การประเมินคุณภาพการนอนหลับในพนักงานดับเพลิงของกรุงเทพมหานคร โดยใช้รูปแบบการสร้างเสริมสุขภาวะในองค์กรขององค์การอนามัยโลก

Sleeping quality assessment among firefighters in Bangkok metropolitan area using who healthy workplace framework

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บทคัดย่อ

การวิจัยนี้ศึกษาความสัมพันธ์ระหว่างปัจจัยสภาพแวดล้อมในสถานที่ทำงานตามรูปแบบการสร้างเสริมสุขภาวะในองค์กรขององค์การอนามัยโลกและคุณภาพการนอนหลับ ในกลุ่มพนักงานดับเพลิงสังกัดกรุงเทพมหานคร จำนวน 301 คน โดยใช้แบบสอบถามแบบตอบด้วยตนเอง ซึ่งประยุกต์จากรูปแบบการสร้างเสริมสุขภาวะในองค์กรขององค์การอนามัยโลก คู่มือการดำเนินงานสถานที่ทำงานน่าอยู่ น่าทำงาน เสริมสร้างคุณภาพชีวิตและความสุขของคนทำงาน ปี 2561 และแบบสอบถามความเครียดจากงาน Thai-JCQ เป็นเครื่องมือในการเก็บข้อมูล ข้อมูลประกอบด้วย คุณลักษณะทั่วไป ข้อมูลเกี่ยวกับการทำงาน การประเมินสภาพแวดล้อมในสถานที่ทำงาน (ด้านกายภาพ เคมี ชีวภาพ ด้านจิตสังคม ด้านสุขภาวะบุคคล และด้านการมีส่วนร่วมระหว่างองค์กรและชุมชน) สำหรับคุณภาพการนอนหลับ ใช้แบบประเมินคุณภาพการหลับ เพื่อประเมินคุณภาพการนอนหลับของพนักงานดับเพลิงในช่วงหนึ่งเดือนที่ผ่านมา วิเคราะห์ข้อมูลทางสถิติ โดยศึกษา ความถี่ ร้อยละ ค่าเฉลี่ย ค่าเบี่ยงเบนมาตรฐาน พิสัยควอไทล์ และใช้สถิติ Chi-square test, independent t-tests, Mann Whitney U test และ logistic regression เพื่อศึกษาความสัมพันธ์ของปัจจัยที่ศึกษากับคุณภาพการนอนหลับ

ผลการศึกษาพบว่า จากพนักงานดับเพลิง 301 คน ส่วนมาก 52.2% มีคุณภาพการนอนหลับที่ไม่ดี และ 39.2% มีคุณภาพการนอนหลับดี โดย 64.3% ในกลุ่มคุณภาพการนอนหลับที่ไม่ดี มีระยะเวลาการนอนหลับที่สั้นไม่เกิน 7 ชั่วโมงต่อคืน และมีประสิทธิภาพในการนอนโดยรวมต่ำ (ต่ำกว่าหรือเท่ากับ 85.0% ของประสิทธิภาพในการนอนโดยรวม) ปัจจัยสภาพแวดล้อมในสถานที่ทำงานตามรูปแบบการสร้างเสริมสุขภาวะในองค์กรขององค์การอนามัยโลก พบว่า ด้านกายภาพ เคมี ชีวภาพ ด้านจิตสังคม และ ด้านสุขภาวะบุคคล มีความสัมพันธ์กับคุณภาพการนอนหลับของพนักงานดับเพลิง จากผลการศึกษานี้ยืนยันว่า ปัจจัยด้านสภาพแวดล้อมในสถานที่ทำงานส่งผลต่อคุณภาพการนอนหลับ การจัดทำและปฏิบัติตามคู่มือการสร้างเสริมสุขภาวะในองค์กร เป็นแนวทางที่สามารถช่วยปรับปรุงสภาพแวดล้อมในสถานที่ทำงานให้ดีขึ้นอย่างยั่งยืน อีกทั้งยังช่วยส่งเสริมสุขภาพความปลอดภัยของพนักงานดับเพลิงให้มีความเป็นอยู่ที่ดี

คำสำคัญ : คุณภาพการนอนหลับ, พนักงานดับเพลิง, สภาพแวดล้อมในสถานที่ทำงานด้านกายภาพ, สภาพแวดล้อมในสถานที่ทำงานด้านจิตสังคม

Abstract

This study aimed to investigate the relationship between workplace conditions (healthy workplace) and sleep quality among firefighters working in Bangkok Metropolitan Area, Thailand. The self-administrative questionnaire was developed from WHO's 2018 Healthy Workplace Framework. The use of Happy for Life Guideline and Job Content Questionnaire in Thai version (Thai-JCQJ) was for assessing personal characteristics, working characteristics and Healthy Workplace conditions (physical work environment, the psychosocial work environment, personal health resources in the workplace and enterprise community involvement). The Pittsburgh Sleep Quality Index (PSQI) Thai version was used to evaluate sleep quality of firefighters in the past month. Descriptive statistics illustrated included frequency, mean, standard deviation, interquartile range and percentage. Chi-square test, independent t-tests, Mann-Whitney U test and logistic regression statistically tested the relationship between observed factors.

The results showed that out of 301 firefighters, the majority 52.2% encountered poor sleep quality and 39.2% stayed with good sleep quality. Firefighters who attained poor sleep experienced with short sleep duration ≤ 7 hours at 64.3%, with low sleep efficiency

(≤ 85.0% of sleep efficiency) at 72.0%. Regarding the workplace conditions according to the WHO's Healthy Workplace Framework, the reports showed that the physical work environment, personal health resources in the workplace and psychosocial work environment were significantly associated with sleep quality of firefighters. Such findings of this study affirmed the effects of working conditions to sleep quality. The provision and implementation of the healthy workplace handbook within organizations could help better improve the workplace environment in a sustainable manner. It also helps promote health, safety and well-being of firefighters.

Keywords : Sleep Quality, Firefighters, Physical Work Environment, Psychosocial Work Environment

Introduction

Poor sleep is a significant concern in the workplace, indicating impending fatigue, decreased work engagement, increased sick leave, and a higher risk of occupational accidents and injuries. Muzamil Hassan et al., found that sleep disruptions can lead to short-term issues like increased stress responses and depression and long-term health problems such as hypertension and cardiovascular diseases.[1] Flores et al. explored poor sleep quality's links to cognitive and emotional deficits, highlighting its impact on high-risk behaviors and emotional regulation.[2] Globally, insufficient sleep is a public health crisis that goes unnoticed, leading to substantial economic costs.[3]

According to the Centers for Disease Control and In Prevention (CDC) state-based survey conducted in 2014, merely 65.0% of adults in the United States indicated they achieved a healthy duration of sleep.[3] From 2000 to 2022, the systematic review showed the global prevalence of poor sleep quality in firefighters at 51.4%.[4] In the previous studies, the proportion of firefighters in Thailand had poor sleep accounted for 49.1%,[15] and a study by Wipawan Chaoum. found a 42.4% prevalence of poor sleep quality in an understudied population in Southern Thailand.[5] Studies in Bangkok revealed that habitual snoring and excessive daytime sleepiness are significantly associated with factors such as higher

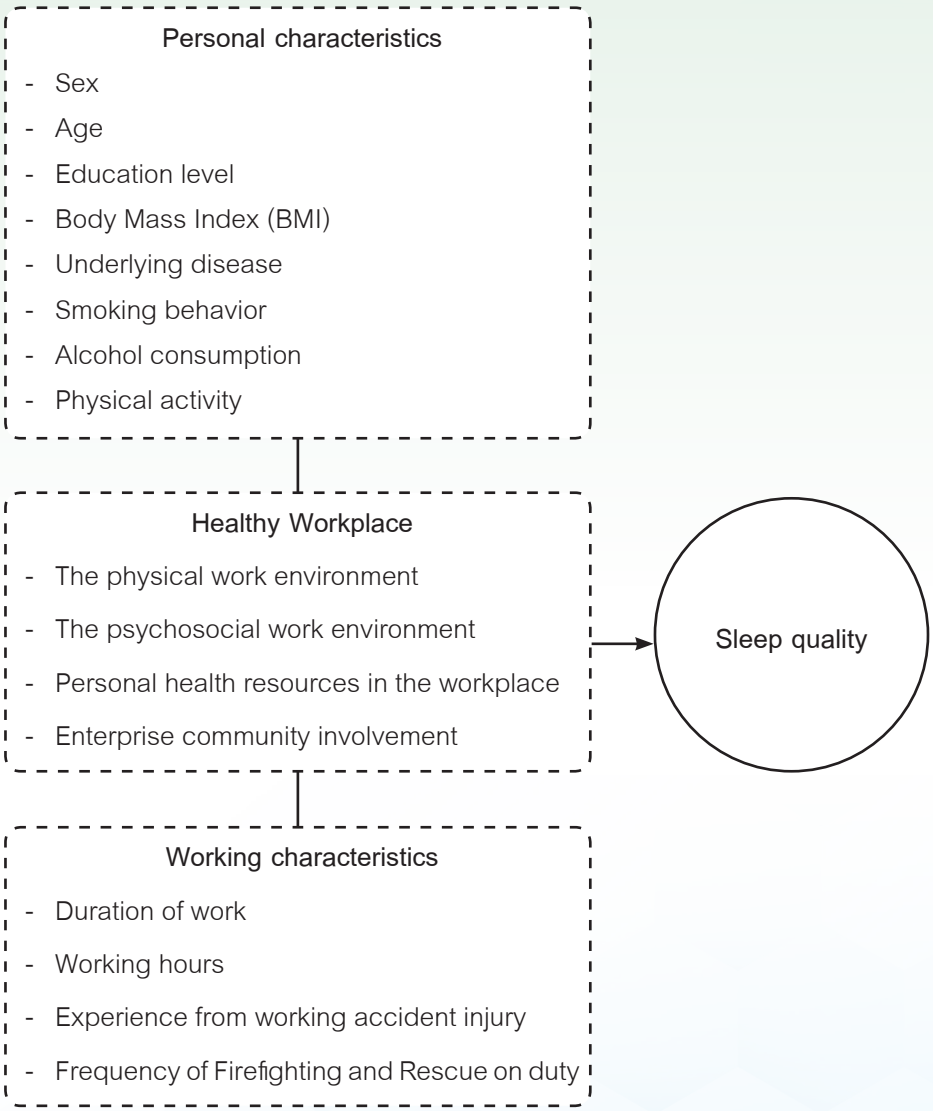
BMI and shorter nocturnal sleep durations.[6] The National Sleep Foundation defines good sleep quality with specific criteria, emphasizing the importance of achieving a total sleep duration of 7 to 9 hours for adults.[7-8]

Firefighters, engaged in one of the nation's most perilous professions, are susceptible to heart attacks, physical stress, and other conditions due to demanding tasks, psychological stressors, heat stress, dehydration, use of personal protective equipment, and smoke exposure.[9] These factors result in adverse effects on the vascular, cardiac, and hemostatic systems.[10] Moreover, the work environment significantly impacts sleep quality, with stressful conditions leading to disrupted sleep patterns and sleep disturbances.[11] Research highlights the causative role of job demands and the importance of job control in sleep quality,[12] with further evidence supporting the influence of physical work conditions, such as noise and extreme temperatures, on poor sleep quality and insomnia.[13] In addition, work characteristics such as long work hours, work schedules or shift rotating patterns, and personal characteristics including lifestyle were found a great influencing contributor to health issues and sleep quality.[14] From studied firefighters in Bangkok Thailand with posttraumatic stress disorder (PTSD) had a significantly higher probability of experiencing poor sleep quality than those without.[15] Others also evidently supported that workplace condition factors could influence and relate to sleep quality. It was highly potential that workplace conditions of firefighters may have been associated with their sleep quality. The WHO's Healthy Workplace Model promotes health, safety, and well-being through continuous improvement, covering physical and psychosocial work environments, personal health resources, and community involvement.[16] This study aims to assess sleep quality among firefighters in Bangkok and investigate the relationship between workplace conditions and sleep quality using the WHO's Healthy Workplace Framework & Model, aligned with the Sustainable Development Goals (SDGs).[17]

Objectives

1. To assess sleep quality among firefighters working in Bangkok Metropolitan Area.
2. To investigate the relationship between workplace conditions (WHO's Healthy Workplace Framework) and sleep quality among firefighters working in Bangkok Metropolitan Area.

Conceptual Framework



Methods

Design and participants: A cross-sectional study design was used, involving 301 firefighters from 6 Fire Brigade covering 37 fire stations of Bangkok Fire and Rescue Department under supervision of The Bangkok metropolitan Administration, Thailand. The study sample was selected using random stratified cluster sampling methods to represent the firefighter population from the total 1,791 firefighters (N=1,791) were stratified into six groups according to organizational structure. Then, random stratified cluster sampling from each structure group, the total sample size of 350 firefighters from each selected group was selected by random from all levels of firefighters and calculated[18] was topped up 10% of non-response which used a 95% confidence level for analysis were invited to participate in the study.

Participation by individual firefighters was voluntary and not compensated, and willingly provided informed consent to join in the study. Active firefighters at all level were aged of 20-60 years and employed at least one year are inclusion group. Participants who underwent treatment and under medications related to sleep disorders were included.

Measurement tools: Data was collected from December 2021 to April 2022 through a self-administered questionnaire comprised 4 parts including 1) Personal characteristics 2) Working characteristics 3) Healthy workplace developed from the WHO Healthy Workplace Framework, 2018's Healthy Workplace, Happy for Life Guideline, and the Thai version of the Job Content Questionnaire (Thai-JCQJ). These cover 4 domains such as physical work environment, psychosocial work environment, personal health resources in the workplace and enterprise community involvement. 4) Sleep quality was assessed using the Pittsburgh Sleep Quality Index Thai version (PSQITHAI).[15] The researcher developed and modified questions of the questionnaires after a validity test proved by three experts in the same field of research, of which deducted from 29 to 26 items. The self-administered questionnaires comprised seven components, and each item was assigned a weight on a 0-3 interval scale. The total PSQI score stretched from 0 to 21, with higher scores indicating poorer sleep quality. Based on the global PSQI score. A Total PSQI score exceeding 5 was classified as "poor sleep".[19]

In the present study, the Index of item Objective Congruence (IOC) method was used to determine the content validity of the measurements. An acceptable content validity was calculated by IOC rate higher than 0.5. The IOC score this study was 0.88 the test was calculated as[20] Cronbach's alpha of Pittsburgh Sleep Quality Index Thai version assessment was 0.81, workplace conditions assessment including the physical work environment was 0.91, the psychosocial work environment was 0.99, personal health resources in the workplace was 0.88 and enterprise community involvement was 0.61. The reliability coefficient showed an acceptable level of internal consistency.[21]

Statistical analysis: Statistical significance from the study was considered at p-value ≤ 0.05. Statistical analyses included descriptive statistics for described the general demographic by frequency, minimum, maximum, mean, standard deviation, interquartile range and percentage. For Chi-square test, independent t-tests, Mann Whitney U test and logistic regression to determine the relationships between the associated factors and sleep quality among firefighters. This was done to estimate odds ratios and corresponding 95% confidence intervals (95% CI).

Ethical considerations

The study was approved by the Ethic Review Committee of Mahidol University with certificate of approval no. MUPH 2021-112 issued on 25 October 2021. Operations followed research ethics principles, including respect for persons, beneficence and justice.

Results

The study on personal characteristics of firefighters in the Bangkok Metropolitan Area revealed that out of 301 participants in Table 2, 99.7% were male, with an age range of 26-59 years and an average age of 42.6 years. Most firefighters (56.1%) had a Bachelor's degree, followed by high vocational certificates (24.6%). The average BMI was 25.1 kg/m2, with 41.5% categorized as obese and 27.2% as overweight. Health issues were reported by 14% of the firefighters, including heart disease, diabetes and hypertension. Additionally, 26.6% were current smokers and 54.8% consumed alcohol with 23.3% drinking only on special occasions. Physical activity was performed by 66.4% of the firefighters with over half completing at least 150 minutes per week.

The majority of firefighters in Bangkok held positions at the Experienced and Operational Levels 71.4%, followed by the Professional Level 23.9% and Practitioner Level 2.7%. Most of them had been working for 11-20 years, with an average duration of 13.3 years (SD=6.2). The majority 94.0% worked more than 8 hours a day. Nearly half 48.8% had experienced work-related injuries or accidents. Most 92.0% performed firefighting and rescue duties no more than 25 times per week in the past six months.

The comparisons of personal characteristics with sleep quality among these firefighters revealed no statistically significant differences.

Table 1 The comparison of personal characteristics between the firefighters with good sleep and poor sleep, n=301

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Sex				0.248 [a]
Male	300 (99.7%)	117 (99.2%)	157(100%)	
Female	1 (0.3%)	1 (0.8%)	0 (0.0%)	
Age (years)				0.224 [a]
≤ 30	6 (2.0%)	2 (1.7%)	4 (2.5%)	
31 - 40	101 (33.6%)	47 (39.8%)	44 (28.0%)	
41 - 50	171 (56.8%)	61 (51.7%)	95 (60.5%)	
51 - 60	23 (7.6%)	8 (6.8%)	14 (8.9%)	

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Education				0.514 [a]
Lower or high school	2 (7.0%)	0 (0.0%)	2 (1.3%)	
Senior high school or Vocational certificate	20 (6.6%)	6 (5.1%)	13 (8.3%)	
High vocational certificate or equivalent level	74 (24.6%)	30 (25.4%)	35 (22.3%)	
Bachelor's or equivalent level	169 (56.1%)	65 (55.1%)	89 (56.7%)	
Upper Bachelor's level	36 (12.0%)	17 (14.4%)	18 (11.5%)	
Body mass index (kg/m^2)				0.931 [a]
< 18.5				
(Underweight)	6 (2.0%)	1 (0.8%)	2 (1.3%)	
18.5 - 22.9				
(Normal weight)	67 (22.3%)	30 (25.4%)	33 (21.0%)	
23.0- 24.9				
(Overweight)	82 (27.2%)	30 (25.4%)	41 (26.1%)	
25.0 - 29.9				
(Obesity I)	125 (41.5%)	49 (41.5%)	69 (43.9%)	
≥ 30 (Obesity II)	21 (7.0%)	8 (6.8%)	12 (7.6%)	

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Health problem				0.416 [a]
Yes	42 (14.0%)	14 (11.9%)	24 (15.3%)	
No	259 (86.0%)	104 (88.1%)	133 (84.7%)	
Smoking status				0.312 [a]
Currently smoke	80 (26.6%)	27 (22.9%)	40 (25.5%)	
Ever smoke	68 (22.6%)	22 (18.6%)	39 (24.8%)	
Never smoke	153 (50.8%)	69 (58.5%)	78 (49.7%)	
Alcohol consumption				0.103 [a]
Yes	165 (54.8%)	59 (50.0%)	94 (59.9%)	
No	136 (45.2%)	59 (50.0%)	63 (40.1%)	
Alcohol consumption per week				0.279 [a]
1 - 2 days per week	47 (15.6%)	14 (23.7%)	31 (33.0%)	
3 - 4 days per week	37 (12.3%)	11 (18.6%)	24 (25.5%)	
5 - 7 days per week	11 (3.7%)	5 (5.3%)	5 (5.3%)	
Only on special occasions	70 (23.3%)	29 (49.2%)	34 (36.2%)	
Physical activity				0.845 [a]
Yes	200 (66.4%)	78 (66.1%)	102 (65.0%)	
No	101 (33.6%)	40 (33.9%)	55 (35.0%)	

*Significant at $p < 0.05$, [a] Chi-square, b t Test, [c] Mann-Whitney U test

According to Table 2, Comparisons of working characteristics including work position, duration of work, working hours and experience from working with sleep quality among these firefighters revealed no statistically significant differences.

Table 2 The comparison of working characteristics between the firefighters with good sleep and poor sleep, n=301

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Working Position				0.681 [a]
Senior Professional Level (Chief of fire and rescue station)	8 (2.7%)	5 (4.2%)	3 (1.9%)	
Professional Level or Practitioner Level	72 (23.9%)	30 (25.4%)	39 (24.8%)	
Senior Level	6 (2.0%)	3 (2.5)	3 (1.9%)	
Experienced Level and Operational Level	215 (71.4%)	80 (67.8%)	112 (71.3%)	
Duration of work (year)				0.511 [c]
< 5	52 (17.3%)	19 (16.2%)	28 (17.8%)	
5-10	46 (15.3%)	18 (15.4%)	27 (17.2%)	
11-20	189 (62.8%)	73 (62.4%)	96 (61.1%)	
> 20	13 (4.3%)	7 (6.0%)	6 (3.8%)	
No answer	1 (0.3%)			

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Mean	13.3	13.8	12.9	
Std. Deviation	6.2	6.4	6.0	
IQR	8.0	8.0	8.0	
Range (min-max)	2.0-36.0	3.0-35.0	2.0-33.0	
Working hours (hour)				**0.790** [a]
≤ 8	13 (4.3%)	6 (5.2%)	7 (4.5%)	
> 8	283 (94.0%)	109 (94.8%)	148 (95.5%)	
				0.283 [c]
Mean	11.8	11.7	11.8	
Std. Deviation	0.9	1.1	0.9	
IQR	0.0	0.0	0.0	
Range (min-max)	7.0-12.0	7.0-12.0	7.0-12.0	
Experience from working accident/injury				**0.053** [a]
Yes	147 (48.8%)	50 (42.4%)	85 (54.1%)	
No	154 (51.2%)	68 (57.6%)	72 (45.9%)	
Firefighting and rescue on duty (in the past 6 month)				**0.217** [a]
0-25 time per week	277 (92%)	109 (99.1%)	143 (96.6%)	
26-50 time per week	4 (1.3%)	0 (0.0%)	4 (2.7%)	

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
More than 50 time per week	2 (0.7%)	1 (0.9%)	1 (0.7%)	
No answer	18 (6.0%)			
				0.434 [c]
Mean	**6.2**	**5.4**	**6.6**	
Std. Deviation	8.9	7.2	10.2	
IQR	5.5	5.25	5.0	
Range (min-max)	0.0-100.0	0.23-60.0	0.0-100.0	

*Significant at $p < 0.05$, [a] Chi-square, [c] Mann-Whitney U test

The study of sleep quality among Bangkok firefighters found more than half or 157 (52.2%) of firefighters experienced poor sleep quality. They met the cut-off point criteria for the Pittsburgh Sleep Quality Index (PSQI) score > 5.0. They attained PSQI score ranging from 6.0 to 15.0, with a mean score of 8.6 (SD=2.3). While 118 (39.2%) firefighters acquired good sleep quality. Firefighters with good sleep had PSQI score ranging from 0.0 to 5.0, and a mean score stood at 3.4 (SD=1.5). Twenty-six firefighters whose responses were incomplete and inapplicable for processing PSQI score.

The comparisons of Pittsburgh Sleep Quality Index (PSQI) between firefighters with good and poor sleep, shown in Table 3, revealed significant differences in sleep quality. Firefighters who attained poor sleep experienced with short sleep duration ≤ 7 hours at 64.3%, with low sleep efficiency (≤ 85% of sleep efficiency) at 72.0%. All differences were statistically significant (p-value < 0.05).

Table 3 The comparison of the Pittsburgh Sleep Quality Index between the firefighters with good sleep and poor sleep, n=301

General Information	Total n=301 (data missing=26)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Component 1: Subjective sleep quality				< 0.001*
Very good	58 (21.1)	49 (41.5)	9 (5.7)	
Fairy good	155 (56.4)	64 (54.3)	91 (58.0)	
Fairy bad	59 (21.5)	5 (4.2)	54 (34.4)	
Very bad	3 (1.1)	0 (0)	3 (1.9)	
Component 2: Sleep latency (mins)				< 0.001*
≤ 15	99 (36.0)	68 (57.6)	31 (19.7)	
16 - 30	52 (18.9)	15 (12.7)	37 (23.6)	
31 - 60	11 (4.0)	2 (1.7)	9 (5.7)	
> 60	113 (41.1)	33 (28.0)	80 (51.0)	
Component 3: Sleep duration (hour)				< 0.001*
≤ 5	18 (6.5)	0 (0)	18 (11.5)	
5.1 - 6.0	65 (23.6)	5 (4.2)	60 (38.2)	
6.1 - 7.0	48 (17.5)	25 (21.2)	23 (14.6)	
> 7	144 (52.4)	88 (74.6)	56 (35.7)	

General Information	Total n=301 (data missing=26)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Component 4: Sleep efficiency				< 0.001*
< 65%	51 (18.5)	6 (5.1)	45 (28.7)	
65% - 74 %	34 (12.4)	5 (4.2)	29 (18.5)	
75% - 85%	53 (19.3)	14 (11.9)	39 (24.8)	
> 85%	137(49.8)	93 (78.8)	44 (28.0)	
Component 5: Sleep disturbances				< 0.001*
Not during the past month	29 (10.5)	26 (22.0)	3 (1.9)	
Less than once a week	177 (64.4)	86 (72.9)	91 (58)	
Once or twice a week	65 (23.6)	6 (5.1)	59 (37.6)	
Three or more time a week	4 (1.5)	0 (0)	4 (2.5)	
Component 6: Use of sleep medication				< 0.001*
Not during the past month	243 (88.4)	116 (98.3)	127 (80.9)	
Less than once a week	19 (6.9)	2 (1.7)	17 (10.8)	
Once or twice a week	11 (4.0)	0 (0)	11 (7.0)	
Three or more time a week	2 (0.7)	0 (0)	2(1.3)	

General Information	Total n=301 (data missing=26)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Component 7: Daytime dysfunction due to sleep				< 0.001*
Not during the past month	209 (76)	106 (89.8)	103 (65.6)	
Less than once a week	47 (17.1)	12 (10.2)	35 (22.3)	
Once or twice a week	12 (4.4)	0 (0)	12 (7.6)	
Three or more times a week	7 (2.5)	0 (0)	7 (4.5)	

* Chi-square test significant at $p < 0.05$

This study assessed firefighters' workplace conditions using the WHO's healthy workplace framework, focusing on the physical work environment, personal health resources and enterprise community involvement. The physical work environment in fire stations had an overall hazard and hygiene management mean score of 17.4 (SD=6.1). Firefighters with good sleep quality had an average score of 19.1 (SD=5.3), while those with poor sleep quality averaged 16.3 (SD=6.2). Regarding personal health resources, most firefighters (60.8%) scored below the standard level across 14 items, with a mean score of 6.7 (SD=5.1). Firefighters with good and poor sleep quality had mean scores of 7.4 (SD=5.1) and 5.8 (SD=5.0), respectively.

For enterprise community involvement, more than half of the firefighters reported active participation in initiatives such as primary healthcare (81.1%), scholarships (72.8%), CSR activities (79.1%), education and knowledge sharing (90.4%), and environmental protection (59.8%), with a mean score of 3.8 (SD=1.5). Firefighters with good sleep quality had a mean score of 4.0 (SD=1.4), while those with poor sleep quality scored 3.7 (SD=1.5). Comparisons between sleep quality and working conditions revealed significant associations between sleep quality and both the physical work environment and personal health resources (p-value < 0.05), while enterprise community involvement did not show a significant correlation.

Table 4 Physical work environment, personal health resources in the workplace and enterprise community involvement characteristics of firefighters.

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
The Physical Work Environment (Q3001 to 3023)				<0.001* [c]
Mean	17.4	19.1	16.3	
Std. Deviation	6.1	5.3	6.2	
IQR	9.0	6.0	9.0	
Range (min-max)	0.0-23.0	0.0-23.0	0.0-23.0	
Personal Health Resources in the Workplace (Q3201-3214)				0.058 [a]
Under standard	183 (60.8%)	63 (53.4%)	107 (68.2%)	
Initial	38 (12.6%)	17 (14.4%)	20 (12.7%)	
Good	6 (2.0%)	4 (3.4%)	2 (1.3%)	
Very good	74 (24.6%)	34 (28.8%)	28 (17.8%)	
				0.007* [c]
Mean	6.7	7.4	5.8	
Std. Deviation	5.1	5.1	5.0	
IQR	11.0	11.0	8.0	
Range (min-max)	0.0-14.0	0.0-14.0	0.0-14.0	

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Enterprise Community Involvement (Q3301-Q3305)				
Primary healthcare for firefighter and family members				0.161 [a]
Yes	244 (81.1%)	99 (83.9%)	121 (77.1%)	
No/Not sure	57 (18.9%)	19 (16.1%)	36 (22.9%)	
Scholarship for firefighter and family members				0.112 [a]
Yes	219 (72.8%)	90 (45.9%)	206 (67.5%)	
No/Not sure	82 (27.2%)	28 (23.7%)	51 (32.5%)	
Supporting Corporate Social Responsibility activities				0.573 [a]
Yes	238 (79.1%)	95 (80.5%)	122 (77.7%)	
No/Not sure	63 (20.9%)	23 (19.5%)	35 (22.3%)	
Facilitate education and knowledge sharing to community				0.060 [a]
Yes	272 (90.4%)	111 (94.1%)	137 (87.3%)	
No/Not sure	29 (9.6%)	7 (5.9%)	20 (12.7%)	

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Supporting environment protection or zero carbon emission				0.448 [a]
Yes	180 (59.8%)	73 (61.9%)	90 (57.3%)	
No/Not sure	121 (40.2%)	45 (38.1%)	67 (42.7%)	
				0.050 [c]
Mean	3.8	4.0	3.7	
Std. Deviation	1.5	1.4	1.5	
IQR	2.0	2.0	2.0	
Range (min-max)	0.0-5.0	0.0-5.0	0.0-5.0	

*Significant at $p < 0.05$, [a] Chi-square, [c] Mann-Whitney U test

The study compared psychosocial work environment characteristics between firefighters with good and poor sleep quality as Table 5, attained a high job demand at 70.3% and 57.3% respectively. In comparison of job control between those two groups of firefighters, it revealed a statistically significant difference at p-value < 0.05. Additionally, more than half of the participants reported high social support, with slightly more firefighters with good sleep quality reporting high social support. Participants generally reported low psychological job demand, physical job demand and job security, regardless of sleep quality. This research could contribute to understanding the relationship between sleep quality and work environment among firefighters.

Table 5 The comparison of psychosocial work environment characteristics between the firefighters with good sleep and poor sleep quality.

General Information	Total n=301 n (%)	Sleep quality of firefighters (n=275)		p-value*
		Good n (%) 118 (39.2)	Poor n (%) 157 (52.2)	
Job control				0.027* [a]
Low job control	110 (36.5%)	35 (29.7%)	67 (42.7%)	
High job control	191 (63.5%)	83 (70.3%)	90 (57.3%)	
Psychological job demand				0.549 [a]
Low psychological job demand	194 (64.5%)	80 (67.8%)	101 (64.3%)	
High psychological job demand	107 (35.5%)	38 (32.3%)	56 (35.7%)	
Physical job demand				0.765 [a]
Low physical job demand	164 (54.5%)	64 (54.2%)	88 (56.1%)	
High physical job demand	137 (45.5%)	54 (45.8%)	69 (43.9%)	
Job security				0.644 [a]
Low job security	195 (64.8%)	75 (63.6%)	104 (66.2%)	
High Job security	106 (35.2%)	43 (36.4%)	53 (33.8%)	
Social support				0.383 [a]
Low social support	115 (38.2%)	42 (35.6%)	64 (40.8%)	
High Social support	186 (61.8%)	76 (64.4%)	93 (59.2%)	

*Significant at $p < 0.05$, a Chi-square

In addition, an association between such independent factors of study as physical work environment, personal health resources in the workplace as well as job control and sleep quality of firefighters was technically further investigated by applying the logistic regression as shown in Table 6.

Table 6 Logistic regression characteristics between the firefighters with good sleep and poor sleep.

Factors related to sleep quality of firefighters	p-value*	OR Exp(B)	95% CI for OR	
			Upper	Lower
The Physical Work Environment	< 0.001* [c]	0.9	0.9	1.0
Personal Health Resources in the Workplace	0.007* [c]			
Under standard (ref)				
Initial		2.1	1.2	3.7
Good		1.4	0.6	3.2
Very good		0.6	0.1	3.6
Psychosocial work environment	0.027* [a]	0.6	0.3	0.9
(job control)				

*Significant at $p < 0.05$, [a] Chi-square, [c] Mann-Whitney U test

Conclusions and Discussion

The study analyzed the Pittsburgh Sleep Quality Index (PSQI) results of firefighters, revealing significant associations in each of its seven components ($p < 0.05$). Findings showed that 64.3% of firefighters experienced poor sleep, characterized by a short sleep duration (7 hours or fewer), while 72.0% had low sleep efficiency (85.0% and below). These results align with National Sleep Foundation guidelines, which recommend a total sleep time of 85.0%[7] or more of the total time spent in bed and sleep duration of 7 to 9 hours for adults aged 26-64.[8] Compared with previous studies, the proportion of firefighters with poor sleep in this study was higher than prior research 49.1%,[15] yet similar to the global prevalence of poor sleep quality in firefighters 51.4%.[4] These findings emphasize the need to address sleep quality among firefighters for better health and performance.

The finding association of personal characteristics and sleep quality among these firefighters revealed no statistically significant differences that were inconsistent with some previous studies. Reviews by Parkes KR discovered that Salo. Study revealed that the prevalence of insomnia symptoms tended to be higher in older age groups, particularly in the age range of 34-45 years. Additionally, the occurrence of sleep lost over worry' was notably high among individuals aged 34-60 years, with a subsequent decline in older age groups.[22] Tobacco smoking was also a significant factor affecting higher odds of various sleep problems, including both short and long sleep duration, difficulty falling or staying asleep, sleep dissatisfaction and overall increased sleep problems.[23]

In terms of the association of working characteristics and sleep quality, no significant association with sleep quality was observed. The results, therefore, showed inconsistency with the previous studies. Other factors possibly influenced on sleep difficulty, sleep disturbances and sleep quality among shift workers for instance, excessive caffeine intake during night shifts and lack of physical activity due to disruptions in diurnal rhythms.[24-25] Regarding the workplace conditions according to the WHO's Healthy Workplace Framework, the reports showed that the physical work environment, personal health resources in the workplace and psychosocial work environment were significantly associated

with sleep quality of firefighters. The study showed consistency with previous studies. The study on offshore day-shift personnel by assessing psychosocial and physical work environments, including job demands, job control, supervisor support and physical stressors that reported poor sleep quality was predicted by the cumulative impact of overtime work, low support and adverse physical work environments.[12] The higher control of job predicted a reduction in sleep complaints.[22]

The study confirms that workplace conditions significantly impact sleep quality among firefighters. Implementing the WHO Healthy Workplace Framework can improve workplace environments, thereby enhancing the health, safety, and well-being of firefighters. Future research should extend to cover firefighters in other areas or organizations such as rural or upcountry areas. Also, should focus on longitudinal studies to better understand these relationships over time and the effectiveness of specific interventions.

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วิภาภรณ์ สีอ่อน, สุจินดา จารุพัฒน์ มารุโอ, เธียรไชย ยักทะวงษ์, อริยะ บุญงามชัยรัตน์. การประเมินคุณภาพการนอนหลับในพนักงานดับเพลิงของกรุงเทพมหานครโดยใช้รูปแบบการสร้างเสริมสุขภาวะในองค์กรขององค์การอนามัยโลก. วารสารสถาบันป้องกันควบคุมโรคเขตเมือง. 2568;10(1):1-26.

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