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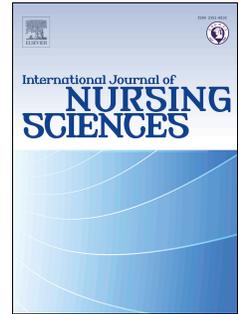
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Hazardous work environments increase the risk of burnout in Macau nurses

Sydney X. Hu, Andrew L. Luk, Graeme D. Smith

Objective: To examine the effects of various hazardous factors in working environments on burnout in a cohort of clinical nurses in Macau.

Methods: A cross–sectional survey was used to examine specific workplace hazards for burnout in qualified nurses ($n = 424$) in Macau. Structural equation modeling (SEM) was used to analyze relationships between specific hazards and manifestations of burnout.

Results: In the final model, workplace hazards accounted for 73% of the variance of burnout with a standardized regression weight of 0.85. The measures of the model fit were acceptable. Bodily hazards, threats of violence, and physical environmental hazards were found to significantly contribute to two major determinants of burnout, emotional exhaustion and depersonalization.

Conclusions: Workplace environmental hazards increased the risk of burnout amongst clinical nurses in Macau. Better management of these factors may help to protect nursing staff and reduce the risk of burnout and attrition from the nursing profession.

Key words: Nurses, Hazardous work environments, Burnout, Stress

1. Introduction

Globally, the nursing profession suffers from high levels of attrition and a shortage of trained manpower [1]. These issues are intertwined with the demanding practice environment and the risk of occupational burnout [2]. In the United States, the shortage of registered nursed (RN) may exceed 500,000 by 2025 [3]. Another American study estimated that 30%-50% of all new RNs elect to leave clinical positions within the first three years of their graduation [4]. The European NEXT study which included more than 28,000 nurses from ten countries revealed that nurses with high burnout scores had three times the risk of leaving their job in half of the countries surveyed [5]. Burnout is also a significant issue for nurses in China [6]. The situation in Macau is no different, where the nurse annual turnover rate was 14% in the largest hospital in Macau [7]. Nurse burnout is an important phenomenon to examine, particularly in times of severe nursing shortages, as it has been linked to nurse attrition and observed to ultimately impact the quality of patient care [8].

Burnout is typically characterized by a depletion of emotional resources, diminution of energy, an increase in negative attitudes and feelings as well as insensitivity and a lack of compassion towards service recipients. The absence of a feeling of personal accomplishment is also a manifestation of burnout [9]. Insight into

the important factors that impact nurse burnout could help identify potential strategies

to protect and to retain nursing staff within the profession.

Around the world, clinical nurses are exposed to a variety of hazardous working

conditions [8]. It has been estimated that general hospital employees are exposed to an

average of 300 chemicals, including disinfectants, waste gases, and hazardous drugs

at their workplace [10]. Additionally, health care workers are at a high risk of

encountering physical violence at the workplace. A study of six tertiary teaching

hospital emergency nurses revealed that 40.5% of the respondents experienced some

form of physical violence [11]. In Australia, it was found that 67% of the health

employees ($n = 400$) had been verbally abused, 10.5% had been bullied, and 12% had

been assaulted during the course of a year [12]. In the United States, the Bureau of

Labor Statistics (BLS) data showed that the occupational injury and illness rate of

hospital employees was 7.6 per 100 full-time workers compared with a rate of 3.9 per

100 workers in the private sector [13]. This data also demonstrated that incidence

rates for three of the four most prevalent nonfatal illness and injury types

(overexertion injuries, falls, and workplace violence) are 65–260% higher in health

care than in other areas of private industry [13].

While clinical nurses will always face potential challenges at work, occupational

stress resulting from bullying, harassment, or horizontal violence (BHHV, including

behaviours of unkindness, discourtesy, sabotage, divisiveness, infighting, lack of cohesiveness, scapegoating, and criticism), as observed in clinical nurses in Hong Kong, is increasing [14]. In fact, between 17% and 76% of professional nurses in other international studies reported experiencing BHHV [15]. Although different methods of study may partially explain for this wide range, BHHV is commonly accepted as a pernicious occupational hazard for nurses globally [16, 17]. BHHV has been shown to have detrimental effects on physical and psychosocial health as well as work attrition the recipients [16, 17]. Psychological distress symptoms include anxiety, panic, depression, loss of confidence and self-esteem, mood swings, and irritability [15]. One study in Germany revealed that around a third of almost 2000 health care workers felt stressed by the levels of workplace violence that they had experienced [18].

Hazardous working conditions have been previously correlated with professional burnout. However, the effects of BHHV and other work related hazards on burnout have not yet been widely studied in clinical nurses. Here, a survey was performed to examine the extent to which various hazardous work conditions affect burnout in clinical nurses in Macau. These findings may provide practical implications for nurses and nursing administrators to prevent burnout and attrition within the nursing profession.

2. Methods

2.1. *Research Ethics*

The study protocol was reviewed and approved by the Research and Ethics

Committee of the research institution. Permission to conduct the study was obtained

from the Nursing Director of the Hospital. Guarantee of confidentiality and

anonymity was included in the invitation letter given to each participant.

2.2. *Study Design*

An explorative cross-sectional questionnaire survey was conducted on permanent

registered nurses in the larger of two hospitals in Macau, a Special Administrative

Region of China. In this hospital, only about 10% of the nursing staff was not

permanent.

2.3. *Study Instrument*

The study instrument was a questionnaire that consisted of three sections. In the first

section, demographic data, including age, gender, marital status, education, and years

of work experience was collected. The second section addressed burnout using the

Maslach Burnout Inventory (MBI), a reliable instrument widely used to measure burnout [20]. Some terminology in the MBI was slightly rephrased; for example, the word "client" was changed to "patient," in order to use terminology relevant to the nursing work environment.   The instrument consisted of 22 questions with a 7-point Likert scale ranging from 0 (never) to 6 (every day). The MBI has three components: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA), with the former two being the most important determinants of burnout [9]. The EE component measures feelings of being emotionally overextended and exhausted by one's work and a higher EE score represents feeling of exhaustion and tiredness. The DP component assesses the presence of an impersonal response towards a recipient's effort. A higher DP score indicates treating individuals as impersonal objects. Finally, the PA component assesses feelings of competence and successful achievement related to one's work.

The final section of the questionnaire addressed issues associated with hazardous work conditions. In this section, the questions were adapted from the Fourth European Working Conditions Survey [21] as a base. To ensure rigor in this process, three local nursing directors were interviewed to modify the questionnaire in order to make it relevant to the local work environment. After the interviews and minor revision, the questionnaire was pilot tested with ten qualified nurses to assess content validity.

Some questions required minor fine-tuning, such as providing examples. Respondents were asked to use a five-point Likert scale (1 to 5, where 1= never and 5 = constantly) to indicate how often they had been exposed to various conditions at work in the past month.

2.4. *Recruitment of study respondents*

The study invited all clinically qualified full-time nurses from the hospital to participate in the study. The inclusion criteria were registered nurses employed as permanent staff. The exclusion criteria were contracted or non-registered nurses. All hospital nurses were given a questionnaire with a self-sealing envelope for them to return the questionnaire when completed. The questionnaires were distributed by the ward nursing unit managers and collected by research assistants in person. A total of 424 out of 434 nurses (98% response rate) returned fully completed questionnaires.

2.5. *Statistical analysis*

When exploratory factor analysis is combined with multiple regression analyses, the result is structural equation modeling (SEM). SEM allows questions to be answered that involve multiple regression analyses of the different factors. In order to establish the factor structure of the scales that were used for this survey and to ensure that the variables demonstrated discriminant validity, a Principal Components Analysis (PCA)

using an oblique rotation was conducted. PCA was used "to extract maximum variance from a data set with a few orthogonal factors" [22], so that a large number of variables could be reduced down to a smaller number of components. These results revealed the scales to be reliable.

SEM was performed with AMOS 7.0 software and was applied to test models of relationships between burnout and variables. The maximum likelihood estimation was used to examine the correlation matrix of the observed indicators. The global goodness-of-fit of the models was assessed with the root mean square error of approximation (RMSEA) [23] and the comparative fit index (CFI) [24] in order to establish whether there was a fit between the specified model and the data as well as overall validity of the model. A CFI larger than 0.95 and a RMSEA lower than 0.06 indicate an excellent fit, whereas CFI > 0.90 and RMSEA < 0.08 indicate an adequate fit, and CFI > 0.90 and RMSEA > 0.08 indicate a mediocre but acceptable fit [24]. Statistical significance of the $\chi2$ value was not used to evaluate the goodness-of-fit because large samples may lead to a bias in statistical power to detect even the smallest and possibly irrelevant deviations. The statistical significance as well as the algebraic sign of the estimated path coefficients was used to determine validity of the model.

3. Results

3.1. *Respondent Demographics*

All nurses (n = 434) of the hospital were invited to participate and 424 (98%) returned completed questionnaires. The demographic data of the respondents are shown in Table 1. The majority of the respondents were female (96%), aged 30 and under (51%), married (55%), graduated with a Bachelor's degree (83%), employed on a permanent basis (76%), and level three nurses (49%), which is the lowest professional grade of nurse at the hospital.

3.2. *Key Variables*

Three key variables were identified through principal component factor analysis of the workplace hazards (Table 2). Component one, WHF1, concerned bodily hazards, involving tiring body postures, movements, and potentially harmful chemical contacts. Component two, WHF2, was related to threats of violence, including bullying, discrimination, unwanted sexual attention, and physical violence. Component three, WHF3, concerned indoor pollution, including uncomfortable temperature, air, and noise pollution. These three components together accounted for 53% of variance of the hazards. Bartlett's test of sphericity approximate chi-square is 1374.67 (df = 78; *P* < 0.001). The Cronbach's alpha reliability coefficients for these subscales of WHF1,

WHF2, and WHF3 were 0.81, 0.75, and 0.52, respectively. Three burnout questions from the MBI scale had loadings less than 0.5 in the principal component analysis. These questions were: "I feel emotionally drained from my work"; "I can easily understand patients' feelings about things"; and "I feel burned out from my work". Although these variables were relevant to burnout, they were removed due to low factor loading.

Principal component factor analysis of burnout revealed three key variables (Table 3). Three questions had loadings of less than 0.5 and were subsequently removed form analysis. These questions were: "I feel emotionally drained from my work"; "I can easily understand patients' feelings about things"; and "I feel burned out from my work". Component one, BOF1, concerned depersonalization as it involved depersonalized feelings towards others and self. Component two, BOF2, concerned personal achievement, as it involved positive perceptions of work abilities. Component three, BOF3, concerned emotional exhaustion, as it involved emotional strain. These three components together accounted for 79% of the variance of the hazards. Bartlett's test of sphericity approximate chi-square is 3306.87 (df=171), $P < 0.001$. The Cronbach's alpha reliability coefficient for the subscales of BOF1, BOF2, and BOF3 was 0.84, 084 and 0.75, respectively.

3.3. *The Model*

Figure 1 shows significant pathways of the final model, which includes measurement and structural relationships between workplace hazard, burnout, and associated factors. The variable of workplace hazard was found to be directly related to WHF1 bodily hazards (b = 0.61), WHF2 violence threats (b = 0.40), and WHF3 indoor pollution (b = 0.51). The factors of WHF1, WH2, and WH3 accounted for 37%, 16%, and 26% of variance in workplace hazard, respectively. Burnout was directly related to BOF1, depersonalization (b = 0.69), and BOF3, emotional exhaustion (b = 0.79), but inversely related to BOF2, personal achievement (b = -0.14). BOF1, BOF2, and BOF3 accounted for 47%, 2%, and 62% of the variance in burnout, respectively. Workplace hazard had a direct effect on burnout (b = 0.35), which accounted for 73% of the variance. The diagnostics of the model indicated that error terms of BOF1 and WHF1 were inter-correlated. The measures of model fitness were as follows: RMSEA=0.093 and CFI= 0.933. These values for the indices indicated that the final model fit the data reasonably.

4. Discussion

Although extensive research has been conducted on employee burnout in healthcare

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settings, the effects of various hazardous work environments specifically on clinical nursing burnout have not been well studied. With increasingly hazardous work environments, it is important to understand the factors that affect the wellbeing of clinical nurses. In this study, factors contributing to burnout were examined in a large cohort of clinical nurses, for the first time in Macau. Three workplace related hazards were identified; bodily hazards, threats of violence, and physical environmental hazards. These factors significantly contributed to emotional exhaustion and depersonalization, determinants of burnout, amongst clinical nurses in Macau.

4.1. *Workplace hazards and burnout*

Our study revealed that workplace hazards might have a direct effect on burnout in clinical nurses. These results support the previous literature on nursing burnout, highlighting a relationship between environmental factors, such as poor air quality, and specific manifestations of burnout, emotional exhaustion and depersonalization [19]. Indoor air temperature and noise were also found to significantly affect all aspects of burnout. This finding is contradictory to one study of air ambulance professionals which revealed that none of the stressors uniquely predicted depersonalization [25]. The difference could potentially be related to the use of different measurement tools in the studies. A novel finding was that threats of violence have an impact on nursing burnout. Overall, our findings reinforce the idea

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that a hazardous workplace can influence the development of burnout in nurses.

4.2. *Limitations*

There were several limitations to this study. First, the cohort consisted of nurses from only one hospital in Macau, and therefore can not be generalized. These findings need to be addressed with a larger sample population. Second, the cross-sectional design of the study limited our ability to infer causality in any of the reported relationships. However, SEM supported a model that designates the direction of the variables as leading to burnout, although not the other way around, or perhaps through reciprocal or cyclical relationships. Third, the workplace hazards were only measured by the perception of the respondent, rather than recording actual levels, such as for air quality, or number of incidents. Perceptions can sometimes be inaccurate, and yet, at other times, might be more important than the actual situation; for example, whether the room temperature is too hot or cold. Finally, while our study had a very high compliance rate (98%), it is possible that there was pressure from management to complete the questionnaires.

Despite these limitations, our results support and add new information in several important ways. First, relatively understudied areas in the workplace, namely, bodily hazards and air pollution, were examined for associations with burnout, and these workplace hazards were shown to lead to both depersonalization and emotional

exhaustion, specific features of burnout. Moreover, some theoretical and empirical support has been provided for examining perceptions of the physical work conditions in the context of burnout in the nursing profession. Our findings may also be potentially generalizable to other health related occupations that take place in a similar clinical environment, such as paramedical professions.

4.3. *Conclusion and Implications*

The risk of occupational burnout may be exacerbated in occupations that take place in hazardous work environments. This study revealed that all three workplace hazards examined, bodily hazards, threats of violence, and physical environmental hazards, significantly contributed to the occurrence of emotional exhaustion and depersonalization in this cohort of nurses in Macau. The results thus provide an impetus to recognize the impact and to reduce the levels of workplace hazards in order to prevent burnout and attrition among nurses. Better management of workplace hazards is therefore important not only for inherent improvements in physical health, but also in the psychosocial health of nurses due to the minimization of emotional exhaustion and depersonalization.

Importantly, the results may help nurses and nursing administrators to identify sources of workplace hazards and to develop interventions. Nurses could try to

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modify their body posture and movements, adjust room temperatures, and reduce

noise levels to appropriate levels, while nursing administrators might provide

workplace safety training and education, supportive work equipment and facilities,

and appropriate procedures to deal with the management and prevention of violence.

Raising awareness and continuous monitoring of hazardous work conditions thus

should play a primary role in protecting the occupational health of nurses and as a

retention strategy in the nursing profession.

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Table 1. Demographics of the respondents

		Number	Percentage
Gender	Male	17	4
	Female	404	96
	Total	421	100
Marital Status	Single	191	45
	Married or separated	229	55
	Total	420	100
Age	25 and under	119	28
	26-30	96	23
	31-35	111	26
	36-40	40	9
	41 or above	57	13
	Total	423	100
Education	Diploma	62	15
	Undergraduate	349	83
	Postgraduate	8	2
	Total	419	100
Professional Grade	Level 3	205	49
	Level 2	74	18
	Level 1	90	21
	Assistant Nursing Unit Manager or above	52	12
	Total	421	100
Employment Status	Permanent	315	76
	Contract	97	24
	Total	412	100

Note: Level 3 is the most junior Registered Nurse, and Level 1 is the most senior Registered Nurse.

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Table 2. Key Variables of Workplace Hazards

Workplace Hazards	Component		
	WHF1 Bodily Hazard	WHF2 Violence Threat	WHF3 Indoor Pollution
1. Work involves repetitive hand or arm movements	.747		
2. Work involves handling or being in direct contact with materials which can be infectious, such as waste and bodily fluids	.733		
3. Work involves tiring or painful positions	0.726		
4. Work involves standing or walking	0.719		
5. Work involves carrying or moving heavy loads	0.670		
6. Work involves handling or being in skin contact with chemical products or substances	0.631		
7. Over the past 12 months, personally subjected at work to threats of bullying / harassment		0.823	
8. Over the past 12 months, personally subjected at work to threats of discrimination		0.723	
9. Over the past 12 months, personally subjected at work to threats of unwanted sexual attention		0.714	
10. Over the past 12 months, personally subjected at work to threats of physical violence		0.636	
11. Being exposed at work to too high or too low temperatures			0.745
12. Being exposed at work to smoke or fumes			0.692
13. Being exposed at work to noise so loud that you would have to raise your voice to talk to people			0.586

Extraction method: Principal Component Analysis

Rotation method: Varimax with Kaiser Normalization

a. Rotation converged in 4 iterations.

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Table 3. Key Variables of Burnout

		Component		
	Burnout	BOF 1 Depersonalization	BOF 2 Personal Achievement	BOF 3 Emotional Exhaustion
1.	I've become more callous towards people since I took this job.	0.775		
2.	I worry that this job is hardening me emotionally.	0.765		
3.	I feel frustrated by my work.	0.754		
4.	I don't really care what happens to some patients.	0.736		
5.	Working with people directly puts too much stress on me.	0.708		
6.	I feel I treat some patients as if they were impersonal objects.	0.703		
7.	Working with people all day is really a strain for me.	0.683		
8.	I feel like I am at the end of my rope.	0.648		
9.	I feel recipients blame me for some of their problems.	0.517		
10.	I feel exhilarated after working closely with my recipients.		0.772	
11.	I can easily create a relaxed atmosphere with my recipients.		0.722	
12.	I have accomplished many worthwhile things in this job.		0.658	
13.	I feel I'm positively influencing other people's lives through my work.		0.597	
14.	I feel very energetic.		0.563	
15.	In my work, I deal with emotional problems very calmly.		0.560	
16.	I deal very effectively with the problems of my recipients.		0.509	
17.	I feel used up at the end of the day.			.821
18.	I feel I am working too hard on my job.			.754
19.	I feel fatigued when I get up in the morning and have to face another day on the job			.737

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Figure 1. The final model of the relationship between workplace hazards and

burnout.