 hrs	2.40	(1.13- 5.08)	0.022*	4.91	(2.24- 10.75)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.77	(2.10- 6.77)	<0.001**	4.94	(2.54- 9.63)	<0.001**
Catch-up sleep hours >2 hrs	2.98	(1.32- 6.71)	0.008**	6.74	(2.94- 15.46)	<0.001**
Exercise time per week #						
No physical exercise	ref			ref		
Regular physical exercise						
<90 minutes/week	0.96	(0.74- 1.26)	0.786	0.62	(0.44- 0.89)	0.008**
≧90 and <150 minutes/week	0.72	(0.52- 1.01)	0.057	0.85	(0.58- 1.25)	0.413
≧150 minutes/week	0.75	(0.54- 1.05)	0.092	0.77	(0.51- 1.16)	0.209

Multinomial logistic regression. *p<0.05, **p<0.01.
$ Adjusted for gender, age, length of service, profession, day shift, exercise, meal time, frequently eat out, work hours.
# Adjusted for gender, age, length of service, profession, day shift, lack of sleep, mealtime, frequently eat out, work hours.

We also attempted to categorize the participants who had regular physical exercise based on the total weekly exercise hours. The numbers for each subgroup and the distribution of WB levels according to the different subgroups are shown in Tables 1 and 2. However, there was no dose-response relationship between weekly exercise hours and WB levels after adjustment (Table 4).

DISCUSSION

To our knowledge, this is the first study to assess the combined effect of unhealthy lifestyle factors on WB and to determine the associations between weekend catch-up sleep and WB in the medical workplace. Our findings show that five key modifiable lifestyle factors, including abnormal meal times, often eating out, lack of sleep, no exercise, and >40 weekly work hours, were independently associated with WB levels. The number of these combined unhealthy lifestyle factors was shown to be associated with severity of WB in a dose-dependent manner. As the numbers of the abovementioned lifestyle factors increased, the proportion of respondents with medium or high levels of WB rose. Among these lifestyle factors, a lack of sleep

showed the strongest correlation with WB in the medical workplace. In the subgroup analysis of sleep hours, among respondents with duration of workday sleep less than 7 hours, weekend catch-up sleep was related to reduced burnout risk. However, for those with workday sleep hours greater than 7 hours, weekend catch-up sleep was related to an elevated risk of workplace burnout.

For the non-modifiable factors, our findings are consistent with previous studies which showed that females gender was independently associated with higher burnout levels.[2 24] Our study also confirmed the results of a previous study that showed being a nurse was associated with higher burnout levels.[2] However, WB in nurses was not significantly different compared with other occupations (except administrative staff) after adjustment. In contrast to other previous studies,[2 24 25] length of service and age were not significant risk factors for WB after adjustment in our study. A possible explanation for this is that our results were adjusted for additional lifestyle factors, whereas some previous studies did not control for other variables.[2 24]

With regard to modifiable factors, our study revealed that obesity was not an independent risk factor for WB, as higher BMI was correlated with lower burnout scores, which was consistent with previous research. [26] A possible explanation for this is that hypercortisolism is commonly associated with increased food intake and body weight gain. [27] However, burnout was more consistently associated with hypocortisolism, [28] which leads to the inhibition of food consumption. In contrast to other studies,[29 30] our results found that smokers had lower WB scores compared to non-smokers, while there were no differences in WB scores among alcohol drinkers and betel nut users compared with their abstaining counterparts. This may be due to the sociocultural characteristics of the study population, in which less than 5% of the participants reported smoking, drinking, or using betel nuts .[31 32]

Our analysis of the five key modifiable factors showed that "normal meal times" and "infrequent eating out" were significantly associated with a lower risk of WB. Although no previous studies have directly investigated the relationship between these two factors and burnout, higher levels of fast-food consumption were reported to be positively associated with burnout.[10] Moreover, we found that being "physically active" may protect against burnout, as this variable was associated with a low risk of WB, which is consistent with previous studies.[8 10 33 34] Burnout prevalence was lower among students who exercised consistently following CDC recommendations, compared with those who exercised less.[8 33] Previous studies did not find a dose-response relationship for exercise hours, which was similar to our findings.[25] Additionally, we found that long work hours were a risk factor for higher WB levels. Previous studies also demonstrated that "Working more than 14 consecutive hours" and "Working over 40 hours per week" were independent risk factors associated with burnout.[8 24]

Due to the limitations of the official questionnaire used in this study, we surveyed exercise duration per week, general meal times, and average number of times eating out per day, without distinguishing between workdays and weekends. Clemens Drenowatz, et al. found that weekend behaviors appeared to be of particular importance, even though overall physical activity levels were similar between weekdays and the weekend. [35] A possible explanation is the greater freedom of lifestyle choices during the weekend. Moreover, a nationally representative survey of diet among U.S. adults revealed that weekend consumption was associated with increased calorie intake and poorer diet quality. [36] The greater prevalence of fast-food and full-service restaurant consumption may contribute to poorer diet quality on weekends. A possible explanation for this phenomenon is that time away from one's

occupation leads to more time spent on food-related activities, and social aspects of weekends are often paired with eating. [37] Future research should distinguish the impact of lifestyle habits on workdays and weekends on burnout.

In this study, the strongest correlation with WB was lack of sleep, which was similar to previous studies.[9 25 34] Weishan Chin et al. found that nurses who slept less than 6 hours during the workweek had a higher risk for WB compared to those who slept more than 7 hours.[9] In addition, Megan R. Wolf et al. also found that sleeping less than 7 hours was an independent predictor of burnout among medical students.[34] Although certain studies have explored the relationship between chronotype/social jetlag and burnout,[18] no previous studies have directly investigated the association between weekend catch-up sleep hours and burnout.

Our results revealed that weekend catch-up sleep was correlated with lower burnout risk among subjects with a short workday sleep duration (less than 7 hours). This finding was similar to the results of a previous report by Yun Hwan Oh et al.[15] They found that among participants with a short workday sleep duration (less than 7 hours), there was a significant difference in health-related quality of life between those with and without weekend catch-up sleep. A possible mechanism underlying this effect could involve the greater sleep debt among participants with short workday sleep duration. Thus, weekend catch-up sleep could compensate for the sleep debt caused by insufficient sleep during the workweek.[15]However, it was not possible to establish a causal relationship between weekend catch-up sleep and WB in this investigation due to the limitation of the study design.

Our finding revealed that those with "Workday sleep hours ≧ 7 hrs and catch-up sleep hours > 2 hrs" (> 9 hours in total on weekends) had higher OR for WB (6.74 compared to those with enough sleep). Generally, around 7 to 9 hours is regarded as

the optimal duration of sleep in terms of psychological well-being and subjectively perceived health. [38] Although there is no evidence showing correlations between longer sleep durations and burnout, previous studies have found that long sleep duration (> 9 hours) was associated with an increased likelihood of depression, anxiety, and diabetes. [38 39] A potential underlying mechanism may involve increased levels of inflammation markers in long sleepers. [39] Moreover, weekend catch-up sleep behavior could be considered a violation of sleep hygiene rules. [15] Nonetheless, weekend catch-up sleep may reasonably be expected to be associated with better health outcome in subjects with sleep debt, which was indeed borne out by our findings.

Although some studies have investigated the association between combined unhealthy lifestyle factors and risk of depressive symptoms,[14] no similar studies have been conducted for burnout. The present report is the first to assess the combined effect of multiple unhealthy lifestyle factors on burnout level. The impact of lifestyle factors on burnout may vary from culture to culture, and thus we selected lifestyle factors based on items in a questionnaire designed to assess overwork which was developed by the Occupational Safety and Health Administration of Taiwan's the Ministry of Labor. Finally, only factors that were independently associated with burnout were included in the calculation of the combined effects.

Our study has a number of strengths. First, the modifiable risk factors that were selected in our study were based on items in a questionnaire devised by experts for a nationally implemented occupational health program. Therefore, these factors were both culturally representative and suitable indicators for assessing the local medical workplace. Second, we conducted a stratified analysis of "workday sleep hours" and "weekend catch-up sleep hours", in order to provide an overall risk assessment of

weekend catch-up sleep for WB, according to different durations of workday sleep.

This study also had several limitations. First, the study design was cross-sectional, and therefore a causal relationship could not be established. However, it was possible to demonstrate the existence of associations between the modifiable risk factors and WB. Second, there was no information regarding the number of sleep hours of workers who self-reported having enough sleep in this questionnaire. Therefore, our recommendations related to burnout risk for "weekend catch-up sleep hours" and "workday sleep hours", can only be applied to staff experiencing a lack of sleep. Third, there was no objective way to assess the quality of sleep or to verify the self-reported sleep duration in this study. In fact, perceived sleep quality may affect self-reported sleep duration, which should be taken into consideration when interpreting the results of this study. Fourth, this study is part of program that aims to identify medical staff at high risk group of experiencing burnout. The results, as well as findings from physician interviews, will help to inform the development of a workplace health promotion program. These measures will inevitably take up part of the weekly working hours and may affect the consistency of the questionnaire. Furthermore, the data obtained in this study largely comprised self-reported information, and thus information bias may have existed. However, the analysis of our questionnaire results were yielded a Cronbach's α score of 0.866, indicating a high level of reliability.

CONCLUSION

This study found associations between five modifiable risk factors and work-related burnout in a medical workplace in Taiwan, and further demonstrated that burnout severity increased in proportion to the number of risk factors. Weekend catch-up sleep

was correlated with lower burnout risk in participants with a short workday sleep duration (less than 7 hours), but with higher burnout risk in participants with more than seven hours' sleep during the workweek. Clinicians should pay particular attention to people with combined unhealthy lifestyle factors, especially short sleep duration without weekend catch-up sleep. Serious efforts must be undertaken to reduce modifiable risk factors in the workplace to promote the health of medical staff, although further prospective studies are still necessary to establish the causal relationships between unhealthy lifestyle behaviors and burnout.

Patient and Public Involvement

We developed the research questions and outcome measures based on the official questionnaire released by the Occupational Safety and Health Administration in Taiwan. The study was approved by the hospital's IRB (CE18353A) and the requirement for informed consent was waived due to the low risk of the study design. All voluntary medical staff completing an electronic questionnaire were enrolled in the study. We will apply the findings of this research to a workplace health promotion program aimed at improving the health of medical staff.

Acknowledgements

The authors thank all the participants, TCVGH-1077202C and TCVGH-1077203D from Taichung Veterans General Hospital for their support, and the Biostatistics Task Force of Taichung Veterans General Hospital, Taichung, Taiwan, R.O.C. for assistance with the statistical analysis.

Author Contributions Y-T T conceived of the study and supervised all aspects of its implementation. Y-L L completed the analyses and drafted the content. Y-SL and

S-YH assisted with the study design and revised the content. W-MC, C-HC and Y-CY assisted with the statistical analysis and revised the content. All authors helped to conceptualize ideas, interpret findings, and review drafts of the manuscript.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None.

Patient consent Not required.

Ethical approval Institutional Review Board I & II, Taichung Veterans General Hospital (Case no. CE18353A).

Data availability statement All data relevant to the study are included in the article. The data were anonymized prior to analysis to protect the subjects' privacy.

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Figure 1
WB risk among participants with different duration of workday sleep and weekend catch-up sleep.

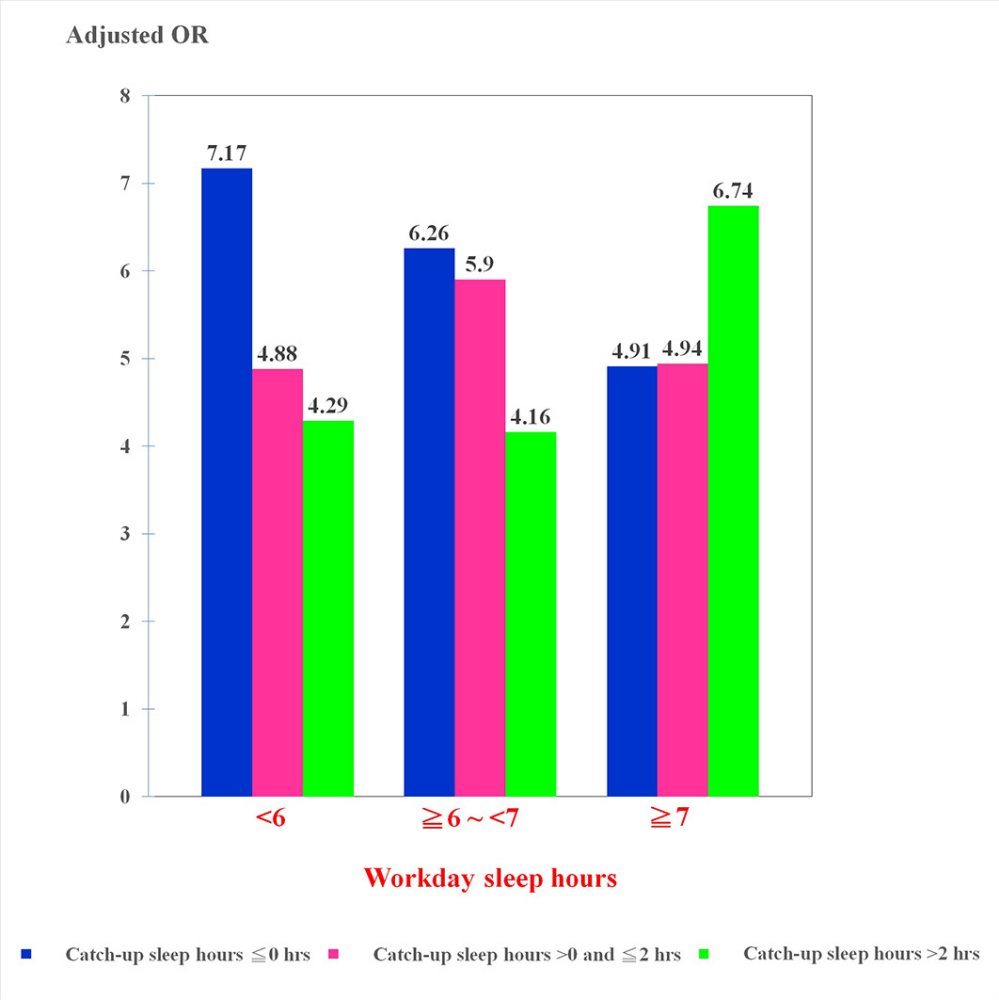

Figure 1: WB risk among participants with different duration of workday sleep and weekend catch-up sleep.

90x90mm (300 x 300 DPI)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of	5

		recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5,6
Bias	#9	Describe any efforts to address potential sources of bias	5
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	6
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	6
Statistical methods	#12c	Explain how missing data were addressed	6
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	6
Statistical methods	#12e	Describe any sensitivity analyses	6
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	6
Participants	#13b	Give reasons for non-participation at each stage	6
Participants	#13c	Consider use of a flow diagram	6

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	6
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
Main results	#16b	Report category boundaries when continuous variables were categorized	8~14
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8~14
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	8~14
Discussion			
Key results	#18	Summarise key results with reference to study objectives	14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	15~17
Generalisability	#21	Discuss the generalisability (external validity) of the study results	15~17
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

This checklist was completed on 03. July 2019 using https://www.goodreports.org/, a tool made by the EQUATOR Network in collaboration with Penelope.ai

BMJ Open

Modifiable Risk Factors Related to Burnout Levels in the Medical Workplace in Taiwan: a Cross-sectional Study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-032779.R2
Article Type:	Original research
Date Submitted by the Author:	11-Oct-2019
Complete List of Authors:	Lin, Yu-Li; Taichung Veterans General Hospital, Department of Family Medicine Chen, Cing-Hua; Taichung Veterans General Hospital, Department of Nursing and Occupational Safety and Health Office Chu, Wei-Min ; Taichung Veterans General Hospital, Division of Occupational Medicine, Department of Emergency Medicine; Chung Shan Medical University, Institute of Medicine Hu, Sung-Yuan; Taichung Veterans General Hospital, Division of Occupational Medicine, Department of Emergency Medicine; National Taichung University of Science and Technology, Department of Nursing, College of Health Liou, Yi-Sheng; Taichung Veterans General Hospital, Department of Family Medicine; National Defense Medical Center, School of Public Health Yang, Yi-Chien ; China Medical University Hospital, Department of Neurology Tsan, Yu-Tse ; Taichung Veterans General Hospital, Division of Occupational Medicine, Department of Emergency Medicine; Chung Shan Medical University, School of Medicine
Primary Subject Heading:	Occupational and environmental medicine
Secondary Subject Heading:	Public health, Global health
Keywords:	Work-related burnout, Combined lifestyle factors, Weekend catch-up sleep

Modifiable Risk Factors Related to Burnout Levels in the Medical Workplace in Taiwan: a Cross-sectional Study

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Word count: 3860

ABSTRACT

Objectives: To detect the combined effects of lifestyle factors on work-related burnout (WB) and to analyze the impact of the number of weekend catch-up sleep hours on burnout risk in a medical workplace.

Design: Cross-sectional study.

Setting: Hospital-based survey in Taiwan.

Participants: In total, 2746 participants completed the hospital's Overload Health Control System questionnaire for the period from the first day of January 2016 through to the end of December 2016, with a response rate of 70.5%. The voluntary participants included 358 physicians, 1406 nurses, 367 medical technicians, and 615 administrative staff.

Primary and secondary outcome measures: All factors that correlated significantly with WB were entered into a multinomial logistic regression after adjustment for other factors. The dose-response relationship of combined lifestyle factors and catch-up sleep hours associated with WB was explored by logistic regression.

Results: Abnormal meal time (Adjusted OR: 2.41, 95% CI 1.85-3.15), frequently eating out (1.49, 1.12-1.97), lack of sleep (5.13, 3.94-6.69), no exercise (1.41, 1.10-1.81), and work hours >40 (2.72, 2.08-3.57) were independently associated with work-related burnout (for high level compared to low level). As the number of risk factors increased (1 to 5), so did the proportion of high severity of WB (1.39, 0.45-4.27 to 32.98, 10.78-100.87). For those with more than seven hours' sleep on workdays, weekend catch-up sleep ($\leqq$0/>0 and $\leqq$2/>2 hours) was found to be related to an increase of burnout risk (4.91, 2.24-10.75/4.94, 2.54-9.63/6.74, 2.94-15.46).

Conclusions: WB in the medical workplace was affected by five unhealthy lifestyle

factors, and combinations of these factors were associated with greater severity of WB. Weekend catch-up sleep was correlated with lower burnout risk in those with a short workday sleep duration (less than 7 hours). Clinicians should pay particular attention to medical staff with short sleep duration without weekend catch-up sleep.

Keywords: Work-related burnout; Combined lifestyle factors; Weekend catch-up sleep.

Article Summary

Strengths and limitations of this study:

- This is the first study to assess the combined effect of unhealthy lifestyle factors on work-related burnout (WB) and to determine the associations between weekend catch-up sleep and WB in the medical workplace.
- The modifiable risk factors included in our study were identified according to the contents of a questionnaire based on a legally authorized and official program, and were therefore culturally representative of the local medical workplace.
- The study design was cross-sectional, and therefore a causal relationship could not be established.
- The associations between weekend catch-up sleep and work-related burnout could only be applied to staff experiencing a lack of sleep, because there was no information regarding the number of sleep hours in staff who reported having enough sleep.
- Information in this study mainly comprised self-reported measures, and thus information bias may have existed.

INTRODUCTION

In recent years, the issue of burnout among employees in the medical profession

has received increasing attention, as it can result in a number of deleterious physical, psychological, and occupational consequences.[1] Previous research has demonstrated that burnout is an important factor when assessing mental health in the workplace.[2] Physician burnout is increasingly being recognized as a public health crisis, which is having a range of negative effects on individual physicians, their patients' care, and the healthcare system as a whole.[3] Moreover, the prevalence of burnout is greater among residents and fellows than among early career physicians.[4] A meta-analytic study revealed that high emotional exhaustion was found in the 31% of the nurses, as well as high depersonalisation and low personal accomplishment in 24% and 38% of the subjects, respectively.[5] Compared to other professions (registered nurses, and respiratory therapists), physicians and nurse practitioners were more likely to report work-life conflict, irregular work hours, and heavy work pressure.[6] Another study noted that physician assistants (61.8%) and nurses (66%) had higher prevalence of high work-related burnout than other medical professions, including physicians (38.6%), administrative staff (36.1%), and medical technicians (31.9%), in a regional hospital in Taiwan.[2]

Many previous studies have found that certain non-modifiable factors, such as gender, age, marriage status, seniority, job category, and shift work, were related to burnout.[2 7] The authors of the present study believe that modifiable factors are more important than non-modifiable factors, because the former can be improved through on-site health services. A few studies have explored modifiable factors related to workplace burnout, such as higher consumption of fast food, infrequent exercise, long working hours, and fewer sleep hours.[8-10] However, to date, no research has been conducted to identify the factors most relevant to burnout, or to assess the combined effects of these factors.

Several studies have shown that the total number of health related lifestyle factors has a greater impact on health outcomes (including mortality in cancer patients, disability-free survival, and depression) than any single lifestyle factor.[11-14] Individual lifestyle behaviors have been associated with elevated burnout level, but to the best of our knowledge, the association between combined lifestyle behaviors and work-related burnout in the medical workplace has not been investigated.

One method of coping with insufficient sleep during the workweek is to increase the sleep duration during the weekend.[15] Previous studies have demonstrated an association between weekend catch-up sleep and various health outcomes, including obesity, hypertension, and health-related quality of life. [15-17] However, there are currently no data in the literature on the association between weekend catch-up sleep and work-related burnout among medical staff.

Thus, the aims of the present study were : (1) to identify modifiable factors associated with work-related burnout in the medical workplace, and to assess the effects of combined lifestyle factors on WB; (2) to determine the risk of work-related burnout based on the number of weekend catch-up sleep hours in patients with varying degrees of sleep insufficiency during the workweek.

METHODS

Participants and study design

This study was approved by the Institutional Review Board I & II of Taichung Veterans General Hospital (Case no. CE18353A). The study design was cross-sectional. The subjects were asked to complete an electronic questionnaire on the Overload Health Control System of Taichung Veterans General Hospital from the first day of January 2016 through the end of December 2016. In total, 2746

participants completed the questionnaire, with a response rate of 70.5% (2746/3894). The voluntary participants included 167 visiting doctors, 191 resident doctors, 1406 nurses, 367 medical technicians, and 615 administrative staff (including 16 supervisors). The data were anonymized prior to analysis to protect the subjects' privacy. Participation in the study did not involve any health risks and all subjects' personal data were secured.

Factors in the questionnaire

In Taiwan, the publication "Guideline for Preventing Diseases Caused by Exceptional Workload" was released by the Occupational Safety and Health Administration of the Ministry of Labor in 2014. According to the guideline, laborers must fill out the overwork assessment questionnaire, which contains items related to sociodemographics (gender, age, and marital status), working conditions (current profession, length of employment, and self-reported type of work), lifestyle factors (smoking/alcohol/betel nut use status, sleep condition, meal times, frequency of eating out, exercise habits, and self-reported working hours per week). The items in the questionnaire were selected by an expert consensus of the Occupational Safety and Health Administration of the Ministry of Labor of Taiwan. If participants selected "lack of sleep" or "regular physical exercise" in the questionnaire, they were required to provide their number of sleep hours on workdays and free days, as well as their total duration of weekly exercise. Weekend catch-up sleep hours were calculated according to the following formula: Weekend sleep hours minus the workday sleep hours.[18] Workday sleep duration was categorized into 3 groups: <6 hours, ≧6 to <7 hours, ≧7 hours. Weekend catch-up sleep duration was categorized into 3 groups: ≤0 hours, >0 to ≤2 hours, >2 hours.

Burnout

The newly developed Copenhagen Burnout Inventory (CBI) by Kristensen et al.[19] is a more straightforward measurement of burnout in medical professionals, as compared to the standard Maslach Burnout Inventory (MBI).[20] The CBI assesses burnout status through the use of three criteria: personal burnout, work-related burnout, and client-related burnout. Additionally, a Chinese version of the Copenhagen Burnout Inventory (C-CBI) was constructed based upon the CBI, which displayed good validity and reliability.[21 22] In this study, we adopted 'Work-related Burnout (WB)' subscales of the C-CBI to assess burnout risk in the workplace. The C-CBI 'work-related burnout' subscales consist of 7 items.[21] All items used a Likert-type, five-response category scale. The responses were rescaled to a 0–100 metric. According to a previous study,[21] the C-CBI WB had a Cronbach's α coefficient of 0.87. For work-related burnout scores, burnout scores of ≧45 and >60 indicated medium and high burnout, respectively, in the analysis.

Statistical analysis

Data from the C-CBI WB subscales were analyzed for internal consistency using Cronbach's α. The WB score was categorized into three levels: Low, Medium, and High. Demographic information, working conditions, and lifestyle factors were expressed by the category variable and were recorded as numbers (%). Differences in the distribution of categorical variables for WB level were tested using the $\chi 2$ test. All factors with significant associations with WB were entered into multinomial logistic regression after adjustment for other factors to calculate the odds ratios (ORs) (95% CIs). All calculations were performed using the statistical software program SPSS version 23, with the level of significance set at $p<0.05$. We used the STROBE cross-

sectional checklist when writing this report.[23]

RESULTS

Characteristics of the participants

The demographic information, working conditions, and lifestyle factors of the participants are summarized in Table 1. Most participants were female (78.55%), 48.83% were married, and 48.73% were single. More than half of the participants were nurses (51.20%) and on day shift (64.64%). Nearly half of the participants were young (between 21 to 34 years old, 47.34%), and around one third were employed for less than 5 years (34.38%). Most participants denied any smoking/alcohol/betel nut use (98.40%/97.45%/95.41%) and had normal BMI (68.79%). Analysis of employees' lifestyle habits revealed abnormal meal times (55.13%), high eating out rates (93.26% reported eating out for at least one meal per day), lack of sleep (59.07%), non-regular physical exercise (60.74%), and working overtime (>40 hours)(58.56%).

Table 1. Characteristics of participants (N=2746)

Factors	N	%	Factors	N	%
Profession			**Mealtime**		
Doctor (visiting physician)	167	(6.08%)	Normal	1232	(44.87%)
Doctor (resident)	191	(6.96%)	Abnormal	1514	(55.13%)
Nurse	1406	(51.20%)	**Eat out**		
Medical technician	367	(13.36%)	0 meal	185	(6.74%)
Administrative staff (supervisors)	16	(0.58%)	1 meal	663	(24.14%)
Administrative staff (other)	599	(21.81%)	2 meals	832	(30.30%)
Age (years)			3 meals	1066	(38.82%)
21-34	1300	(47.34%)	**Lack of sleep**		
35-44	603	(21.96%)	No	1124	(40.93%)
45-54	625	(22.76%)	Yes	1622	(59.07%)
55-66	218	(7.94%)	Workday sleep hours <6 hrs		
Gender			Catch-up sleep hours ≦0 hrs	66	(2.40%)
Male	589	(21.45%)	Catch-up sleep hours >0 and ≦2 hrs	243	(8.85%)
Female	2157	(78.55%)	Catch-up sleep hours >2 hrs	303	(11.03%)
Length of service (years)			Workday sleep hours ≧6 and <7 hrs		
< 5 years	944	(34.38%)	Catch-up sleep hours ≦0 hrs	115	(4.19%)
5-14 years	685	(24.95%)	Catch-up sleep hours >0 and ≦2 hrs	452	(16.46%)

15-24 years	523	(19.05%)	Catch-up sleep hours >2 hrs	211	(7.68%)
>24 years	443	(16.13%)	Workday sleep hours ≧7 hrs		
Missing	151	(5.50%)	Catch-up sleep hours ≦0 hrs	62	(2.26%)
Marital status			Catch-up sleep hours >0 and ≦2 hrs	102	(3.71%)
Single	1338	(48.73%)	Catch up sleep hours >2 hrs	62	(2.26%)
Married	1341	(48.83%)	Missing	6	(0.22%)
Divorced	51	(1.86%)	**Physical exercise**		
Widowed	16	(0.58%)	None	1668	(60.74%)
BMI			Regular	1078	
≦24	1889	(68.79%)	<90 minutes/week	497	(18.10%)
>24	820	(29.86%)	≧90 and <150 minutes/week	289	(10.52%)
Missing	37	(1.35%)	≧150 minutes/week	281	(10.23%)
Smoking			Missing	11	(0.40%)
No	2702	(98.40%)	**Weekly work hours**		
Yes	26	(0.95%)	20-40 hours	1131	(41.19%)
Missing	18	(0.66%)	41-60 hours	1379	(50.22%)
Betel Nut Usage			>60 hours	229	(8.34%)
No	2676	(97.45%)	Missing	7	(0.25%)
Yes	2	(0.07%)	**Lifestyle factors***		
Missing	68	(2.48%)	None	105	(3.8%)
Alcohol Consumption			One	369	(13.5%)
No	2620	(95.41%)	Two	593	(21.7%)
Yes	126	(4.59%)	Three	736	(26.9%)
Work type			Four	734	(26.8%)
Day shift	1775	(64.64%)	Five	202	(7.4%)
Night shift	184	(6.70%)			
Graveyard shift	139	(5.06%)			
Rotating shift	648	(23.60%)			

* Lifestyle factors: Abnormal meal times, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Factors associated with work-related burnout

The reliability of the WB questionnaire was assessed by Cronbach's α for each item, with a resulting score of 0.866, indicating a high internal consistency.

Table 2 displays the distribution of WB levels according to sociodemographic, working, and lifestyle factors. The percentages of the respondents with a low, medium, or high level of WB were 38.71%, 36.64%, and 24.65%, respectively.

Significantly more women than men (65.6% vs. 45.5%, respectively) had a high

WB score, i.e., medium and high levels of WB. Respondents who were single had higher WB scores than those who were married. The 55-66 years age group accounted for the lowest percentage among respondents with a high level of WB, whereas the 21-34 years age group comprised the highest percentage. Among respondents with a medium or high level of WB, those with 15-24 years of employed service constituted the largest percentage (68.9%). With respect to the types of medical professions, nurses had the highest WB scores, while the administrative supervisors had the lowest scores. The non-day shift workers had higher WB scores compared with the day shift workers. The total number of weekly hours of work was significantly correlated with WB level.

Smokers had lower WB scores than non-smokers, but there were no differences in WB scores between alcohol drinkers and non-drinkers or between betel nut users and non-users. There were no significant correlations between WB levels and BMI status. Abnormal meal times, frequently eating out, lack of sleep, no exercise, and > 40 weekly work hours were positively correlated with WB levels.

Table 2. Distribution of work-related burnout levels according to sociodemographics, working, and lifestyle factors

Factors	Work-related burnout						Total (n=2746)		*p*-value
	Low (n=1063)		Medium (n=1006)		High (n=677)				
Profession									
Doctor (visiting physician)	75	(44.9%)	65	(38.9%)	27	(16.2%)	167	(6.1%)	
Doctor (resident)	77	(40.3%)	65	(34.0%)	49	(25.7%)	191	(7.0%)	<0.001*
Nurse	350	(24.9%)	568	(40.4%)	488	(34.7%)	1,406	(51.2%)	*
Medical technician	165	(45.0%)	140	(38.1%)	62	(16.9%)	367	(13.4%)	
Administrative staff (supervisor)	14	(87.5%)	1	(6.3%)	1	(6.3%)	16	(0.6%)	
Administrative staff (other)	382	(63.8%)	167	(27.9%)	50	(8.3%)	599	(21.8%)	
Age (years)									
21-34	458	(35.2%)	448	(34.5%)	394	(30.3%)	1,300	(47.3%)	<0.001*
35-44	226	(37.5%)	240	(39.8%)	137	(22.7%)	603	(22.0%)	*
45-54	246	(39.4%)	251	(40.2%)	128	(20.5%)	625	(22.8%)	
55-66	133	(61.0%)	67	(30.7%)	18	(8.3%)	218	(7.9%)	
Gender									

Male	321	(54.5%)	181	(30.7%)	87	(14.8%)	589	(21.4%)	<0.001*
Female	742	(34.4%)	825	(38.2%)	590	(27.4%)	2,157	(78.6%)	*
Length of service (years) (n=2,595)									
< 5 years	334	(35.4%)	333	(35.3%)	277	(29.3%)	944	(36.4%)	<0.001*
5-14 years	254	(37.1%)	258	(37.7%)	173	(25.3%)	685	(26.4%)	*
15-24 years	163	(31.2%)	219	(41.9%)	141	(27.0%)	523	(20.2%)	
>24 years	231	(52.1%)	154	(34.8%)	58	(13.1%)	443	(17.1%)	
Marital status									
Single	451	(33.7%)	494	(36.9%)	393	(29.4%)	1338	(48.7%)	<0.001*
Married	581	(43.3%)	489	(36.5%)	271	(20.2%)	1341	(48.8%)	*
Divorced	23	(45.1%)	17	(33.3%)	11	(21.6%)	51	(1.9%)	
Widowed	8	(50.0%)	6	(37.5%)	2	(12.5%)	16	(0.6%)	
Smoking (n=2728)									
No	1038	(38.4%)	991	(36.7%)	673	(24.9%)	2702	(99.0%)	0.014*
Yes	17	(65.4%)	7	(26.9%)	2	(7.7%)	26	(1.0%)	
Betel Nut Usage (n=2678)									
No	1032	(38.6%)	984	(36.8%)	660	(24.7%)	2,676	(99.9%)	0.500
Yes	0	(0.0%)	1	(50.0%)	1	(50.0%)	2	(0.1%)	
Alcohol Consumption									
No	1011	(38.6%)	958	(36.6%)	651	(24.8%)	2620	(95.4%)	0.558
Yes	52	(41.3%)	48	(38.1%)	26	(20.6%)	126	(4.6%)	
Meal time									<0.001*
Normal	677	(55.0%)	407	(33.0%)	148	(12.0%)	1232	(44.9%)	*
Abnormal	386	(25.5%)	599	(39.6%)	529	(34.9%)	1514	(55.1%)	
Eat out									<0.001*
0-1 meal	415	(48.9%)	304	(35.8%)	129	(15.2%)	848	(30.9%)	*
2-3 meals	648	(34.1%)	702	(37.0%)	548	(28.9%)	1898	(69.1%)	
Lack of sleep									<0.001*
No	677	(60.2%)	329	(29.3%)	118	(10.5%)	1124	(40.9%)	*
Yes	386	(23.8%)	677	(41.7%)	559	(34.5%)	1622	(59.1%)	
Physical exercise									<0.001*
None	562	(33.7%)	633	(37.9%)	473	(28.4%)	1,668	(60.7%)	*
Regular	501	(46.5%)	373	(34.6%)	204	(18.9%)	1,078	(39.3%)	
BMI (n=2,709)									
≦24	704	(37.3%)	700	(37.1%)	485	(25.7%)	1,889	(69.7%)	0.052
>24	345	(42.1%)	288	(35.1%)	187	(22.8%)	820	(30.3%)	
Weekly work hours (n=2,739)									<0.001*
20-40 hours	620	(54.8%)	372	(32.9%)	139	(12.3%)	1,131	(41.3%)	*
>40 hours	439	(27.3%)	632	(39.3%)	537	(33.4%)	1,608	(58.7%)	
Work type									<0.001*
Day shift	802	(45.2%)	636	(35.8%)	337	(19.0%)	1,775	(64.6%)	

Non-day shift	261	(26.9%)	370	(38.1%)	340	(35.0%)	971	(35.4%)	*
Lifestyle factors#									
None	71	(67.6%)	30	(28.6%)	4	(3.8%)	105	(3.8%)	
One	248	(67.2%)	99	(26.8%)	22	(6.0%)	369	(13.5%)	<0.001**
Two	321	(54.1%)	197	(33.2%)	75	(12.6%)	593	(21.7%)	
Three	243	(33.0%)	304	(41.3%)	189	(25.7%)	736	(26.9%)	
Four	143	(19.5%)	297	(40.5%)	294	(40.1%)	734	(26.8%)	
Five	33	(16.3%)	77	(38.1%)	92	(45.5%)	202	(7.4%)	
Sleep hours (n=2740)									
No lack of sleep	677	(60.2%)	329	(29.3%)	118	(10.5%)	1124	(41.0%)	
Lack of sleep									
Workday sleep hours <6 hrs									
Catch-up sleep hours ≦0 hrs	13	(19.7%)	26	(39.4%)	27	(40.9%)	66	(2.4%)	
Catch-up sleep hours >0 and ≦2 hrs	60	(24.7%)	110	(45.3%)	73	(30.0%)	243	(8.9%)	
Catch-up sleep hours >2 hrs	88	(29.0%)	114	(37.6%)	101	(33.3%)	303	(11.1%)	<0.001**
Workday sleep hours ≧6 and <7 hrs									
Catch-up sleep hours ≦0 hrs	22	(19.1%)	53	(46.1%)	40	(34.8%)	115	(4.2%)	
Catch-up sleep hours >0 and ≦2 hrs	106	(23.5%)	193	(42.7%)	153	(33.8%)	452	(16.5%)	
Catch-up sleep hours >2 hrs	53	(25.1%)	81	(38.4%)	77	(36.5%)	211	(7.7%)	
Workday sleep hours ≧7 hrs									
Catch-up sleep hours ≦0 hrs	12	(19.4%)	24	(38.7%)	26	(41.9%)	62	(2.3%)	
Catch-up sleep hours >0 and ≦2 hrs	18	(17.6%)	51	(50.0%)	33	(32.4%)	102	(3.7%)	
Catch-up sleep hours >2 hrs	10	(16.1%)	24	(38.7%)	28	(45.2%)	62	(2.3%)	
Exercise per week (n=2735)									
No physical exercise	562	(33.7%)	633	(37.9%)	473	(28.4%)	1,668	(61.0%)	
Regular physical exercise									<0.001**
<90 minutes/week	224	(45.1%)	195	(39.2%)	78	(15.7%)	497	(18.2%)	
≧90 and <150 minutes/week	133	(46.0%)	86	(29.8%)	70	(24.2%)	289	(10.6%)	
≧150 minutes/week	135	(48.0%)	90	(32.0%)	56	(19.9%)	281	(10.3%)	

Chi-Square test. *p<0.05, **p<0.01.
Lifestyle factors: Abnormal meal times, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Independent factors associated with work-related burnout

As detailed in Table 3, multinomial logistic regression demonstrated that administrative staff had the lowest risk for WB when compared to nurses (Adjusted OR: 0.45/0.33, for medium/high level compared to low level). Women had adjusted

ORs of 1.41/1.59 for WB (Medium/high level compared with low level) when compared with men. The effects of age, length of service, and non-day shift work were non-significant after adjustments.

In terms of lifestyle factors, abnormal meal time (adjusted OR: 1.47/2.41), frequently eating out (adjusted OR: 1.17/1.49), lack of sleep (adjusted OR: 2.86/5.13), no exercise (adjusted OR: 1.27/1.41), and work hours >40 (adjusted OR: 1.56/2.72) were independently associated with work-related burnout (for medium/high level compared to low level).

Table 3. Multinomial logistic regression of factors associated with work-related burnout.

Factors	Work-related burnout					
	Medium vs Low			High vs Low		
	OR	95% CI	*p* value	OR	95% CI	*p* value
Gender (M vs F)	1.41	(1.08- 1.85)	0.013*	1.59	(1.11- 2.29)	0.012*
Age (years)						
21-34	ref.			ref.		
35-44	1.17	(0.86- 1.59)	0.323	0.82	(0.56- 1.20)	0.301
45-54	1.23	(0.76- 1.98)	0.403	0.74	(0.41- 1.34)	0.322
55-66	1.19	(0.64- 2.19)	0.583	0.62	(0.26- 1.46)	0.275
Length of service (years)						
< 5 years	ref.			ref.		
5-14 years	0.90	(0.68- 1.19)	0.463	0.85	(0.61- 1.18)	0.342
15-24 years	1.21	(0.77- 1.89)	0.404	1.64	(0.95- 2.82)	0.074
>24 years	0.95	(0.56- 1.61)	0.856	1.02	(0.51- 2.02)	0.960
Profession						
Nurse	ref.			ref.		
Doctor (visiting physician)	0.63	(0.39- 1.00)	0.052	0.47	(0.26- 0.87)	0.015*
Doctor (resident)	0.64	(0.40- 1.02)	0.063	0.57	(0.34- 0.97)	0.038*
Medical technician	0.83	(0.60- 1.15)	0.268	0.74	(0.49- 1.11)	0.150
Administrative staff (supervisor)	0.11	(0.01- 0.88)	0.037*	0.45	(0.05- 3.80)	0.462
Administrative staff (other)	0.45	(0.33- 0.61)	<0.001**	0.33	(0.22- 0.50)	<0.001**
Day shift (No vs Yes)	1.04	(0.81- 1.34)	0.753	1.18	(0.88- 1.57)	0.268
Lack of sleep	2.86	(2.33- 3.50)	<0.001**	5.13	(3.94- 6.69)	<0.001**
No physical exercise	1.27	(1.03- 1.55)	0.024*	1.41	(1.10- 1.81)	0.006**
Abnormal meal time	1.47	(1.19- 1.82)	<0.001**	2.41	(1.85- 3.15)	<0.001**
Often eat out	1.17	(0.94- 1.46)	0.152	1.49	(1.12- 1.97)	0.006**

Weekly work hours >40 hours	1.56	(1.26- 1.94)	<0.001**	2.72	(2.08- 3.57)	<0.001**
Lifestyle factors$#						
None	ref.			ref.		
One	0.91	(0.54- 1.52)	0.717	1.39	(0.45- 4.27)	0.564
Two	1.34	(0.82- 2.19)	0.246	3.37	(1.17- 9.72)	0.025*
Three	2.53	(1.55- 4.14)	<0.001**	9.58	(3.36- 27.31)	<0.001**
Four	3.95	(2.37- 6.58)	<0.001**	21.73	(7.58- 62.31)	<0.001**
Five	4.99	(2.64- 9.43)	<0.001**	32.98	(10.78- 100.87)	<0.001**
p for trend			<0.001**			<0.001**

Multinomial logistic regression. *p<0.05, **p<0.01.
$ Adjusted for Gender, Age, Length of service, Profession, Day shift
# Lifestyle factors: Abnormal meal time, Frequently eat out, Lack of sleep, No exercise, Weekly work hours>40hours.

Combined effects of independent lifestyle factors associated with work-related burnout

The combined effect of the five independent factors (abnormal meal times, frequently eating out, lack of sleep, no exercise, and >40 work hours) is displayed in Table 2. As the number of risk factors increases, the proportion of subjects with medium and high levels of WB increases (32.4%, 32.8%, 45.9%, 67.0%, 80.5%, 83.7% for subjects with 0-5 factors, respectively), in a dose-response manner.

Table 3 reveals the results of the analysis of the number of lifestyle factors associated with WB by multinomial logistic regression. The adjusted OR (medium level compared to low level) of the participants with 1 to 5 lifestyle factors were 0.91 (95% CI: 0.54 to 1.52), 1.34 (95% CI: 0.82~2.19), 2.53 (95% CI: 1.55~4.14), 3.95 (95% CI: 2.37~6.58), 4.99 (95% CI: 2.64~9.43), respectively,, compared to those without any factors. The adjusted OR (high level compared to low level) of the participants with 1 to 5 lifestyle factors were 1.39 (95% CI: 0.45 to 4.27), 3.37 (95% CI: 1.17~9.72), 9.58 (95% CI: 3.36~27.31), 21.73 (95% CI: 7.58~62.31), 32.98 (95% CI: 10.78~100.87), compared to those without any factors. There was a significant difference in WB (high level compared to low level) among participants with at least

two factors, when compared to those without any factors.

Association between weekend catch-up sleep hours and work-related burnout.

The participants who experienced a lack of sleep were categorized into groups based upon their workday sleep hours and weekend catch-up sleep hours. The numbers of each group are shown in Table 1. The distribution of WB levels according to the different groups is shown in Table 2.

In Table 4, the multinomial logistic regression model demonstrates the trends observed in the different groups. In the "workday sleep hours <6 hours" group, those with more weekend catch-up sleep hours had lower WB scores (adjusted OR: 7.17/4.88/ 4.29 for ≦0/ >0 and ≦2 / >2 hours, compared to those with enough sleep). In the "workday sleep hours ≧6 and <7 hours" group, those with more weekend catch-up sleep hours also had lower WB scores (adjusted OR: 6.26/ 5.90/4.16 for ≦0, >0 and ≦2, >2 hours, compared to those with enough sleep). However, in the "workday sleep hours ≥ 7 hours" group, those with more catch up sleep hours had higher WB scores (adjusted OR: 4.91/4.94/6.74 for ≦0/>0 and ≦ 2/>2 hours, compared to those with enough sleep) (Figure 1).

Table 4. Subgroup analysis: multinomial logistic regression of sleep hours associated with work-related burnout.

Factors	Multivariate model					
	Medium vs. Low			High vs. Low		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Workday and weekend catch-up sleep hours [$]						
No lack of sleep	ref.			ref.		
Lack of sleep						
Workday sleep hours <6 hrs						
Catch-up sleep hours ≦0 hrs	2.90	(1.38- 6.09)	0.005**	7.17	(3.31- 15.53)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.09	(2.14- 4.47)	<0.001**	4.88	(3.14- 7.61)	<0.001**
Catch-up sleep hours >2 hrs	2.13	(1.52- 2.98)	<0.001**	4.29	(2.89- 6.37)	<0.001**
Workday sleep hours ≧6 and <7 hrs						
Catch-up sleep hours ≦0 hrs	3.74	(2.12- 6.57)	<0.001**	6.26	(3.33- 11.76)	<0.001**

Catch-up sleep hours >0 and ≦2 hrs	3.38	(2.50- 4.57)	<0.001**	5.90	(4.10- 8.47)	<0.001**
Catch-up sleep hours >2 hrs	2.33	(1.54- 3.51)	<0.001**	4.16	(2.63- 6.60)	<0.001**
Workday sleep hours ≧ 7 hrs						
Catch-up sleep hours ≦0 hrs	2.40	(1.13- 5.08)	0.022*	4.91	(2.24- 10.75)	<0.001**
Catch-up sleep hours >0 and ≦2 hrs	3.77	(2.10- 6.77)	<0.001**	4.94	(2.54- 9.63)	<0.001**
Catch-up sleep hours >2 hrs	2.98	(1.32- 6.71)	0.008**	6.74	(2.94- 15.46)	<0.001**
Exercise time per week #						
No physical exercise	ref			ref		
Regular physical exercise						
<90 minutes/week	0.96	(0.74- 1.26)	0.786	0.62	(0.44- 0.89)	0.008**
≧90 and <150 minutes/week	0.72	(0.52- 1.01)	0.057	0.85	(0.58- 1.25)	0.413
≧150 minutes/week	0.75	(0.54- 1.05)	0.092	0.77	(0.51- 1.16)	0.209

Multinomial logistic regression. *p<0.05, **p<0.01.
$ Adjusted for gender, age, length of service, profession, day shift, exercise, meal time, frequently eat out, work hours.
# Adjusted for gender, age, length of service, profession, day shift, lack of sleep, mealtime, frequently eat out, work hours.

We also attempted to categorize the participants who had regular physical exercise based on the total weekly exercise hours. The numbers for each subgroup and the distribution of WB levels according to the different subgroups are shown in Tables 1 and 2. However, there was no dose-response relationship between weekly exercise hours and WB levels after adjustment (Table 4).

DISCUSSION

To our knowledge, this is the first study to assess the combined effect of unhealthy lifestyle factors on WB and to determine the associations between weekend catch-up sleep and WB in the medical workplace. Our findings show that five key modifiable lifestyle factors, including abnormal meal times, often eating out, lack of sleep, no exercise, and >40 weekly work hours, were independently associated with WB levels. The number of these combined unhealthy lifestyle factors was shown to be associated with severity of WB in a dose-dependent manner. As the numbers of the abovementioned lifestyle factors increased, the proportion of respondents with medium or high levels of WB rose. Among these lifestyle factors, a lack of sleep

showed the strongest correlation with WB in the medical workplace. In the subgroup analysis of sleep hours, among respondents with duration of workday sleep less than 7 hours, weekend catch-up sleep was related to reduced burnout risk. However, for those with workday sleep hours greater than 7 hours, weekend catch-up sleep was related to an elevated risk of workplace burnout.

For the non-modifiable factors, our findings are consistent with previous studies which showed that females gender was independently associated with higher burnout levels.[2 24] Our study also confirmed the results of a previous study that showed being a nurse was associated with higher burnout levels.[2] However, WB in nurses was not significantly different compared with other occupations (except administrative staff) after adjustment. In contrast to other previous studies,[2 24 25] length of service and age were not significant risk factors for WB after adjustment in our study. A possible explanation for this is that our results were adjusted for additional lifestyle factors, whereas some previous studies did not control for other variables.[2 24]

With regard to modifiable factors, our study revealed that obesity was not an independent risk factor for WB, as higher BMI was correlated with lower burnout scores, which was consistent with previous research. [26] A possible explanation for this is that hypercortisolism is commonly associated with increased food intake and body weight gain. [27] However, burnout was more consistently associated with hypocortisolism, [28] which leads to the inhibition of food consumption. In contrast to other studies,[29 30] our results found that smokers had lower WB scores compared to non-smokers, while there were no differences in WB scores among alcohol drinkers and betel nut users compared with their abstaining counterparts. This may be due to the sociocultural characteristics of the study population, in which less than 5% of the participants reported smoking, drinking, or using betel nuts .[31 32]

Our analysis of the five key modifiable factors showed that "normal meal times" and "infrequent eating out" were significantly associated with a lower risk of WB. Although no previous studies have directly investigated the relationship between these two factors and burnout, higher levels of fast-food consumption were reported to be positively associated with burnout.[10] Moreover, we found that being "physically active" may protect against burnout, as this variable was associated with a low risk of WB, which is consistent with previous studies.[8 10 33 34] Burnout prevalence was lower among students who exercised consistently following CDC recommendations, compared with those who exercised less.[8 33] Previous studies did not find a dose-response relationship for exercise hours, which was similar to our findings.[25] Additionally, we found that long work hours were a risk factor for higher WB levels. Previous studies also demonstrated that "Working more than 14 consecutive hours" and "Working over 40 hours per week" were independent risk factors associated with burnout.[8 24]

Due to the limitations of the official questionnaire used in this study, we surveyed exercise duration per week, general meal times, and average number of times eating out per day, without distinguishing between workdays and weekends. Clemens Drenowatz, et al. found that weekend behaviors appeared to be of particular importance, even though overall physical activity levels were similar between weekdays and the weekend. [35] A possible explanation is the greater freedom of lifestyle choices during the weekend. Moreover, a nationally representative survey of diet among U.S. adults revealed that weekend consumption was associated with increased calorie intake and poorer diet quality. [36] The greater prevalence of fast-food and full-service restaurant consumption may contribute to poorer diet quality on weekends. A possible explanation for this phenomenon is that time away from one's

occupation leads to more time spent on food-related activities, and social aspects of weekends are often paired with eating. [37] Future research should distinguish the impact of lifestyle habits on workdays and weekends on burnout.

In this study, the strongest correlation with WB was lack of sleep, which was similar to previous studies.[9 25 34] Weishan Chin et al. found that nurses who slept less than 6 hours during the workweek had a higher risk for WB compared to those who slept more than 7 hours.[9] In addition, Megan R. Wolf et al. also found that sleeping less than 7 hours was an independent predictor of burnout among medical students.[34] Although certain studies have explored the relationship between chronotype/social jetlag and burnout,[18] no previous studies have directly investigated the association between weekend catch-up sleep hours and burnout.

Our results revealed that weekend catch-up sleep was correlated with lower burnout risk among subjects with a short workday sleep duration (less than 7 hours). This finding was similar to the results of a previous report by Yun Hwan Oh et al.[15] They found that among participants with a short workday sleep duration (less than 7 hours), there was a significant difference in health-related quality of life between those with and without weekend catch-up sleep. A possible mechanism underlying this effect could involve the greater sleep debt among participants with short workday sleep duration. Thus, weekend catch-up sleep could compensate for the sleep debt caused by insufficient sleep during the workweek.[15]However, it was not possible to establish a causal relationship between weekend catch-up sleep and WB in this investigation due to the limitation of the study design.

Our finding revealed that those with "Workday sleep hours ≧ 7 hrs and catch-up sleep hours > 2 hrs" (> 9 hours in total on weekends) had higher OR for WB (6.74 compared to those with enough sleep). Generally, around 7 to 9 hours is regarded as

the optimal duration of sleep in terms of psychological well-being and subjectively perceived health. [38] Although there is no evidence showing correlations between longer sleep durations and burnout, previous studies have found that long sleep duration (> 9 hours) was associated with an increased likelihood of depression, anxiety, and diabetes. [38 39] A potential underlying mechanism may involve increased levels of inflammation markers in long sleepers. [39] Moreover, weekend catch-up sleep behavior could be considered a violation of sleep hygiene rules. [15] Nonetheless, weekend catch-up sleep may reasonably be expected to be associated with better health outcome in subjects with sleep debt, which was indeed borne out by our findings.

Although some studies have investigated the association between combined unhealthy lifestyle factors and risk of depressive symptoms,[14] no similar studies have been conducted for burnout. The present report is the first to assess the combined effect of multiple unhealthy lifestyle factors on burnout level. The impact of lifestyle factors on burnout may vary from culture to culture, and thus we selected lifestyle factors based on items in a questionnaire designed to assess overwork which was developed by the Occupational Safety and Health Administration of Taiwan's the Ministry of Labor. Finally, only factors that were independently associated with burnout were included in the calculation of the combined effects.

Our study has a number of strengths. First, the modifiable risk factors that were selected in our study were based on items in a questionnaire devised by experts for a nationally implemented occupational health program. Therefore, these factors were both culturally representative and suitable indicators for assessing the local medical workplace. Second, we conducted a stratified analysis of "workday sleep hours" and "weekend catch-up sleep hours", in order to provide an overall risk assessment of

weekend catch-up sleep for WB, according to different durations of workday sleep.

This study also had several limitations. First, the study design was cross-sectional, and therefore a causal relationship could not be established. However, it was possible to demonstrate the existence of associations between the modifiable risk factors and WB. Second, there was no information regarding the number of sleep hours of workers who self-reported having enough sleep in this questionnaire. Therefore, our recommendations related to burnout risk for "weekend catch-up sleep hours" and "workday sleep hours", can only be applied to staff experiencing a lack of sleep. Third, there was no objective way to assess the quality of sleep or to verify the self-reported sleep duration in this study. In fact, perceived sleep quality may affect self-reported sleep duration, which should be taken into consideration when interpreting the results of this study. Fourth, this study is part of program that aims to identify medical staff at high risk group of experiencing burnout. The results, as well as findings from physician interviews, will help to inform the development of a workplace health promotion program. These measures will inevitably take up part of the weekly working hours and may affect the consistency of the questionnaire. Furthermore, the data obtained in this study largely comprised self-reported information, and thus information bias may have existed. However, the analysis of our questionnaire results were yielded a Cronbach's α score of 0.866, indicating a high level of reliability.

CONCLUSION

This study found associations between five modifiable risk factors and work-related burnout in a medical workplace in Taiwan, and further demonstrated that burnout severity increased in proportion to the number of risk factors. Weekend catch-up sleep

was correlated with lower burnout risk in participants with a short workday sleep duration (less than 7 hours), but with higher burnout risk in participants with more than seven hours' sleep during the workweek. Clinicians should pay particular attention to people with combined unhealthy lifestyle factors, especially short sleep duration without weekend catch-up sleep. Serious efforts must be undertaken to reduce modifiable risk factors in the workplace to promote the health of medical staff, although further prospective studies are still necessary to establish the causal relationships between unhealthy lifestyle behaviors and burnout.

Patient and Public Involvement

We developed the research questions and outcome measures based on the official questionnaire released by the Occupational Safety and Health Administration in Taiwan. The study was approved by the hospital's IRB (CE18353A) and the requirement for informed consent was waived due to the low risk of the study design. All voluntary medical staff completing an electronic questionnaire were enrolled in the study. We will apply the findings of this research to a workplace health promotion program aimed at improving the health of medical staff.

Acknowledgements

The authors thank all the participants, TCVGH-1077202C and TCVGH-1077203D from Taichung Veterans General Hospital for their support, and the Biostatistics Task Force of Taichung Veterans General Hospital, Taichung, Taiwan, R.O.C. for assistance with the statistical analysis.

Author Contributions Y-T T conceived of the study and supervised all aspects of its implementation. Y-L L completed the analyses and drafted the content. Y-SL and S-

YH assisted with the study design and revised the content. W-MC, C-HC and Y-CY assisted with the statistical analysis and revised the content. All authors helped to conceptualize ideas, interpret findings, and review drafts of the manuscript.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None.

Patient consent Not required.

Ethical approval Institutional Review Board I & II, Taichung Veterans General Hospital (Case no. CE18353A).

Data availability statement All data relevant to the study are included in the article. The data were anonymized prior to analysis to protect the subjects' privacy.

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Figure 1
WB risk among participants with different duration of workday sleep and weekend catch-up sleep.

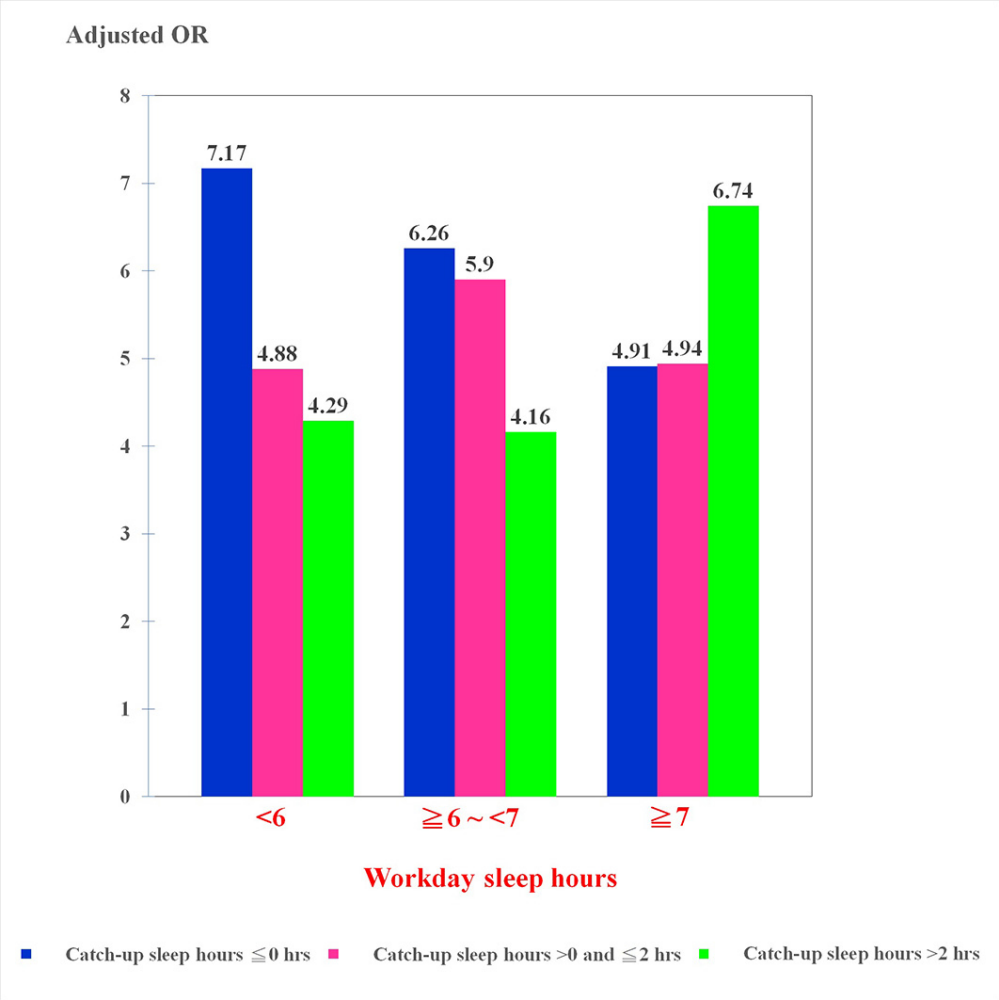

Figure 1: WB risk among participants with different duration of workday sleep and weekend catch-up sleep.

90x90mm (300 x 300 DPI)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of	5

		recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	5,6
Bias	#9	Describe any efforts to address potential sources of bias	5
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	6
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	6
Statistical methods	#12c	Explain how missing data were addressed	6
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	6
Statistical methods	#12e	Describe any sensitivity analyses	6
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	6
Participants	#13b	Give reasons for non-participation at each stage	6
Participants	#13c	Consider use of a flow diagram	6

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	6
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
Main results	#16b	Report category boundaries when continuous variables were categorized	8~14
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8~14
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	8~14
Discussion			
Key results	#18	Summarise key results with reference to study objectives	14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	15~17
Generalisability	#21	Discuss the generalisability (external validity) of the study results	15~17
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

This checklist was completed on 03. July 2019 using https://www.goodreports.org/, a tool made by the EQUATOR Network in collaboration with Penelope.ai