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Psychosocial factors, musculoskeletal disorders and work-related fatigue amongst nurses in Brunei: structural equation model approach

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ABSTRACT

Introduction: Psychosocial factors, musculoskeletal disorders and work-related fatigue have adverse effects on individual nurses and place a substantial financial burden on health care. Evidence of an association has been reported in the literature, but no theoretical explanation has been published to date.
Aim: To explore and develop a structural model to provide a theoretical explanation for this relationship.
Methods: A cross-sectional study using data from 201 valid samples of emergency and critical care nurses across public hospitals in Brunei was performed via self-administered questionnaire. The structural equation model was assessed using partial least squares analysis.
Results: A valid and robust structural model was constructed. This revealed that 61.5% of the variance in chronic fatigue could be explained by psychosocial factors and musculoskeletal disorders pathways. Among the psychosocial factors, work–family conflict was identified as a key mediator for progression of musculoskeletal problems and subsequent fatigue through stress and burnout.
Conclusion: This report provides a novel theoretical contribution to understanding the relationship between psychosocial factors, musculoskeletal disorders and work-related fatigue. These preliminary results may be useful for future studies on the development of work-related fatigue and musculoskeletal disorders, particularly the central role of work–family conflict.

1. Introduction

Worldwide, research on psychosocial factors in the work environment has grown rapidly in the past decades. Evidence from these studies has led to general understanding that the psychosocial work environment is a multi-factored phenomenon that has far-reaching consequences. Negative outcomes include development of stress-related disorders such as neurasthenia and burnout [1], onset of musculoskeletal disorders [2], musculoskeletal complaints [3], and fatigue [4].

2. Literature review

2.1. Psychosocial factors

Psychosocial factors, also known as psychosocial work stressors, represent one of the most important components to consider when determining the health and safety of a workplace [5]. The effects of adverse psychosocial factors have been demonstrated to be detrimental for both nurses and the healthcare organisation. Factors such as effort–reward imbalance, overcommitment, high job demand, and low influence at work are known to be important reasons affecting nurses' intention to leave [6] and have been associated with poor mental health among nurses [7]. These factors have contributed to a high rate of workplace problems such as musculoskeletal injuries, which place a high financial burden on the healthcare organisation [8].

Furthermore, emergency and critical care nursing are among the high dependency nursing specialties at greater risk of being affected by a wide range of psychosocial work stressors [9]. In addition, emergency nurses have been found to be more likely to experience adverse psychosocial stressors than other nurses [10]. This is mainly because work conditions for emergency and critical care nurses are often hectic and difficult to predict due to the constantly changing and wide variation in pathology received each day [11].

2.2. Musculoskeletal disorders

Musculoskeletal disorders (MSDs), sometimes known as repetitive strain injuries or cumulative trauma disorders, have been reported to be among the most common work-related health

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issues in nurses [12]. MSDs may only be apparent days, months or even years after exposure to work hazards [5].

Existing evidence has established the relationship between onset of MSDs and psychosocial factors [3,13]. These factors encompass the organisation of work and the organisational culture, including attitudes, values and practices that are carried out daily at the workplace [5]. High job demands, low influence at work and effort–reward imbalance have contributed to a high rate of MSDs, which has cost healthcare organisations millions of dollars in terms of staff turnover and absenteeism [8,14].

However, the majority of previous studies that measured psychosocial factors used the Job Content Questionnaire and the Effort-Reward Imbalance scale. They were restricted to the measurement of a few factors based on a single theoretical model [15]. The aetiology and pathways of understanding and control regarding MSDs are complex [16]. In order to evaluate and manage risk factors related to the development of MSDs it is important to examine interactions between all relevant activities at work and outside work rather than to focus on a single risk factor [14].

2.3. Work-related fatigue

In nursing, fatigue is defined as nurses' subjective feelings of acute physical and mental tiredness or exhaustion that create an unrelenting overall condition that interferes with their physical and cognitive ability to function at their normal capacity [17]. Lower back pain, sustained from work-related activities such as repetitive bending, lifting and transferring patients, is is one of the most common MSDs amongst nursing personnel [18].

Work-related fatigue is recognised to have an adverse effect on quality of care, patient satisfaction, and patient and nurse safety [19,20]. Fatigue and exhaustion have been reported to be among the reasons why nurses leave the profession, and this has aggravated the relentless issue of nurse shortages [21,22]. Nurses working long hours with a short recovery period may experience cognitive, psychomotor and behavioural impairment that leads to slow reaction times, lapses in critical judgment, reduced motivation and an increase in medical errors [20]. A recent report stated that medical errors have become the third leading cause of death in the United States, following heart disease and cancer [23]. There is also strong evidence to suggest that an increase in fatigue lowers immune function and thus increases the risk of sickness and absence; a costly consequence for healthcare organisations [24,25].

From the literature, it appears that there is overlapping evidence to suggest a significant relationship between these three constructs. As no studies were found to have examined this relationship, the aim of this study was to explore and subsequently develop a valid and reliable structural model to provide a theoretical explanation for this relationship.

3. Methods

This cross-sectional study was approved by the joint review committee of the University of Brunei Darussalam and the Ministry of Health. The study, which ran from February to April 2016, was conducted among emergency and critical care nurses across public hospitals in Brunei. A detailed description of the data collection procedure has been reported previously [26].

Psychosocial factors were measured using the Copenhagen Psychosocial Questionnaire Version 2 (COPSOQ II), developed by the National Research Centre for the Working Environment, Denmark. COPSOQ II provides comprehensive assessment of psychosocial factors at work based on multiple theories rather than traditional measures based on a single theory [27]. MSDs were assessed using the 'standing workers' version of the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), developed by the Human Factors and Ergonomics Laboratory at Cornell University. Work-related fatigue was measured using the 'shift workers' trait scale version of the Occupational Fatigue Exhaustion Recovery scale (OFER), developed by Winwood et al. [28]. CMDQ and OFER were used as previous studies with large samples of nurses have shown their validity. Similarly, in this study, Cronbach's alpha was >0.70 for COPSOQ II, CMDQ and OFER.

3.1. Data analysis

Data were computed with smartPLS 3 using a regression analysis based on the partial least squares (PLS) optimisation technique to build a structural equation model (SEM) that represents the relationships between the three latent constructs. PLS is a multivariate statistical technique which estimates model parameters that minimise residual variance of the whole model [29].

Data analysis commenced by evaluating the outer and inner measurement models. The outer model establishes the convergent and discriminant validity of the constructs, and the indicator reliability of each item. Convergent validity (correlation between indicators and their construct) is acceptable when the average variance extracted (AVE) is >0.50 (Table 2) [30]. To confirm discriminant validity among the constructs, the square root of AVE based on Fornell and Larcker's criterion was used where values loaded well on to their own construct and poorly on other constructs (Table 3). Heterotrait-monotrait (HTMT) values were also calculated where a value >0.90 affirms discriminant validity [31]. Composite reliability coefficient or Dillon-Goldstein's rho and the Cronbach alpha coefficient were used to measure internal coherence of the indicators to the constructs (i.e. internal consistency reliability). The thresholds for both reliabilities are >0.70, but 0.60 is acceptable in exploratory studies [32,33]. Indicator reliability was assessed where outer loadings should be >0.708. The variance inflation factor (VIF) was used to check for collinearity issues where a value >5 indicates no serious threats of multicollinearity [34].

The inner model evaluates path coefficient estimates and coefficient of determination (R^2), effect size (f^2) and their significance (bootstrapping) [35]. f^2 values of 0.02, 0.15 and 0.35 denote weak, moderate and strong effects, respectively [36]. The PLS algorithm was run through 300 iterations. A complete bootstrap resampling method (5000 subsamples) was applied using bias-corrected and accelerated bootstrap method to determine the significance of

Table 1
Descriptive statistics of respondents' characteristics ($N = 201$).

Measure	Items	Frequency	(Percent)
Gender	Male	61	(30.3)
	Female	140	(69.7)
Age (years)	22–30	72	(35.8)
	31–40	90	(44.8)
	>40	39	(19.4)
Marital status	Married	138	(68.7)
	Single	63	(31.3)
Nursing education	Diploma levels (below)	150	(74.6)
	Bachelors & Masters degrees	51	(25.4)
Smoking	Yes	25	(12.4)
	No	176	(87.6)
Department	Emergency	100	(49.8)
	Critical care	101	(50.2)
Years employed	Less than 5 years <5	59	(29.4)
	5–10 years	63	(31.3)
	11–15 years	45	(22.4)
	>15	34	(16.9)

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