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Risk factors of work-related neck and shoulder pain among emergency nurses

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Abstract

Emergency (ER) nurses are prone to work-related neck pain (WNP) and work-related shoulder pain (WSP). This study aimed to determine risk factors associated with WNP and WSP among ER nurses in Thailand. A total of 240 emergency nurses from 10 regional tertiary hospitals in the northeast of Thailand completed a self-administered questionnaire, which included questions on demographic and work characteristics, experiences of work stress, and WNP and WSP. Multiple logistic regression analyses were used to analyse the significant risk factors of WNP and WSP, using an adjusted odds ratio (ORadj) and a p-value < 0.05. The 12-month prevalence of WNP and WSP in emergency nurses was 37.5% and 49.6%, respectively. Risk factors significantly associated with WNP included having worked in the ER >10 years (ORadj = 2.42, 95% CI: 1.17-4.99); having performed cardiopulmonary resuscitation (CPR) (ORadj = 1.87, 95% CI: 1.01-3.47); and a high level of stress at work (ORadj = 3.53, 95% CI: 1.65-7.58). Risk factors associated with WSP were being female (ORadj = 2.17, 95% CI: 1.05-4.48); neck bending (ORadj = 2.28, 95% CI: 1.13-4.62); and a high level of work stress (ORadj = 3.45, 95% CI: 1.79-6.66). Emergency nurses in Thailand presented with both WNP and WSP. Personal factors, >10 years of working in ER, performing CPR and bending the neck, and high work stress contributed to both WNP and WSP. The results call for the need to put into place relevant safety measures and routine ergonomic assessments and address work-related stress in public regional hospitals to reduce the prevalence of neck/shoulder pain and job-related stress among ER nurses.

Keywords: Musculoskeletal disorders, Risks, Work-related stress, Emergency nurse

1. Introduction

Emergency nurses who specialize in treating patients with life-threatening injuries or critical illness in the emergency room (ER) at regional hospitals of Thailand [1] are at risk of experiencing repetitive strain injuries and stress leading to musculoskeletal disorders (MSDs) [2,3]. Work-related musculoskeletal disorders (WMSDs) and their symptoms, particularly those of the back, neck, and shoulder, are the most common health problems in ER nursing [3-5]. WMSDs are prevalent among nurses in both developing and developed nations. However, the prevalence rates differ, depending on the ER conditions. The highest 12-month prevalence of WMSDs has been reported in Nigeria (77.8%) [5], while the lowest prevalence has been found in India (36%) [6]. A Thai study found the prevalence of WMSDs to be at 73.3% in ER nurses [7], which is higher than that found among Thai registered nurses (47.8%) [8]. The predominant areas of pain reported were around the neck and shoulder [7].

The US Occupational Safety and Health Administration (OSHA) [9] reported that specific handling tasks, like reaching, bending, twisting, rotating, and lifting, exposed the healthcare workers to significant risks of shoulder pain (SP) and neck pain (NP). Compared to those working in non-ER functions, ER nurses are at a

higher risk of having low back pain, primarily due to specific patient-handling tasks involving push and pull movements and prolonged standing of more than two hours [10,11]. Ergonomic and psychosocial factors were also significant causes of low back pain [10,12].

Currently, the ratio of professional nurses in Thailand is 2.4 nurses per 1,000 people (2.4:1,000), higher than other healthcare professionals. About one percent of registered nurses in Thailand work in the ER at regional hospitals [13]. Depending on the number of patients who visit the emergency department, one or two registered nurses are generally assigned to work on each shift of the regional hospitals in the northeast (NE) of Thailand. Our previous study conducted on ER nurses of those regional hospitals found that work-related shoulder pain (WSP) and neck pain (WNP), possibly caused by work-related stress, was the leading musculoskeletal health problems [7]. In addition, a study of Thai registered nurses indicated that the prevalence of MSDs significantly increased with age, body mass index, and working experience [8]. Yet studies on the risk factor predictors of WNP and WSP are limited and unclear concerning how those workers' characteristics or work-related factors in ER and psychological factors are associated with WNP and WSP among ER nurses. This study investigated the association between the work-related risk factors of WNP and WSP among ER nurses of NE Thailand. A stepwise multiple logistic regression analysis was used to analyse the data. This study will inform future strategies, health and safety measures, and prevention programmes on musculoskeletal disorders among ER nurses.

2. Materials and methods

A cross-sectional study was carried out with emergency nurses from 10 regional hospitals in NE Thailand to investigate the associated risk factors of WNP and WSP among ER nurses in the same population as the previous study [7]. These 10 regional hospitals were Maharat Nakhon Ratchasima, Sunpasitthiprasong, Udon Thani, Buriram, Surin, Chaiyaphum, Sakonnakhon, Sisaket, Khon Kaen, and Roi Et hospitals, with a total population of 356 nurses. The sample size was based on the previous investigation of the prevalence rate of WMSDs among ER nurses [7], and from the total of 356 self-administered questionnaires which were distributed, the completed questionnaires of 240 ER nurses who met the inclusion criteria were included for data analysis (response rate = 78.1%, meeting criteria = 67.4%). The previous analysis described the characteristics of the population and working conditions, and the prevalence of WMSDs among ER nurses from the self-administered questionnaire, which consisted of four main parts.

Part 1 included questions on demographic characteristics, i.e., gender and age; body mass index (BMI); housework involving repetition or handling objects, e.g., cleaning/washing/cooking; the number of years working in the ER; types of shift work; current job position (direct patient care vs. indirect patient care); any history of chronic disease (e.g., diabetes, hypertension, dyslipidemia, asthma, etc.); and smoking habits. Participants' BMI (weight (kg)/height^2 (m^2)) values were categorized into four groups following the BMI criteria for Asian populations [16]: underweight (BMI <18.5), normal (BMI = 18.5-22.9), overweight (BMI = 23-24.9), and obesity level I (BMI = 25-29.9) and obesity level II (BMI >30).

Part 2 included questions on types of frequently performed tasks or assignments and a measure of ergonomic risk factors. Participants were asked to describe their working positions inpatient or object handling tasks performed in their job in the previous 12 months (i.e., frequent use of arms or hands, pulling, pushing, lifting, or rotating). Each job task was assigned a rating for performing such activities using a four-point Likert scale (never = 0, sometimes = 1, often = 2, always = 3). These scores were partitioned into two groups (yes = often or always, no = never or sometimes).

Part 3 used the Subjective Workload Index (SWI) consisting of the questions of the Thai version used in the previous study and presented the results [7], which initially came from Vanwonterghem, Verboven, & Cloostermans [17], to measure the experience of psychological problems at work during the previous 12 months. The SWI consisted of eight items. The first six items (fatigue, perceived risks, task complexity, mental concentration, work rhythm, and responsibility) were related to the factors contributing to workload-related psychological problems. The remaining two items (interest in and autonomy in the job) were regarded as measures of job satisfaction. Respondents were asked to answer the SWI questions using a visual analogue scale (VAS) ranging from 0 to 10. A continuum scale was used for the six items measuring factors contributing to psychological problems, ranging from 0 = no apparent concern to 10 = extreme distress. A continuum scale was also used for the two items on job satisfaction, ranging from 0 = not satisfied to 10 = maximal satisfaction. The SWI score was calculated using the following formula, and the SWI scores from each participant were categorized into six levels (Table 1).

$$SWI = [(\sum Factors\ contributing\ to\ psychological\ distress) - (\sum Factors\ of\ satisfaction)] / 8 \quad (1)$$

Table 1 Six levels of subjective workload index (SWI) classified by SWI scores for implementation of action on work-related stress.

Level	Score	Level of SWI	Follow-up needed for implementation of action
1	<1	No apparent problem	No action required
2	1 - <2	Very mild	Check answer from each contributing factor.
3	2 - <3	Mild	Detailed analyses and a medium-term review (after a month) are needed.
4	3 - <4	Moderate	Detailed analyses and a short-term review (after a week) are needed.
5	4 - <5	Severe	Immediate action required (within two days)
6	≥5	Extremely severe	The affected individual is required to stop his/her activity and receive immediate support.

For risk factor analysis, as per the objective of this study, the SWI scores were recoded into two levels (high stress: SWI score ≥ 3 or higher than level 3, low stress: SWI score <3 or level 3 and lower). Part 4 asked about participants' experiences of WMSDs in the previous 12 months included work-related neck pain (WNP) and work-related shoulder pain (WSP). The WMSD questionnaire showed good face validity, and internal reliability [7] was assessed by asking participants to rate the severity of neck and shoulder pain symptoms. The participants reported the severity of pain according to three levels (mild, moderate, severe). In reporting the prevalence and associated factors of pain in this study, a case of WNP was defined as having reported at least moderate pain that occurred partly in the neck. A case of WSP was described as having reported at least moderate shoulder pain.

Data analyses were performed using STATA version 10.0. The prevalence rates of WNP and WSP over the previous 12-months were calculated using the following formulas:

$$\textit{Prevalence of WNP} = \textit{(Number of participants who experienced at least moderate WNP x100)/240} \quad (2)$$

$$\textit{Prevalence of WSP} = \textit{(Number of participants who experienced at least moderate WSP x100)/240} \quad (3)$$

The correlation between the WNP or WSP and each of the variables measured was tested by univariate analysis. Multiple logistic regression analyses (backward elimination) were performed to identify which variables would significantly explain the occurrence or risk of WNP and WSP. All variables with a 95% CI and p-value < 0.20 in the univariate analysis were included in the multiple logistic regression analysis. The potential confounding variables, like gender, age, and work experience, were consistently included in all multivariate analyses. The odds ratio (OR) and 95% confidence interval of the OR (95% CI), adjusted odds ratio (ORadj), and 95% CI of the ORadj were presented. The level of statistical significance was set at a p-value < 0.05.

3. Results

3.1 Demographic characteristics work stress, and prevalence of work-related neck and shoulder pain

Of the 240 emergency nurses, 82.5% were female and the mean age was 34.5 years old (SD = 9.2, median = 34, min = 23, max = 60). The average number of years working in the ER was 9.1 years (SD = 8, min = 1, max = 34). About one-third (35.6%) of the participants had more than ten years of experience working in the ER. The majority (90.4%) performed shift work and were in the normal weight range (mean BMI of 22.1) (SD = 3.6, median = 21.7, min = 15.6, max = 34.3). The mean score for work-related stress was 3.7 (SD = 1.1), which according to the Subjective Workload Index (SWI), presents a moderate to a severe psychological problem (Table 1 and Table 2). In total, 36 percent of the nurses were classified as experiencing a moderate level of stress (SWI score = 3 - <4), and 28.8% were classified as having severe stress levels (SWI score = 4 - <5). Any individuals experiencing severe stress levels, according to the SWI, need immediate attention and support (within days) to remedy the problems. About one-fifth (19.2%) of the participants presented with mild to moderate psychological stress (SWI score = 2 - <3).

The 12-month prevalence rate of WNP was 37.5% (95% CI: 31.3-43.7) and the prevalence rate of WSP was 49.6% (95% CI: 43.2-55.9). Table 2 and Table 3 show the prevalence of WNP and WSP in the previous 12 months based on participants' demographic characteristics, SWI, and nursing tasks with postural ergonomic factors. The prevalence tended to increase with longer years of work experience in ER and higher SWI scores but was not related to age and BMI. Exposure to postural ergonomic factors regarding nursing tasks and performing cardiopulmonary resuscitation (CPR) caused an increased prevalence of WNP and WSP compared to non-exposure.

3.2 Risk factors of work-related neck and shoulder pain

Table 4 and Table 5 show correlations of WNP and WSP with a number of factors, including the confounders (age, gender, and work experience), work-related stress, and personal and work characteristics from the univariate analysis for screening factors to be put into the initial model of the multiple regression analysis. From the univariate analysis, factors significantly correlated with WNP were performing an act of twisting from the waist (p-value = 0.021); bending the neck (p-value = 0.046); pushing/pulling patients (p-value = 0.020); lifting patients/objects > 25 kg (p-value = 0.035); performing CPR (p-value = 0.008); and high levels of work stress (p-value = 0.010). Factors significantly correlated with WSP were BMI $\geq$ 23 kg/m^2 (p-value = 0.044); bending the neck (p-value = 0.012); lifting patients/objects > 25 kg (p-value = 0.035); regularly performing CPR (p-value = 0.047); and high levels of work stress (SWI score $\geq$ 3) at a p-value < 0.001.

In order to examine the risk factors of WNP or WSP, all variables, including the confounders (age, gender, and work experience) and variables with a p-value < 0.20 from the univariate analysis, were entered into the multiple logistic regression analysis. The final models for factor analysis adjusted for confounding factors of WNP and WSP are presented in Table 6 and Table 7, respectively. Having worked in ER for more than 10 years (ORadj= 2.42, p-value = 0.017), performing CPR (ORadj = 1.87, p-value = 0.046) and high levels of work-related stress (ORadj = 3.53, p-value = 0.001) were significant risk factors of WNP. The significant risk factors of WSP were being female (ORadj = 2.60, p-value = 0.012), frequent neck bending (ORadj = 2.28, p-value = 0.021) and high levels of work-related stress (ORadj = 2.85, p-value = 0.002).

Table 2 Prevalence of work-related neck pain (WNP) and work-related shoulder pain (WSP) classified by demographic characteristics and subjective workload index (SWI) among ER nurses (n=240).

Factor	WNP; n (%)		WSP; n (%)	
	Yes (n=90)	No (n=150)	Yes (n=119)	No (n=121)
Gender				
Female	78 (86.7)	120 (80.0)	103 (86.6)	95 (78.5)
Male	12 (13.3)	30 (20.0)	16 (13.5)	26 (21.5)
Age group				
21-30 years	42 (46.7)	60 (40.0)	56 (47.1)	46 (38.1)
31-40 years	28 (31.1)	50 (33.3)	36 (30.3)	42 (34.7)
41-50 years	17 (18.9)	27 (18.0)	21 (17.7)	23 (19.0)
51-60 years	3 (3.3)	13 (8.7)	6 (5.0)	10 (8.3)
Body mass index (BMI)				
Underweight (<18.5)	14 (15.6)	21 (14.0)	22 (18.5)	13 (10.7)
Normal (18.5-22.9)	48 (53.3)	74 (49.3)	64 (53.8)	58 (47.9)
Overweight (23-24.9)	17 (18.9)	27 (18.0)	21 (17.7)	23 (19.0)
Obesity I (25-29.9)	8 (8.9)	20 (13.3)	7 (5.9)	21 (17.4)
Obesity II (>30)	3 (3.3)	8 (5.3)	5 (4.2)	6 (4.9)
Had chronic disease	7 (7.9)	17 (11.3)	15 (12.6)	9 (7.4)
Work experience in ER				
1-10 years	55 (61.1)	100 (64.5)	79 (66.7)	76 (62.8)
11-20 years	26 (28.9)	35 (23.3)	27 (22.7)	34 (28.1)
21-30 years	8 (8.9)	13 (8.7)	10 (8.4)	11 (9.1)
>30 years	1 (1.1)	2 (1.3)	3 (2.5)	0 (0.0)
SWI				
No apparent problem (<1)	1 (1.1)	2 (1.3)	1 (0.8)	2 (1.7)
Very mild (1 - <2)	1 (1.1)	8 (5.3)	1 (0.8)	8 (6.6)
Mild (2 - <3)	8 (8.9)	38 (25.3)	14 (11.8)	32 (26.5)
Moderate (3 - <4)	35 (38.9)	53 (35.3)	43 (36.1)	45 (37.2)
Severe (4 - 5)	33 (36.7)	36 (24.0)	48 (40.3)	21 (17.4)
Extremely severe (>5)	12 (13.3)	13 (8.7)	12 (10.1)	13 (10.7)

Table 3 Prevalence of work-related neck pain (WNP) and work-related shoulder pain (WSP) classified according to posture and nursing tasks among ER nurses (n=240).

Factor	WNP; n (%)		WSP; n (%)	
	Yes (n= 90)	No (n=150)	Yes (n=119)	No (n=121)
Twisting at the waist	73 (81.1)	101 (67.3)	92 (77.3)	82 (67.8)
Bending at the neck	78 (86.7)	114 (76.0)	103 (86.6)	89 (73.6)
Repetitive motion of hands/wrists	80 (88.9)	122 (81.3)	101 (84.9)	101 (83.5)
Pushing/pulling patients	78 (86.7)	111 (74.0)	95 (79.8)	94 (77.7)
Lifting patients/objects 10-25 kg	48 (53.3)	62 (41.3)	61 (51.3)	49 (40.5)
Lifting patients/objects > 25 kg	41 (45.6)	48 (32.0)	52 (43.7)	37 (30.6)
Performing CPR	41 (45.6)	43 (28.7)	49 (41.2)	35 (28.9)

Table 4 Risk factors of work-related neck pain (WNP) indicated by univariate analysis among ER nurses (n=240).

Factor	WNP; n (%)	Univariate analysis	
		OR (95% CI)	*p*-value
[1]Female	78 (39.4)	1.63 (0.75-3.69)	0.188
[2]Age < 35 years	57 (40.4)	1.36 (0.77-2.41)	0.264
[3]Work experience in ER > 10 years	41 (42.7)	1.45 (0.82-2.54)	0.174
[4]Twisting at the waist	73 (41.9)	2.08 (1.07-4.17)	0.021*
[5]Bending at the neck	78 (40.6)	2.05 (0.97-4.60)	0.046*
[6]Repetitive motion of hands/wrists	80 (39.6)	1.84 (0.81-4.47)	0.121
[7]Pushing/pulling patients	78 (41.3)	2.28 (1.08-5.09)	0.020*
[8]Lifting patients/objects 10-25 kg	48 (43.6)	1.62 (0.93-2.84)	0.071
[9]Lifting patients/objects > 25 kg	41 (46.1)	1.78 (1.00-3.15)	0.035*
[10]Performing CPR	41 (48.8)	2.08 (1.16-3.72)	0.008*
[11]High levels of work stress (SWI ≥3)	80 (43.9)	3.76 (1.74-8.83)	< 0.001*

*p-value < 0.05

References for variables [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11] were male, age ≥ 35 years, experience in ER ≤ 10 years, no waist twisting, no neck bending, no repetitive motion of hands/wrists, no pushing/pulling patients, no lifting patients 10-25 kg, no lifting patients >25 kg, no CPR performing, and low levels of work stress (SWI <3), respectively.

Table 5 Risk factors of work-related shoulder pain (WSP) indicated by univariate analysis among ER nurses (n=240).

Factors	WSP; n (%)	Univariate analysis	
		OR (95% CI)	*p*-value
[1]Female	103 (52.1)	1.76 (0.85-3.74)	0.101
[2]Age < 35 years	76 (53.9)	1.52 (0.88-2.64)	0.110
[3]Work experience in ER > 10 years	48 (50.0)	1.03 (0.59-1.78)	0.916
[4]Overweight/obese (BMI > 23)	33 (39.8)	0.54 (0.31-0.97)	0.027*
[5]Chronic disease	15 (62.5)	1.79 (0.69-4.85)	0.182
[6]Twisting at the waist	92 (52.9)	1.62 (0.88-3.00)	0.098
[7]Bending at the neck	103 (53.7)	2.31 (1.14-4.82)	0.012*
[8]Lifting patients between 10-25 kg	61 (55.4)	1.55 (0.89-2.66)	0.094
[9]Lifting patients > 25 kg	52 (58.4)	1.76 (1.00-3.10)	0.035*
[10]Performing CPR	49 (58.3)	1.72 (0.97-3.05)	0.047*
[11]High levels of work stress (SWI ≥3)	103 (56.6)	3.42 (1.73-6.99)	< 0.001*

*p-value < 0.05

References for variables [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11] were male, age ≥ 35 years, experience in ER ≤ 10 years, no waist twisting, no neck bending, no repetitive motion of hands/wrists, no pushing/pulling patients, no lifting patients 10-25 kg, no lifting patients >25 kg, no CPR performing, and low levels of work stress (SWI <3), respectively.

Table 6 Multiple logistic regression analysis on the risk factors of WNP among ER nurses (n=240).

Factor	WNP; n (%)	Multivariate analysis	
		ORadj (95% CI)	*p*-value
[1]Female	78 (39.4)	1.69 (0.77-3.71)	0.192
[2]Age < 35 years	57 (40.4)	1.89 (0.89-4.03)	0.099
[3]Work experience in ER > 10 years	41 (42.7)	2.42 (1.17-4.99)	0.017*
[4]Performing CPR	41 (48.8)	1.87 (1.01-3.47)	0.046*
[5]High levels of work stress (SWI ≥3)	80 (43.9)	3.53 (1.65-7.58)	0.001*

*p-value < 0.05

References for variables [1, 2, 3, 4, 5] were male, age ≥ 35 years, experience in ER ≤ 10 years, no CPR performing, and low levels of work stress (SWI <3), respectively.

Table 7 Multiple logistic regression analysis on the risk factors of WSP among ER nurses (n=240).

Factors	WSP; n (%)	Multivariate analysis	
		ORadj (95%CI)	*p*-value
[1]Female	103 (52.1)	2.60 (1.23-5.49)	0.012*
[2]Age < 35 years	76 (53.9)	1.95 (0.99-3.83)	0.054
[3]Work experience in ER > 10 years	48 (50.0)	1.45 (0.73-2.89)	0.291
[4]Bending at the neck	103 (53.7)	2.28 (1.13-4.62)	0.021*
[5]High levels of work stress (SWI ≥3)	103 (56.6)	2.85 (1.48-5.47)	0.002*

*p-value < 0.05

References for variables [1, 2, 3, 4, 5,] were male, age ≥ 35 years, experience in ER ≤ 10 years, no neck bending, and low levels of work stress (SWI <3), respectively.

4. Discussion

Work-related neck (37.5%) and shoulder pain (49.6%) over the previous 12 months were identified among the ER nurses of NE Thailand who participated in this study. Findings from this study confirm those of other studies which found high levels of MSDs commonly found in nursing populations. The prevalence rate of MSDs (WNP and WSP) reported in this study was similar to those previously reported in Thai registered nurses [8].

Multiple logistic regression analyses showed no significant associations between demographic characteristic variables and WNP, except the number of years working in ER. Those with more than 10 years of work in ER had a higher risk of WNP. This study supports the previous report, which found that the longer one works in the ER, the higher the chance he/she has of experiencing low back pain [10]. However, WSP was not significantly correlated with the work experience of ER nurses. Multiple logistic regression analyses showed a significant association between gender and WSP. Being female was significantly associated with the occurrence of WSP among ER nurses. Female nurses are more susceptible to musculoskeletal injury than their male peers, which may be related to sex differences in muscular strength and multi-site pain [19]. The findings of [20] also concurred those female nurses had a higher risk of shoulder pain than their male counterparts. Another study with Brazilian nurses was also supportive of this study [21]. Therefore, any initiatives to prevent musculoskeletal disorders amongst ER nurses need to be gender relevant.

According to OSHA [9], ageing can increase individual susceptibility to musculoskeletal injuries and illness. Our study, however, showed no significant association between age and the occurrence of WNP or WSP. On the other hand, the European Agency Safety and Health at Work [22] reported that younger or physically fit health workers were more likely to be exposed to specific tasks that might cause musculoskeletal disorders in the long term. Those particular tasks are given to the young and physically fit ER nurses included frequent bending, prolonged standing, carrying, pushing, or regular patient lifting, as previously confirmed [23]. Hence, our findings could explain that working experience of more than 10 years posed a significantly higher risk of WNP when compared to fewer years working in the ER.

BMI, being obese or overweight significantly raises the risk of developing knee osteoarthritis, low back pain, neck pain, shoulder pain, elbow pain, and wrist/hand pain [24]. On the contrary, our study indicated no significant association between being obese or overweight and the occurrence of WNP or WSP. One possible explanation could be that the ergonomic risk factors associated with nursing tasks or psychological factors related to stress at work are better risk indicators for the development of WNP or WSP than BMI.

The univariate analysis indicated that some nursing tasks involving bending the neck, pushing/pulling, lifting, and routine CPR were significant risk factors for both WNP and WSP. After controlling for the confounding variables of gender, age, and work experience, multiple logistic regression analyses indicated significant associations between bending at the neck and WSP, and between performing CPR and the occurrences of WNP. CPR is a lifesaving procedure performed when someone's breathing or heartbeat has stopped, and commonly performed by ER nurses in an emergency. This task includes 1) rescue breathing and 2) chest compression, including transferring the patient to a prone position and using both hands to push down (compress) on the patient's chest. According to OSHA [9], patient-handling tasks are recognized as the significant risk factors of musculoskeletal disorders among ER nurses. Our findings confirm those of other studies. Patient-handling tasks, such as lifting, pulling or pushing, transferring, or moving patients, were found to be significant risk indicators of neck and shoulder pain among nurses [23,25].

Our findings confirm the association between work-related psychological stress and WNP and WSP found elsewhere [5]. According to the Canadian Center for Occupational Health and Safety [24], work-related psychological stress could induce changes in one's physiological function, like increasing someone's sensitivity to pain or muscle tension, which might increase someone's susceptibility to developing WNP or WSP. This cross-sectional study design limits the application of causal inference between each predictor variable and WNP or WSP. Recall bias might have occurred when participants were asked about their neck and shoulder pain in the previous 12 months before the data collection. Further study may include prospective cohort research on the significant predictors of work-related stress, WNP, and WSP.

5. Conclusion

Both WNP and WSP are prevalent among emergency nurses in NE Thailand, at 37.5% and 49.6%, respectively. Female nurses had a significantly higher risk than male nurses of developing WSP, and the nursing tasks involving bending the neck were considerably associated with WSP. Being an emergency nurse for more than 10 years and performing CPR were significantly associated with WNP. Stress at work was also recognized as a predictor of both WNP and WSP. These results show the importance of measures to prevent work-related stress and WNP and WSP. WNP prevention programmes among ER nurses must include safe-handling support

and training on ergonomic risk factors and injury surveillance programmes on the risk factors of WSP among female ER nurses.

6. Ethical approval

This research was approved by the Khon Kaen University Ethics Committee (No. HE571143).

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