

Safety Climate and Physical Workload of Nurses in Chengdu

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บรรยากาศความปลอดภัยและภาระงานทางกายของพยาบาลในโรงพยาบาลมหาวิทยาลัยเฉิงตู สาธารณรัฐประชาชนจีน*

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บทคัดย่อ

ภาระงานทางกายหมายถึงแรงของโครงสร้างและกล้ามเนื้อที่กระทำต่อกระดูกสันหลังเนื่องจากการเคลื่อนไหวและการยึดเหยียดร่างกายในระหว่างการทำงาน ซึ่งส่งผลกระทบต่อสุขภาพทางกายของบุคคล วัตถุประสงค์ของการวิจัยเชิงพรรณนาเพื่อหาความสัมพันธ์คือการสำรวจบรรยากาศความปลอดภัย ภาระงานทางกาย และทดสอบความสัมพันธ์ระหว่างบรรยากาศความปลอดภัย ภาระงานทางกายของพยาบาลในโรงพยาบาลมหาวิทยาลัยเฉิงตู สาธารณรัฐประชาชนจีน กลุ่มตัวอย่างคือพยาบาล 304 คนซึ่งทำงานในโรงพยาบาลของมหาวิทยาลัย 3 แห่งในเมืองเฉิงตู รวบรวมข้อมูลตั้งแต่เดือนกุมภาพันธ์ถึงเดือนมีนาคม ปี พ.ศ. 2561 เครื่องมือในการวิจัย ได้แก่แบบวัดบรรยากาศความปลอดภัย (SCM) ที่พัฒนาโดย Felknor (1977) และดัชนีภาระงานทางกาย (IPWL) ที่พัฒนาโดย Hollmann et al. (1999) และผู้วิจัยได้แปลเครื่องมือทั้งสองเป็นภาษาจีนโดยไม่ได้ดัดแปลง ความตรงของเครื่องมือทั้งสองได้ตรวจสอบโดยผู้พัฒนาเครื่องมือ ค่าสัมประสิทธิ์สหสัมพันธ์ของครอนบาร์คของ SCM เท่ากับ .82 และค่าความเชื่อมั่นของ IPWL โดยการวัดสองครั้งห่างกันสองสัปดาห์เท่ากับ .97 วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา และสัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน

ผลการศึกษาพบว่า

1. ค่าเฉลี่ยของคะแนนบรรยากาศความปลอดภัยตามการรับรู้ของพยาบาลเท่ากับ 3.44 (SD = 0.66)
2. ค่าเฉลี่ยของคะแนนภาระงานทางกายตามการรับรู้ของพยาบาลเท่ากับ 27.78 (SD = 10.25)
3. บรรยากาศความปลอดภัยมีความสัมพันธ์ทางลบในระดับปานกลางกับภาระงานทางกายอย่างมีนัยสำคัญทางสถิติ ($r = -.32, p < .001$).

ผลการวิจัยนี้เป็นข้อมูลพื้นฐานสำหรับผู้บริหารทางการพยาบาลในการกำหนดกลยุทธ์ในการธำรงรักษาบรรยากาศความปลอดภัยเพื่อที่จะลดภาระงานทางกายของพยาบาลในโรงพยาบาล มหาวิทยาลัยเฉิงตู สาธารณรัฐประชาชนจีน

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Abstract

Physical workload is the musculoskeletal load to the lower lumbar spine due to body posture and strenuous effort during work which affects the physical health of a person. This descriptive correlational research study aimed to explore safety climate, physical workload, and the relationship between safety climate and physical workload of nurses in Chengdu University Hospitals, People's Republic of China. The sample was 304 nurses working in three university hospitals in Chengdu. Data collection was carried out from February to March 2018. The research instruments included the Safety Climate Measure (SCM) developed by Felknor (1997), the Index of Physical Workload (IPWL) developed by (Hollmann et al., 1999) and were translated into Chinese by the researcher without any modifications. The validity of the two instruments was confirmed by the developers. The Cronbach's alpha of the SCM was .82, the 2-week test-retest reliability of the IPWL was .97. Descriptive statistics and Pearson's correlation coefficient were used for data analysis.

The results of this study showed that:

1. The safety climate mean score as perceived by nurses was 3.44 (SD = 0.66).
2. The nurse physical workload mean score was 27.78 (SD = 10.25).
3. There was a statistically moderate negative relationship between safety climate and physical workload ($r = -.32, p < .001$).

The findings of this study provide basic information for nursing administrators to develop strategies to maintain a safety climate in order to decrease the physical workload of nurses in Chengdu University hospitals in the People's Republic of China.

Keywords: Safety climate, Physical workload, Nurses

Background and Significance

Physical workload (PW) is the musculoskeletal load to the lower lumbar spine due to body posture and strenuous effort during nursing work (Hollmann, Klimmer, Schmidt, & Kylian, 1999) and encompasses the physical demands when performing tasks. PW is a major contributing factor to lower back pain among healthcare workers (Hignett, 2003; Hoogenboom et al., 2000). Studies found that work-related musculoskeletal disorders (WMSDs), which

can be caused by a high physical workload, will lead to many organizational and individual problems, such as early disability retirement, musculoskeletal or cardiovascular disease and poor cardiorespiratory fitness (Brighenti-Zogg et al., 2016; Karpansalo et al., 2002); and high healthcare expenses. It also affects occupational and private activities, and reduces quality of life (Scuffham, Legg, Firth, & Stevenson, 2010). WMSDs will also lead to high turnover rates of workers leaving the healthcare workforce per-

manently, poor quality of care, and suboptimal patient outcomes (Charney & Schirmer, 2007; de Castro, Hagan, & Nelson, 2006; Stone, 2004).

In 1999, Hollmann et al. proposed a 5-factor model and developed a questionnaire called "Index of Physical Workload" (IPWL) based on the biomechanical model "The Dortmund" (Jäger, Luttmann, & Laurig, 1991). Hollmann et al. believed that the most important factors contributing to the physical workload, especially when occupational working conditions are the unfavorable postures of the body or the extremities and the load that employees handling during the work. The 5 factors, according to Hollman et al., include: 1) Bending, 2) Twisting, 3) Kneeling, 4) Squatting, and 5) Handling of heavy loads required during work (Hollmann et al., 1999).

Several studies of PW have been conducted among healthcare employees in Turkey, Denmark, and America. All the results found that nurses were suffering a relative high PW (Chin, Nam, & Lee, 2016; Clausen et al., 2013; Genç, Kahraman, & Göz, 2016; Lee & Lee, 2017b). Unfortunately, there has been no studies done related to PW among nurses in China. It is claimed that the situation of PW among Chinese nurses has not been investigated.

According to the literature review, two studies conducted in the USA among nurses found that there was a negative relationship between safety climate and physical workload. This means a higher safety climate was significantly associated with a lower physical workload (Lee, Faucett, Gillen, Krause, & Landry, 2010; Lee & Lee, 2017a). Nurses who perceive

organizational concern regarding a safety climate will more likely work cautiously and follow the standard working procedures, thus, reducing the physical workload.

Zohar (1980) was the first person who used the term "safety climate" and defined the safety climate as the perceptions employees have of safety in their workplace. In 1999, Edmondson noted that safety climate among healthcare employees and also gives them psychological safety to help prevent, solve and learn from the problems that occur during delivery of care (Edmondson, 1999). Ultimately, safety climate in a hospital is determined by the internalized values and beliefs of hospital personnel, which is evident in their behaviors. Behavioral change of workers depends greatly on their daily routine and experiences at work (Wills, Watson, & Biggs, 2004). Safety work-related behavior is consistent with the climate they perceived (Zohar, 2008). Therefore, it is clear that safety climate can affect the employees' daily occupational behaviors which is important for healthcare employees and their organizations.

In 1997, Felknor reported a four-factor safety climate model based on previous surveys of hospital-based healthcare workers to assess safety climate and other factors associated with compliance with safety practices. According to Felknor, the safety climate is composed of management commitment to safety, support of co-workers, supervisors for safe work practices, and freedom to report safety violations at work (Felknor, 1997).

Numerous studies related to safety climate have been conducted among healthcare organizations in Costa Rica, America, Italy, Albania, Japan, Denmark and China, however, most of them are not related to the physical workload area. The results were varied regardless of whether they used the same measurement or not (Felknor, Aday, Burau, Delclos, & Kapadia, 2000; Gabrani, Hoxha, Simaku, & Gabrani, 2015; Kawano, Taniwaki, Ogata, Sakamoto, & Yokoyama, 2014; Kristensen et al., 2016; Lee, Faucett, Gillen, & Krause, 2013; Nguyen, Gambashidze, Ilyas, & Pascu, 2015; Xiao, 2015). Furthermore, research studies on physical workload among nurses in China has not been found. Therefore, little is known whether there is a relationship between physical workload and safety climate among nurses in Chengdu.

Chengdu is the capital city of Sichuan province in the People's Republic of China. As there are no practical nurses or helpers in the Chinese healthcare system, nurses are responsible for both nursing and non-nursing tasks, such as giving injections, changing dressings, and doing clerical work (Medical Education Network, 2014). In addition, nurses at university hospitals are responsible for teaching and training student nurses, increasing the physical demands of nurses. Moreover, Chinese nurses are suffering from low physical well-being (Tu, Zhang, & Li, 2012). Because of a lack of research studies related to the safety climate and physical workload in China, it is necessary to conduct a study to explore the safety climate, physical workload and the relationship between them among nurses in Chengdu University hospitals

in the People's Republic of China. The results of this study are expected to provide the basic knowledge of the safety climate and physical workload and can be used as the baseline data for future research in nursing and for health-care organizations in the People's Republic of China.

Objectives

This study aimed to explore the safety climate, physical workload, and the relationship between safety climate and physical workload among nurses in Chengdu University hospitals in the People's Republic of China.

Conceptual Framework

This study explored safety climate which refers to perception of workplace safety by nurses based on the safety climate model by Felknor (1997), which included: 1) management commitment to safety, 2) support of co-workers, 3) supervisors for safety work practices, and 4) freedom to report safety violations at work. The study also explored physical workload which refers to the musculoskeletal load to the lower lumbar spine due to body posture and strenuous effort during nursing work based on the model by Hollmann et al. (1999) which included: 1) trunk, 2) arms, 3) legs, 4) weight, lifted/carried with upright trunk, and 5) weight, lifted/carried with inclined trunk. Nurses who perceived an organizational concern for safety are more likely to work cautiously and follow standards of work safety reducing the physical workload. Therefore, the relationship between safety climate and physical workload was examined.

Methodology

This was a descriptive correlational study conducted among nurses in three Chengdu University hospitals in the People's Republic of China including the Affiliated Hospital of Chengdu University of Traditional Chinese Medicine (AHCUTCM), the First Affiliated Hospital of Chengdu Medical College (FAHCMC), and the Affiliated Hospital of Chengdu University (AHCU).

Population and Sample

The sample in this study included nurses who hold a diploma or higher degree, with a nursing license, and provide direct care for patients in the three Chengdu University hospitals mentioned above. The sample size, calculated by Yamane's (1973) formula, was 342. To counter possible sample loss, 10% of the sample size was added (Burns & Grove, 2005). Therefore, the total sample size of this study was 377 nurses. Proportional stratified random sampling was used for sample selection from the list of nurses in each department of the three university hospitals.

Research instruments

The instruments used in the study was a questionnaire consisting of three parts: 1) the demographic data form developed by the researcher, which was a checklist and included open-ended questions including hospital, department, gender, age, educational level, number of working years, professional title, and mechanical equipment availability; 2) the Index of Physical Workload (IPWL) developed by Hollmann et al. (1999). The IPWL consisted of 19 items that measured the working postures with a five-point scale (0 = never; 4 = very often),

a special formula was used to calculate the total score, with higher scores indicating higher physical workload; and 3) the Safety Climate Measure (SCM) by Felkner (1997). The SCM consisted of 11 items that measured the commitment of management to safety; support of co-workers, supervisors for safety work practices; and the freedom to report safety violations at work. Responses were given using a 5-point Likert scale, (1 = never to 5 = always) with higher scores indicating higher safety climate. IPWL and SCM were translated from English into Chinese by the researcher without any modifications through the translation and back-translation methods (Waltz, Strickland, Lenz, & Waltz, 2005).

The reliability of the instrument was tested with ten nurses selected using similar inclusion criteria as the sample. These nurses were excluded from the sample of this study. For SCM, the Cronbach's alpha was .82, and the test-retest reliability of IPWL was .97.

Ethical Considerations

The study was approved by the Research Ethics Committee of the Faculty of Nursing, Chiang Mai University, Thailand (certificate of ethical clearance (IRB) number 021/2018). Permission for data collection was obtained from the directors of the nursing departments of the three hospitals. To protect human rights, all participants were informed both verbally and in writing. Their identities were not disclosed on returned questionnaires, research reports and/or publications of the study.

Data collection

A questionnaire package was used to collect data. Each package included an information sheet for the study participant, a volunteer research agreement form, a set of questionnaires consisting of three parts, and an envelope. The researcher asked two coordinators from the nursing department of AHCUTCM and FAHCMC to distribute the questionnaires. The researcher was responsible for the questionnaire distribution and collection at AHCU. The researcher and research coordinators distributed the questionnaire package to the participants who were then asked to complete and return the questionnaire in a sealed envelope within two weeks. Participants returned the questionnaires to a locked box provided by the nursing department of each hospital. A total of 377 questionnaires were distributed with a return rate of 88.86% (n = 335). In total, 304 (80.64%) completed questionnaires were used for the data analysis.

Data Analysis

The Statistical Package for Statistical Software (SPSS) program and descriptive statistics were used for data analysis. The significant level was set at 0.01 in this study. Descriptive

statistics such as frequency, percentage, mean, and standard deviation were used to analyze the demographic data. Pearson's Correlation was used to analyze the relationship between safety climate and physical workload since data were normal distributed.

Results

1. Among the 304 nurses, most (97.37%) were female. The majority were between 20 to 30 years old (70.72%). About half of the participants had 1 to 5 years of work experience. A little more than half (56.91%) held a bachelor's degree. Regarding professional title, the largest proportion were senior nurses (50.99%). Among the 304 subjects, 61.18% reported that their departments did not have any mechanical equipment.

2. The overall mean score of safety climate is 3.44 (SD = 0.66) (see Table 1). The overall mean score of physical workload is 27.78 (SD= 10.28) (Table 1).

3. There was a moderate negative relationship between safety climate and physical workload among nurses ($r = -.32$, $p = <.001$) (Table 2).

Table 1 Mean, standard deviation and range of safety climate and physical workload of participants (n = 304)

	Mean	SD	Range
Overall Safety Climate	3.44	0.66	1-5
Overall Physical Workload	27.78	10.25	5.28-56.17

Table 2 Pearson's Correlation coefficient between safety climate and physical workload (n = 304)

Safety Climate Overall Safety Climate	Overall Physical Workload	
	r	p
	-.32	<.001

Discussions

1. Safety climate

The overall mean score of the safety climate of nurses working in university hospitals in Chengdu was 3.44 (SD = 0.66) (Table 1). This score was higher than the results of the study in Costa Rica conducted by Felknor et al. among hospital employees (\bar{X} = 2.84, SD = 0.94) (Felknor et al., 2000). The explanation of the difference between the two studies could be explained in the following way.

Firstly, according to Felknor (1997), the work environment can affect the safety climate of employees in healthcare organizations (p = 0.0032). In China, there is a Bylaw for Chinese Nurses, which was launched ten years ago. This requires that government and health-care organizations should ensure nurses' welfare; guarantee nurses' physical and psychological health; and provide a safe, clean, and tidy workplace (Nurse Bylaw, 2008). Hospitals and healthcare organizations must follow this bylaw, by implementing the above measures. These measures will increase the nurses' perceived organization and management committee to safety; increase the awareness of the importance of safety; and provide a safe and comfortable workplace for the nurses, thereby, increasing the safety climate.

Secondly, Felknor (1997) reported that the administrative controls have a statistically

significant relationship with the safety climate. In China, head nurses are responsible for ensuring the quality of nursing services and are role models for other nurses. Therefore, they inspect nursing work every day. Also, in order to ensure that nursing care is delivered accurately and appropriately, head nurses will offer suggestions and support to the other nurses to help them perform their nursing care, encourage safe work behavior, and correct unsafe and incorrect behavior or procedures (Anonymous, personal communication, March 16, 2018). Therefore, supervision for safe work practices is enhanced, and nurses' general awareness of safety is also improved. Thus, the overall safety climate is increased.

Thirdly, the Responsibility System Based Holistic Nursing (RSBHN) is required by the healthcare government department. The RSBHN is widely applied in healthcare organizations in China (Wang, Liu, Zhao, & Liu, 2016). In this system, the nurse unit group is based on seniority, capacity, and professional title. New nurses are normally led and guided by the senior nurses of the group. They work together and nurses can get help from their group members, senior nurses or supervisors if needed (Ye et al., 2012). This system reassures nurses when they are working. Another major advantage of the system is that they can receive support from co-workers so nurses feel safe in their workplace, hence,

increasing the safety climate.

Training is another factor that can also affect the safety climate of health-care employees ($p = 0.0000$) (Felkner, 1997). In China, all currently practicing nurses have been educated for many years at school for the standard nursing operation procedures (Yang & Liang, 2008). Every nursing student must take a licensing examination and operation tests before she or he is permitted to perform any nursing work. Therefore, all nurses now practicing in China are well educated and trained on the safety-related requirements related to the nursing care procedures (Health Department of Guangdong Province, 2007). Moreover, nurses who work in university hospitals have to follow even stricter requirements than ordinary hospitals, and must also be more careful about their nursing behaviors, since they are role models for the nursing students. In this situation, nurses are then more likely to pay more attention to safety in their daily work. This attention, in turn, is likely to serve to increase the safety climate.

According to the results of this present study, it is notable that nurses scored the lowest on Item 11 ($\bar{X} = 2.60$, $SD = 1.21$), which is “Feel free to report safety violations.” This means that the nurses feel uncomfortable or pressure when they have to report safety violations. One reasonable explanation for this response is they may worry about the consequences after reporting. According to the literature review, speaking up is perceived to be a risky behavior that challenges the status quo. When people face the possibility of negative consequences, those individuals will

often avoid sharing their concerns due to fear or self-defense (Dedahanov & Rhee, 2015). At the three targeted university hospitals, due to the RSBHN system, the nurses in each unit are normally required to work together as a group. If one nurse reports any safety violations to the head nurse, they may be punished for that the violation. However, the nurse who reported the violation will still need to work with the victim, which may deteriorate the relationship between them. The worry of offending co-workers is, therefore, normally likely to report violations which make them feel pressure.

2. Physical Workload

The results of this study showed that the overall mean score of physical workload was 27.78 ($SD = 10.25$) (Table 1). This was higher than the results of a study conducted in Denmark among female eldercare service workers ($\bar{X} = 17.3$, $SD = 9.5$) (Clausen et al., 2013). However, the results in this study were lower than the results in the study conducted among nurses in California ($\bar{X} = 35.0$, $SD = 13.3$) (Chin et al., 2016).

The differences in the results between the Danish study and the current study can be explained in the following ways. In the hospital where the current Chengdu study was conducted, patients tend to have more serious health conditions than people in eldercare services. The patients were more dependent on the nurses. Therefore, the nurses in the Chengdu hospital have to take full responsibility for delivery of nursing care treatments. In the case of patients in a coma, and patients with physical limitations, nurses need to help them

turn over regularly to avoid bed sores. This kind of situation is highly likely to increase the physical energy of nurses, thus, also increasing their physical workload.

The availability of mechanical equipment can also affect the physical workload of nurses. According to a study by Lee et al (2013), nurses in units providing patient lifting equipment had a lower physical workload than those without this equipment ($p = 0.045$) (Lee et al., 2013). In this study, only 26.3% ($n = 80$) of the participants said that mechanical equipment was available in their department. On the other hand, 61.2% ($n = 186$) reported none, and 12.5% ($n = 38$) reported do not know, which means at least 73.68% ($n = 224$) of the nurses do not use mechanical equipment in their daily work.

Another significant finding revealed that older nurses had a significantly lower physical workload than younger nurses ($p < 0.001$) (Jørgensen, Nabe-Nielsen, Clausen, & Holtermann, 2013). The mean age of the sample in this study was 29 ($SD = 5.46$), which is much younger than the mean age in the study conducted in Denmark ($\bar{X} = 46.3$, $SD = 9.1$) (Clausen et al., 2013). The possible reason for this difference is that the older nurses are likely to be given different assignments due to their extensive experience and management knowledge. They are much more likely to take responsibility for paperwork and management, instead of the actual delivery of nursing care. This is likely to explain why the physical workload index in this study was higher than in the study conducted with a sample of female workers in eldercare services.

In China, due to the nurse qualification examination measures, nursing students need to practice in a hospital for at least eight months, before they can get permission to take the Nurse Licensing Examination (Ministry of Public Health of China & Ministry of Human Resources and Social Security of China, 2010). During this practice period, most nursing students choose university hospitals, where they can get better educational and practical experience. During the practice period, nursing students will be assigned to a qualified, licensed nurse, who will be their supervisor. The student will practice non-invasive nursing care under their supervision, such as patient turn over, morning nursing care, and measurement of patients' vital signs. (Anonymous, personal communication, March 16, 2018). Most of the practical activities done by the nursing students involve physical work, so their help is likely to reduce the physical efforts expended by the regular nurses. Thus, the help of student nurses can decrease the physical workload of nurses.

Another significant observation regarding the physical workload of nurses is that those working in university hospitals are also responsible for teaching. Thus, they must be role models for the students. These university hospitals also have higher standards than ordinary hospitals in China. Thus, the nurses in university hospitals are generally more likely to follow standard operating procedures. They are also more likely to be aware of safety practices, and to maintain better behavior in their daily work, thereby decreasing their physical workload. This is likely to explain why the physical workload in

this present study in China was lower than that in the previous study conducted in the USA.

3. Relationship between safety climate and physical workload

There was a moderate negative relationship between safety climate and physical workload ($r = -.32, p = <.001$) (Table 2). This is in support of the results of the study conducted by Lee and Lee (2017a), which stated that better safety climate is linked to lower physical workload, and that safety climate would influence employee's physical workload.

The findings in this present study in China were that the higher the safety climate, as perceived by the nurses, the lower the physical workload the nurses normally have. This is similar to the results of two previous studies which used different instruments. For example, the study conducted by Lee et al. (2010) showed that safety climate was negatively correlated with physical workload among 361 critical care nurses in the USA ($r = -.16, p < .01$). Also, another, subsequent study done by Lee and Lee (2017a) showed that the perception of safety climate was negatively related to physical workload ($p < .01$) among 280 California Registered Nurses.

A reasonable explanation for that is having a good safety climate is likely to positively affect the nurses' daily work activities and behavior (Ameko, 2015; Wills et al., 2004). When nurses perceive a high degree of safety in their workplace and are also aware of the importance of safety in their work, they will be more likely to care about the safety of their practices and procedures, behavioral patterns,

and postures. Then, when they practice the correct, natural, and appropriate behavior forms and postures, the musculoskeletal load to the lower lumbar spine will be decreased, thus, reducing the physical workload (Arvidsson et al., 2012; Hollmann et al., 1999; Karpansalo et al., 2002).

Conclusions and Implications

The results of this study provided basic information for hospitals and nursing administrators regarding the safety climate and physical workload. On this basis, 1) nursing administrators should keep the safety policies to maintain a safety climate; 2) strategies should be developed to encourage nurses to report safety violations in hospitals to improve the safety climate; 3) nurses' health should be the first priority in the policy formulation; and 4) nursing administrators should develop strategies or interventions to reduce the physical workload among nurses, such as redesign the working process, provide assistant equipment to reduce the unnecessary walking or moving.

Recommendations

Further study should be conducted at different departments as well as hospitals of different levels among nurses in the People's Republic of China. Other factors related to physical workload should be identified and examined to extend the knowledge for developing interventions to reduce the physical workload.

Acknowledgement

The researcher would like to sincerely thank the Affiliated Hospitals of Chengdu Uni-

versity for supporting me to continue my master's degree program at Chiang Mai University.

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