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Research Article

Physical Activity as a Novel Predictive Factor for Intention to Resign Among Emergency Department Nurses

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Abstract

Background: The intention to resign among nursing staff is a critical concern, particularly in Taiwan. While factors such as workplace bullying, work environment, and burnout have been widely studied, the potential role of physical activity in influencing resignation intention remains unexplored. This study aimed to investigate whether physical activity levels can serve as predictive factors for intention to resign among emergency department (ED) nurses.

Methods: A descriptive and prospective study was conducted among 121 ED nurses from three hospitals in Southern Taiwan. Data were collected using structured questionnaires, including demographic information, the Negative Acts Questionnaire-Revised (NAQ-R), Taiwan Nursing Work Environment Index (TNWEI), Maslach Burnout Inventory-Human Service Survey (MBI-HSS) Chinese version, and International Physical Activity Questionnaire-Short Form (IPAQ-SF) Taiwanese version. Univariate and multiple linear regression analyses were performed to identify factors associated with intention to resign.

Results: A significant negative correlation was observed between physical activity levels and the intention to resign among ED nurses. Higher physical activity levels were associated with reduced intention to resign. The overall regression model demonstrated strong explanatory power (R-squared value = 0.76).

Conclusions: This study identifies physical activity as a predictive factor for intention to resign among ED nurses, offering a novel perspective for understanding and addressing nurse turnover. Promoting physical activity among nursing staff may help mitigate resignation intentions, enhance organizational stability, and improve the quality of patient care. These findings can inform healthcare administrators and policymakers to develop targeted strategies to support nurse retention.

Keywords: Emergency Service, Hospital, Exercise, Nurses, Personnel Turnover

Background

The prevalence of the intention to resign among nursing staff in Taiwan ranges from 62.4% to 90.8%, which is significantly higher than the average rates observed in Europe and other Asian countries (14.0% to 61.5%) [1]. The intention to resign is highly correlated with actual turnover behavior, representing the final stage of the process of leaving an organization [2].

High turnover rates can lead to delays in patient treatment, incidents compromising patient safety, reduced organizational productivity, and adverse impacts on the physical and mental health of nursing staff. Additionally, it can decrease job satisfaction and even result in negative socioeconomic consequences [3].

Given the high turnover rates among nursing staff, understanding the underlying factors contributing to this issue is crucial. Various factors, including the work environment and personal factors, influence the intention to resign of nursing staff. Work environment factors include adequate resources, collaboration between nursing and medical staff, and opportunities for continuing education [4,5]. Personal factors include experiences of workplace bullying and burnout [6,7].

Burnout has attracted increasing attention in recent years. Maslach conceptualizes burnout as a multifaceted response to prolonged work-related stress, encompassing emotional exhaustion—characterized by feelings of depletion and the absence of emotional reserves; depersonalization—marked by a cynical, detached attitude towards others and a loss of idealism; and reduced personal accomplishment, reflecting a diminished sense of competence and efficacy in professional performance [8].

Nurses in emergency departments (ED) work in highly stressful environments, including long working hours, handling life-threatening diseases, and dealing with anxious patient families. A study comparing ED nurses with nurses from other specialties found that ED nurses have a more critical and distressing working environment, resulting in higher rates of stress [9].

Previous research has shown that physical activity can reduce burnout. Physical activity includes flexibility and strength physical activities, such as yoga, Pilates, and body balance, and aerobic physical activities, such as cross-training, running, and cycling [10,11]. However, to our knowledge, this study is the first to explore whether physical activity can reduce the intention to resign among ED nurses and whether physical activity can serve as a predictor of intention to resign.

Methods

This study aimed to investigate the relationships between workplace bullying, work environment, burnout, physical activity, and intention to resign among ED nurses. In addition,

this study aimed to examine whether physical activity could serve as a predictor of intention to resign among these nurses.

This is a descriptive and prospective study. The study was approved by the Chi Mei medical center Institutional Board of 11011-J02. All patient data were anonymized. Patient informed consent was waived due to the retrospective and observational nature of the study. The welfare of patients was not affected by the waiver. The participants were ED nurses from three hospitals in Southern Taiwan (one tertiary medical center and two regional hospitals). Data were collected from February 2022 to June 2022. The inclusion criteria required nurses to have at least six months of experience in the ED, whereas the exclusion criteria included those who had worked in the ED for less than six months or refused to participate.

The required sample size for this study was estimated using G-power 3.1 statistical software, setting a moderate effect size of 0.5, a power of 0.80, and a significance level α value of .05. The estimated sample size was 118 ED nurses. To account for an anticipated 20% sample loss, we distributed 142 questionnaires and received responses from all participants. After the exclusion of 21 incomplete responses, 121 valid responses remained.

Data collection

Data were collected using a structured questionnaire survey, which included a collection of demographic variables, the Negative Acts Questionnaire-Revised (NAQ-R), the Taiwan Nursing Work Environment Index (TNWEI), the Maslach Burnout Inventory-Human Service Survey (MBI-HSS) Chinese version, the Nurses' Intention to Stay Scale, and the International Physical Activity Questionnaire-Short Form (IPAQ-SF) Taiwanese version. To ensure participants' rights, this study was submitted for review and approval by the Institutional Review Board (IRB) of a designated hospital prior to its initiation. Following IRB approval, permission was obtained from the hospital's nursing department, and the research objectives, purpose, and methods were explained to the supervisors of the participating units. An anonymous questionnaire packet, containing a study information sheet detailing the research motives, objectives, and methodology, along with the questionnaire itself, was distributed. The distribution process was facilitated by emergency department assistants, who handed the packets to eligible nursing staff in the emergency department.

The nursing staff sealed their completed questionnaires in envelopes and deposited them into a pre-arranged collection box located within their unit. The researcher personally retrieved the collection box after a data collection period of two weeks. Upon retrieval, each questionnaire was assigned a unique identifier for tracking purposes. Subsequently, invalid

questionnaires, such as those that were blank or incomplete, were excluded before data entry and statistical analysis were conducted.

Demographic variables

The forms included information on age, sex, marital status, years of experience working in the ED, and work shifts (rotating or fixed day shifts).

NAQ-R

In 1991, the Bergen Bullying Research Group developed the Negative Acts Questionnaire. The scale was translated and refined by Einarsen and Ranke into the NAQ-R [12]. This study used the Chinese version of the NAQ-R translated by Ma et al. [13]. The scale consists of 22 items divided into three dimensions: work-related bullying (seven items), personal-related bullying (12 items), and physical intimidation (three items). The total score ranges from 22 to 110, with higher scores indicating a higher frequency of negative bullying behavior. In a study by Hsieh et al., the overall scale had a Cronbach's α value of 0.96 [14].

TNWEI

The original scale was developed by Kramer and Hafner [15]. Aiken and Patrician then revised it to create the Nursing Work Index-Revised (NWI-R) [16]. Lin et al. subsequently developed the TNWEI based on the NWI-R [17]. The TNWEI encompasses four dimensions with a total of 19 items: organizational support (seven items), nurse staffing and resources (four items), nurse-physician collaboration (four items), and support for continuing education (four items). The content validity of the TNWEI is reported to be 100%, with an overall Cronbach's α value of 0.85.

MBI-HSS Chinese version

Burnout syndrome was assessed using the MBI-HSS Chinese version [18,19]. This tool comprises 20 items categorized into three subscales: emotional exhaustion (eight items), depersonalization (four items), and personal accomplishment (eight items). Emotional exhaustion is considered the core dimension of the scale. Scores below 21 indicated low levels of burnout, scores between 22 and 32 reflected moderate burnout, and scores above 33 indicated high burnout. The overall scale demonstrated a Cronbach's α value of 0.91 [19].

Nurses' Intention to Stay Scale

The Nurses' Intention to Stay Scale, developed by Tsay et al. in 1998, consists of five items designed to assess the strength of an individual's intention to remain in their position [20]. Three items were reverse-scored to assess the intention to resign, whereas two items were positively scored to assess the intention to stay. The total score ranged from 5 to 25, with higher scores reflecting a greater intention to stay. In this study, reverse scoring was used to infer participants'

intentions to resign. The scale demonstrated a Cronbach's α value of 0.83 [21].

IPAQ-SF Taiwanese version

The Taiwanese version IPAQ-SF was developed in 1998 to standardize the surveillance of physical activity globally. Since then, it has become the most widely used tool for assessing physical activity, available in two formats: the 31-item long form (IPAQ-LF) and the 9-item short form (IPAQ-SF). [22,23]. The Taiwanese version of the IPAQ-SF was translated by Liou et al. in 2008 and demonstrated a content validity of 99.4% [24]. We classified participants' physical activity levels into three categories according to the IPAQ-SF guidelines: insufficiently active, minimally active, and health-enhancing physical activity active [25].

Data analysis

The baseline information of study population was described in number with percentage. A mean with standard deviation (SD) and range was calculated for every structured questionnaire survey. SPSS Statistics version 26.0 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp) was used for the data analysis. The Kolmogorov–Smirnov test was employed to evaluate the normality of the data distribution, and the results indicated that the data followed a normal distribution. Univariable linear regression analysis was conducted to examine the correlation between various variables, including demographic factors, NAQ-R, TNWEI, MBI-HSS Chinese version, IPAQ-SF Taiwanese version, and the Nurses' Intention to Stay Scale. Variables with a p-value <0.05 were identified as significantly correlated factors. Subsequently, multivariable linear regression analysis was performed to further analyze the factors significantly associated with the nurses' intention to resign. Statistical significance was set at $p < 0.05$.

Results

Study population characteristics

As shown in Table 1, most of the 121 participants were female (87.6%). The most common age group was 30–39 years (43%), followed by <29 years (40.5%) and >40 years (16.5%). Most of the participants were unmarried (65.3%). The most common work shift was the rotating shift (85.1%). Regarding the total number of years of service in the ED, 39.7% of the participants had more than 10 years of experience, 36.4% had 5–9 years of experience, and 24% had 1–4 years of experience.

Mean scores on NAQ-R, TNWEI, MBI-HSS Chinese version, Nurses' Intention to Stay Scale, and IPAQ-SF Taiwanese version

As illustrated in Table 2, the average score for workplace bullying was 28.69 (SD=7.84), indicating that occasional

bullying was commonly perceived among the nursing staff. The overall average score for the work environment was 52.86 (SD=9.75), suggesting that the ED nursing staff's satisfaction with the work environment ranged from disagree to agree. Among the three dimensions of burnout, "personal achievement" had the highest average score at 31.15 (SD=8.20), followed by "emotional exhaustion" with an average score of 24.83 (SD=9.88), and "depersonalization" had the lowest average score at 6.88 (SD=5.53). The average score for the intention to resign among ED nursing staff was 12.69 (SD=4.39). The IPAQ-SF Taiwanese version categorizes participants' physical activity levels into three groups: insufficiently active, minimally active, and health-enhancing physical activity active. The distribution of participants across these levels is as follows: 38 (31.4%) individuals are classified as insufficiently active, 47 (38.8%) as minimally active, and 36 (29.8%) as health-enhancing physical activity active.

Univariate regression: Analyzing factors correlated with intention to resign

The results of the univariate regression analysis indicated that several variables were statistically significant predictors of nurses' intention to resign (Table 3). These variables included the NAQ-R for assessing bullying (B = 0.112, p = 0.028), the TNWEI to evaluate the work environment (B = -0.150, p < 0.001), and the three dimensions of the MBI-HSS Chinese version to assess burnout: emotional exhaustion (B = 0.236, p < 0.001), depersonalization (B = 0.391, p < 0.001), and personal accomplishment (B = -0.215, p < 0.001). Additionally, the IPAQ-SF Taiwanese version (B = -4.578, p < 0.001) was a significant predictor.

Multiple regression analysis of the variables affecting intention to resign

As illustrated in Table 4, the multiple linear regression analyses conducted to assess the predictive power of the variables that were statistically significant in the univariate regression analysis, including the NAQ-R, TNWEI, the three domains of the MBI-HSS Chinese version, and the IPAQ-SF Taiwanese version. The results indicated that the overall model was statistically significant (p < 0.001). Among the variables included in the model, only the IPAQ-SF Taiwanese version and the emotional exhaustion and depersonalization domains of the MBI-HSS Chinese version were statistically significant predictors. Additionally, the overall model demonstrated strong explanatory power, with an R-squared value of 0.76. The R-squared value of 0.76 indicates that 76% of the variance in intention to resign can be explained by the variables included in the model.

Variables	N = 121(%)
Sex	
Male	15 (12.4)

Female	106 (87.6)
Age	
<30 years	49 (40.5)
30–39 years	52 (43.0)
>39 years	20 (16.5)
Marital status	
Single	79 (65.3)
Married	42 (34.7)
Work shift	
Fixed day shift	18 (14.9)
Rotating shift	103 (85.1)
Years of service at the emergency department	
1–4	29 (24.0)
5–9	44 (36.4)
>10	48 (39.6)
International Physical Activity Questionnaire—Short Form Taiwanese version	
Insufficiently active	38 (31.4)
Minimally active	47 (38.8)
Health-enhancing physical activity active	36 (29.8)

Table 1: Study population characteristics and distribution of the Taiwanese version of the International Physical Activity Questionnaire–Short Form

Variables	Mean (SD)	Total score range
Negative Acts Questionnaire Revised	28.69 (7.84)	22 – 110
Taiwan Nursing Work Environment Index	52.86 (9.75)	19 – 76
Maslach Burnout Inventory-Human Service Survey-Chinese version		
Emotional exhaustion	24.83 (9.88)	0 – 48
Depersonalization	6.88 (5.53)	0 – 24
Personal accomplishment	31.15 (8.20)	0 – 48
Nurses' Intention to Stay Scale	12.69 (4.39)	5 – 25

Table 2: Mean scores of the Negative Acts Questionnaire Revised, Taiwan Nursing Work Environment Index, Maslach Burnout Inventory-Human Service Survey-Chinese version, Nurses' Intention to Stay Scale

Independent variables	Coefficient	95% CI	p value
Age	-0.755	-1.855 to 0.344	0.176
Sex	1.173	-1.225 to 3.571	0.335
Marriage	-1.355	-3.003 to 0.293	0.106
Shift	-0.098	-2.328 to 2.131	0.931
Years in emergency room	0.160	-0.656 to 0.975	0.699
NAQ-R	0.112	0.012 to 0.211	0.028*
TNWEI	-0.150	-0.227 to -0.073	< 0.001*
MBI-HSS Chinese version			
Emotional exhaustion	0.236	0.168 to 0.304	< 0.001*
Depersonalization	0.391	0.265 to 0.516	< 0.001*
Personal accomplishment	-0.215	-0.304 to -0.126	< 0.001*
IPAQ-SF Taiwanese version	-4.578	-5.160 to -3.995	< 0.001*

Table 3: Univariate regression: Analyzing factors correlated with intention to resign

NAQ-R, Negative Acts Questionnaire Revised; TNWEI, Taiwan Nursing Work Environment Index; MBI-HSS Chinese version, Maslach Burnout Inventory-Human Service Survey-Chinese version; IPAQ-SF Taiwanese version, International Physical Activity Questionnaire—Short Form Taiwanese version; CI, confidence interval; *p < 0.05

Independent variables	Coefficient	95% CI	p value
IPAQ-SF Taiwanese version	-3.730	-4.314 to -3.146	< 0.001*
MBI-HSS Chinese version			
Emotional exhaustion	0.057	0.006 to 0.108	0.029*
Depersonalization	0.160	0.077 to 0.242	< 0.001*
Personal accomplishment	-0.054	-0.109 to 0.001	0.053
TNWEI	-0.020	-0.069 to 0.029	0.414
NAQ-R	-0.027	-0.083 to 0.029	0.343
R ² = 0.760 p < 0.001*			

Table 4: Multiple regression analysis of variables affecting intention

to resign

NAQ-R, Negative Acts Questionnaire Revised; TNWEI, Taiwan Nursing Work Environment Index; MBI-HSS Chinese version, Maslach Burnout Inventory-Human Service Survey-Chinese version; IPAQ-SF Taiwanese version, International Physical Activity Questionnaire—Short Form Taiwanese version; CI, confidence interval; *p < 0.05

Discussion

Previous research has demonstrated that burnout is an independent factor influencing the intention to resign. Heinen et al. found that burnout was consistently associated with increased intention among nurses to leave their profession across 10 European countries [26]. The analysis revealed that nurses with high burnout scores were twice as likely to intend to leave their professions. Furthermore, Feng et al. demonstrated that emotional exhaustion is positively correlated with the intention to resign [27]. This finding is consistent with our study's findings, which also identified a significant association between emotional exhaustion and turnover intention.

To our knowledge, this study is the first to examine the impact of physical activity on intentions to resign among ED nurses. Previous research has predominantly focused on factors such as workplace bullying, evaluations of the work environment, work-life quality, job satisfaction, and assessments of individual conditions such as burnout [7].

In a multicenter study, Portero et al. identified a lack of daily exercise as a significant predictor of burnout [28]. Similarly, Goldberg et al. found that reduced levels of physical activity serve as a significant predictor of burnout among ED personnel [29]. Several possible mechanisms have been proposed to explain the relationship between physical activity and burnout; however, the precise mechanisms remain unclear. These proposed mechanisms include psychological and physiological factors that are believed to contribute to the positive effects of physical activity. From a psychological perspective, regular physical activity is thought to promote psychological detachment from work, thereby reducing the likelihood of prolonged stress responses such as burnout. Regular physical activity has been proposed to enhance an individual's ability to manage psychological stress [30,31,32]. A large-scale study conducted in the United States in 2018 by Chekroud et al., which included a sample of 1.2 million participants, demonstrated the psychological benefits of exercise [33].

Physiologically, several potential mechanisms have been proposed to explain the beneficial effects of exercise. Nowacka-Chmielewska et al. stated that exercise enhances brain resilience by increasing the levels of growth factors, such as brain-derived neurotrophic factor (BDNF), and promoting neuroplasticity, which collectively contribute to

improved mood regulation and cognitive functions. Additionally, Silverman and Deuster suggested that regular physical activity attenuates the overactivation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system, thereby reducing cortisol and catecholamine responses, which play a critical role in modulating stress reactivity. [34,35]. These studies emphasized that any form of physical activity can reduce the mental health burden, aligned with the principles of the IPAQ-SF Taiwanese version that we used, which focuses on the total amount of physical activity rather than specific types of physical activity.

The findings of our study offer clinical value, as it is the first to propose physical activity as a predictive indicator of the intention to resign. This indicator can serve as a reference by which hospital administrators and managers can allocate resources more effectively. For example, they could organize exercise-related activities, invite exercise professionals to lead regular programs or create dedicated spaces for the nursing staff to engage in physical activities. Additionally, incentive programs could encourage inactive nurses to incorporate physical activity into their routines. These measures would enhance the accessibility of physical activity, thereby supporting the integration of physical activity into the daily lives of nursing staff.

Additionally, using the amount of physical activity as an indicator to monitor the potential intention to resign among nursing staff may be less intrusive. Inquiring about the frequency and duration of their recent physical activity was considerably easier and less intrusive than directly inquiring about their intentions to resign. By using physical activity levels as a predictor of intention to resign, it becomes easier to monitor the physical and psychological well-being of nursing staff and their intention to resign. Targeted encouragement of physical activity among employees could further reduce their intention to resign. This approach contributes to greater organizational stability and overall well-being, ultimately benefiting the entire healthcare system and enhancing patient safety. This study provides valuable insights into the predictors of intention to resign and lays the groundwork for future interventions aimed at improving nurse retention.

This study had some limitations. First, it was conducted in a single country and within a single healthcare system, encompassing one tertiary medical center and two regional hospitals, which may have limited the generalizability of our findings. However, this uniformity also helps to eliminate potential confounding effects related to differences in healthcare systems, policies, and hospital cultures. Second, the study included only ED nurses and excluded other nursing staff members. Nonetheless, given that ED nurses are more exposed to burnout than nurses working in other departments, which is a key factor influencing the intention to resign, these findings may offer more specific insight into the predictive factor of intention to resign [6,7,36].

Conclusions

Our findings provide a novel perspective that could inform targeted strategies for reducing the intention to resign. We investigated whether the Taiwanese version of the IPAQ-SF and the Chinese version of the MBI-HSS could serve as predictive factors for the intention to resign, and this is the first study to explore the use of physical activity levels as a predictor of the intention to resign among ED nurses. Our findings indicate a negative correlation between physical activity levels and the intention to resign, suggesting that nurses with higher levels of physical activity are less likely to intend to resign. These results provide a foundation for healthcare administrators to encourage nursing staff to engage in more physical activities, which enhances physical and mental health and lowers the intention to resign. In turn, this promotes organizational stability and improves the quality of patient care. However, further research is needed to investigate the underlying mechanisms by which physical activity mitigates the intention to resign.

Declarations

Ethics approval and consent to participate: The study was approved by the Chi Mei medical center Institutional Board of 11011-J02. All patient data were anonymized. Patient informed consent was waived due to the retrospective and observational nature of the study. The welfare of patients was not affected by the waiver.

Consent for publication: Not applicable

Availability of data and materials: The data analyzed in this study are available upon request from the corresponding author.

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References

1. Wang, J. L., S. T. Chiou, L. Y. Chien, and N. Huang. "Examination of the relevant factors of satisfaction with salary and intention to resign or leave the industry among clinical nurses in Taiwan." *Cheng Ching Med J* 14 (2018): 27-39.
2. Coetzee, Melinde, and Jeannette van Dyk. "Workplace bullying and turnover intention: Exploring work engagement as a potential mediator." *Psychological reports* 121, no. 2 (2018): 375-392.
3. Yeun, Young-Ran, and Jeong-Won Han. "Effect of nurses' organizational culture, workplace bullying and work burnout on turnover intention." *International Journal of Bio-Science and Bio-Technology* 8, no. 1 (2016): 372-380.
4. Dunn, Sandra, Brenda Wilson, and Adrian Esterman. "Perceptions of working as a nurse in an acute care setting." *Journal of Nursing management* 13, no. 1 (2005): 22-31.
5. Lake, Eileen T. "Development of the practice environment scale of the nursing work index." *Research in nursing & health* 25, no. 3 (2002): 176-188.
6. Al-Ghabeesh, Suhair Hussni, and Haya Qattom. "Workplace bullying and its preventive measures and productivity among emergency department nurses." *BMC health services research* 19 (2019): 1-9.
7. Al Zamel, Luma Ghazi, Khatijah Lim Abdullah, Chong Mei Chan, and Chua Yan Piaw. "Factors influencing nurses' intention to leave and intention to stay: An integrative review." *Home Health Care Management & Practice* 32, no. 4 (2020): 218-228.
8. Maslach, Christina. "A multidimensional theory of burnout." *Theories of organizational stress* 68, no. 85 (1998): 16.
9. Browning L, Ryan CS, Thomas S et al. Nursing Specialties and Burnout. *Psychol Health Med* 2007;12(2):248-254.
10. Gerber, Markus, Serge Brand, Catherine Elliot, Edith Holsboer-Trachsler, Uwe Pühse, and Johannes Beck. "Aerobic exercise training and burnout: a pilot study with male participants suffering from burnout." *BMC research notes* 6 (2013): 1-9.
11. Bretland, Rachel Judith, and Einar Baldvin Thorsteinsson. "Reducing workplace burnout: the relative benefits of cardiovascular and resistance exercise." *PeerJ* 3 (2015): e891.
12. Einarsen, Ståle, and Bjørn I. Raknes. "Harassment in the workplace and the victimization of men." *Violence and victims* 12, no. 3 (1997): 247-263.
13. Ma SC Current situation and related factors of workplace bullying among hospital nurses in Taiwan. Master's Thesis, Graduate Institute of Nursing, Kaohsiung Medical University. 2014;2014:1-221.
14. Hsieh, Yu-Hui, Hsiu-Hung Wang, and Shu-Ching Ma. "The mediating role of self-efficacy in the relationship between workplace bullying, mental health and an intention to leave among nurses in Taiwan." *International journal of occupational medicine and environmental health* 32, no. 2 (2019): 245-254.
15. Kramer, Marlene, and Laurin P. Hafner. "Shared values: impact on staff nurse job satisfaction and perceived productivity." *Nursing research* 38, no. 3 (1989): 172-177.
16. Aiken, Linda H., and Patricia A. Patrician. "Measuring organizational traits of hospitals: the Revised Nursing Work Index." *Nursing research* 49, no. 3 (2000): 146-153.
17. Lin, Li-Chiu, Huan-Fang Lee, and Miaofen Yen. "Establishing a measurement tool for a nursing work environment in Taiwan." *Research and theory for nursing practice* 31, no. 1 (2017): 75-88.
18. Maslach, Christina. "Maslach burnout inventory-human services survey (MBI-HSS)." *MBI manual* (1996): 192-198.
19. LEE, HUAN-FANG, TSAIR-WEI CHIEN, and Miaofen Yen. "Examining factor structure of Maslach burnout inventory among nurses in Taiwan." *Journal of Nursing Management* 21, no. 4 (2013): 648-656.
20. Tsay, S. M., and M. S. Lu. "The relationship between nurses' career development and their intent-to-stay." *J Nurs Res* 6 (1998): 96-108.
21. Tseng, Hsu Min, Hui Ling Chen, Yueh O. Chuang, and Wei Ting Huang. "Factors related to nurses' intentions to stay: The interactor between nurses' work environment and personality traits." *Taiwan Journal of Public Health* 38, no. 1 (2019): 42-52.
22. Craig, Cora L., Alison L. Marshall, Michael Sjöström, Adrian E. Bauman, Michael L. Booth, Barbara E. Ainsworth, Michael Pratt et al. "International physical activity questionnaire: 12-country reliability and validity." *Medicine and science in sports and exercise* 35, no. 8 (2003): 1381-1395.
23. Lee, Paul H., Duncan J. Macfarlane, Tai Hing Lam, and Sunita M. Stewart. "Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review." *International journal of behavioral nutrition and physical activity* 8 (2011): 1-11.
24. Liou, Yiing Mei, Clark JC Jwo, Kaiping Grace Yao, Li-Chi Chiang, and Lian-Hua Huang. "Selection of appropriate Chinese terms to represent intensity and types of physical activity terms for use in the Taiwan version of IPAQ." *Journal of Nursing Research* 16, no. 4 (2008): 252-263.
25. Craig, C., A. Marshall, M. Sjoström, A. Bauman, P. Lee, D. Macfarlane, T. Lam, and S. Stewart. "International physical activity questionnaire-short form." *J Am Coll Health* 65, no. 7 (2017): 492-501.
26. Heinen, Maud M., Theo van Achterberg, René Schwendimann, Britta Zander, Anne Matthews, Maria Kózka, Anneli Ensio et al. "Nurses' intention to leave their profession: a cross sectional observational study in 10 European countries." *International journal of nursing studies* 50, no. 2 (2013): 174-184.
27. Feng, Yisong, and Jing Cui. "Emotional Exhaustion and Emotional Contagion: Navigating Turnover Intention of Healthcare Personnel." *Journal of Multidisciplinary Healthcare* (2024): 1731-1742.

28. Portero de la Cruz, Silvia, Jesús Cebrino, Javier Herruzo, and Manuel Vaquero-Abellán. "A multicenter study into burnout, perceived stress, job satisfaction, coping strategies, and general health among emergency department nursing staff." *Journal of clinical medicine* 9, no. 4 (2020): 1007.
29. Goldberg, Richard, R. Wayne Boss, Linda Chan, Janet Goldberg, William K. Mallon, Doris Moradzadeh, Eric A. Goodman, and Mark L. McConkie. "Burnout and its correlates in emergency physicians: four years' experience with a wellness booth." *Academic Emergency Medicine* 3, no. 12 (1996): 1156-1164.
30. Geurts, Sabine AE, and Sabine Sonnentag. "Recovery as an explanatory mechanism in the relation between acute stress reactions and chronic health impairment." *Scandinavian journal of work, environment & health* (2006): 482-492.
31. Sonnentag, Sabine. "Psychological detachment from work during leisure time: The benefits of mentally disengaging from work." *Current directions in psychological science* 21, no. 2 (2012): 114-118.
32. Colcombe, Stanley, and Arthur F. Kramer. "Fitness effects on the cognitive function of older adults: a meta-analytic study." *Psychological science* 14, no. 2 (2003): 125-130.
33. Chekroud, Sammi R., Ralitz Gueorguieva, Amanda B. Zheutlin, Martin Paulus, Harlan M. Krumholz, John H. Krystal, and Adam M. Chekroud. "Association between physical exercise and mental health in 1· 2 million individuals in the USA between 2011 and 2015: a cross-sectional study." *The lancet psychiatry* 5, no. 9 (2018): 739-746.
34. Silverman, Marni N., and Patricia A. Deuster. "Biological mechanisms underlying the role of physical fitness in health and resilience." *Interface focus* 4, no. 5 (2014): 20140040.
35. Nowacka-Chmielewska, Marta, Konstancja Grabowska, Mateusz Grabowski, Patrick Meybohm, Malgorzata Burek, and Andrzej Małcki. "Running from stress: Neurobiological mechanisms of exercise-induced stress resilience." *International journal of molecular sciences* 23, no. 21 (2022): 13348.
36. Salvarani, Valerio, Giulia Rampoldi, Stefano Ardenghi, Marco Bani, Paola Blasi, Davide Ausili, Stefania Di Mauro, and Maria Grazia Strepparava. "Protecting emergency room nurses from burnout: The role of dispositional mindfulness, emotion regulation and empathy." *Journal of nursing management* 27, no. 4 (2019): 765-774.