A Model of Safety Performance in Perioperative Registered Nurses

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ABSTRACT

Background: Health care in the 21st century places a greater emphasis on the quality of care. Safety climate data can serve as a benchmark for hospitals to gauge their safety performance in advancing patient safety.

Objective: To propose and test a model of safety performance in perioperative registered nurses.

Methods: The Workplace Health and Safety questionnaire and the Personal Strain questionnaire were administered to 240 perioperative registered nurses who work at seven university hospitals in Thailand. A path analysis using the Analysis of Moment Structures program version 7.0 was employed to test the hypothesized model relating safety climate, safety knowledge, safety motivation, personal strain and safety performance which is differentiated between the two types of safety performance; safety compliance and safety participation.

Results: The results in this study confirmed the research model, in that the safety climate had a direct positive effect on safety knowledge and safety motivation, and had a direct negative effect on personal strain. Safety knowledge, safety motivation, and personal strain mediated the link between safety climate and safety compliance. Furthermore, safety motivation and personal strain also mediated the link between safety climate and safety participation.

Conclusion: Health care managers can use the resulting data to design effective safety management systems and identify areas for improvement. Designing effective nursing management tools to enhance safety climate, safety knowledge, and safety motivation and to reduce personal strain should be further developed.

Keywords: Safety climate, safety performance, personal strain, perioperative registered nurses

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Health care in the 21st century focuses on the quality of care. Health care policy makers around the world are making patient safety a priority. The Institute of Medicine estimated that between 44,000 to 98,000 deaths occur annually as a result of medical errors including medication errors, surgical mistakes, and surgical complications. As in many countries, safety has always been a major issue and often a problem in the Thai health care organization. The most common parameter affecting patient safety was related to surgical issues, found in thirty percent of these cases.

The Association of Perioperative Registered Nurses (AORN) supports comprehensive approaches in each health care delivery system to ensure patient’s safety while providing quality care. The safety of patients undergoing operative or other invasive procedures is a primary responsibility of the perioperative registered nurse. Perioperative registered nurses play key roles in these successes by implementing and following safety guidelines.

Recently most medical personnel have increased their interest in the use of safety climate surveys to assess safety performance. Safety climate data can serve as a benchmark for hospitals to gauge their safety performance for advancing their patient safety agenda. In seeking to understand patient safety, research which examines predictors of safety performance can contribute to the understanding of patient safety.

Safety climate

A climate for safety was first described by Zohar in his study of industrial safety practices. Drawing on the psychology literature, defined climate as "a summary of molar perceptions that employees share
about their work environments”. Griffin and Neal argued perceptions of the policies, procedures, and practices related to safety, comprise the safety climate. DeJoy DM, et al., defined safety climate as employee perceptions of the importance of safety in their organization. Thus, safety climate can be defined as the shared set of perceptions by employees of the policies, procedures, practices, and rewards relating to safety issues. The safety climate reflects the extent to which employees believe that safety is valued within the organization. Safety climate is a specific form of organizational climate, which describes individual perceptions of the value of safety in the work environment. These factors include: management values, management and organizational practices, communication, and employee involvement in workplace safety.

In this research, safety climate is defined as the shared set of perceptions by employees of the policies, procedures, practices, and rewards relating to safety issues. Safety climate reflects the extent to which employees believe that safety is valued within the organization. The perceptions arise from the following: interactions with peers, supervisors, and other healthcare providers; formal institutional policies and procedures.

Safety performance

Individual job performance has been defined as “behaviors enacted by an employee that are aimed at meeting organizational goals”. Performance, in this context, includes only those actions or behaviors that are relevant to the organization’s goals and can be scaled in terms of each individual’s proficiency. Neal A and Griffin MA differentiate between two types of safety behavior: safety compliance and safety participation. Safety compliance is defined as, “adhering to safety procedures and carrying out work in a safe manner”. Safety participation is defined as “helping coworkers, promoting a safety program within the workplace, demonstrating initiative, and putting effort into improving safety in the workplace”. The current study focuses on the actions or behaviors that individuals exhibit in their work tasks to promote the health and safety of workers, clients, the public, and the environment. This includes safety compliance and safety participation.

Personal strain

The cost of stress is experienced at both the individual, (as by the discussion on physical and personal strain symptoms) and corporate level (by reductions in productivity and on-the-job performance). Individual job performance improves with increased levels of stress, up to a certain limit. At some point, stress becomes dysfunctional and reduced performance is experienced. Both too much, and too little stress has had a detrimental effect on performance. Although some degree of stress is beneficial to performance, excessive stress induces role strain that results in lower job performance.

A model of safety performance

The theoretical framework for this study was derived from the performance theory based on work by Campbell JP, et al. The model which described the relationship between safety climate and safety performance was based on the work by Griffin MA and Neal A. There are three parts to the Griffin MA and Neal A framework; the antecedents of performance, the determinants of performance and the components of performance. They differentiate between two types of safety performance: safety compliance and safety participation. The term safety compliance is the term used to describe the core activities that are necessary for maintaining workplace safety. The term safety participation is used to describe behaviors that do not directly contribute to an individual’s personal safety, but which do help to develop an environment that supports safety. These behaviors include activities such as participating in voluntary safety activities, helping coworkers with safety-related issues, and attending safety meetings.

According to this framework, safety compliance and safety participation are a function of three major types of determinants; knowledge, skill, and motivation. Based on this theory, individuals should be motivated to participate in safety activities and have knowledge about safety procedures if they perceive a positive safety climate. General safety climate, therefore, is classified as antecedents of safety performance. A key element of a positive safety climate is related to staff’s perceptions of management’s safety values and commitment to safety. Therefore, a positive safety climate will promote safety participation through employees’ reciprocation of perceived management safety values.

Based on the work of Siu OL, Phillips DR, and Leung TW, they studied the relationships between safety climate, psychological strain, and safety performance among 374 construction workers in Hong Kong. The results showed that safety climate, psychological strains, and safety performance were related. Furthermore, psychological distress was found to be a mediator of the relationship between safety climate and safety performance. To summarize, the key assumptions are from the Griffin and Neal (2000) models and the work of Siu OL, Phillips DR, and Leung TW (2004). Fig 1 depicts the hypothesized model in this study.

Research objectives

The purposes of the present study were to propose and test a model of safety performance in perioperative registered nurses.

MATERIALS AND METHODS

A cross-sectional design was employed to answer the research questions. After receiving approval from the Christian University of Thailand Review Board and the Ethical Committee of university hospitals, the questionnaires were mailed to a proportional random sample of 240 (35%) perioperative registered nurses who worked at 7 university hospitals in Thailand from May to September 2008.

Research instruments

The instruments used were three self-report surveys: 1) the Personal Data Form, 2) the Workplace Health and Safety Questionnaire, and 3) the Personal Strain Questionnaire. Permission was granted for use of these surveys in this study by their developers. The Workplace Health and Safety Questionnaire consisted of 42 items which assessed perioperative registered nurses perceptions of safety climate, safety knowledge, safety motivation, and safety performance in...
their departments and facilities. These were measured on a five-point Likert scale that ranged from strongly disagree (1) to strongly agree (5). The Personal Strain Questionnaire consisted of 40 items which assessed perioperative registered nurses strain in four dimensions, which included vocational strain, psychological strain, interpersonal strain, and physical strain. These were measured on a five-point Likert scale that ranged from rarely or never (1) to most of the time (5). Both instruments were translated into Thai, using a back-translation method. Content validity was established by review of six experts. The alpha coefficient of the Personal Strain Questionnaire was .87 and the alpha coefficient for each dimension of the Workplace Health and Safety Questionnaire was .88 for safety climate, .78 for safety knowledge, .88 for safety motivation, .81 for safety compliance, and .86 for safety participation.

Analysis

Descriptive statistics were used to characterize the respondents. Bivariate associations among the variables in the study were tested using Pearson product-moment correlation coefficients. The causal relationships, which were proposed in the model, were tested by the Analysis of Moment Structures program version 7.0.\(^1&8\)

**RESULTS**

From May to September 2008, 224 perioperative registered nurses (93.33%) responded to the previously described mailed questionnaires. The subjects in this study represented a cross-section of perioperative registered nurses in the university hospitals of Thailand. Table 1 depicted the demographic characteristics of the respondents. The majority were female (98.21%), educated with a Bachelor’s Degree in 86.16%. The most frequent age range was from 20-30 years old (34.38%), followed by 31-40 years old (32.59%). The majority of survey respondents (24.11%) had a work experience of 6-10 years with their current employer.

Correlations

Table 2 depicted the descriptive statistics of the variables in this study. As specified by the model, the correlations among the variables were all significant at the p <0.01 and p <0.001.

Model testing

We conducted a path analysis using the Analysis of Moment Structures program to test the hypotheses and the goodness of fit of the hypothesized model relating safety climate, safety knowledge, safety motivation, personal strain, safety compliance, and safety participation as depicted in Fig 1. All model fit statistics confirmed that the hypothesized structural equation model was fit with the structural equation model derived from the empirical data \[\chi^2(51) = 58.076, \text{ p >0.05}, \text{ Root Mean Square Error of Approximation (RMSEA) = 0.025, Comparative Fit Index (CFI) = 0.996, Normed Fit Index (NFI) = 0.996, Goodness of Fit Index (GFI) = 0.962, Tucker-Lewis Index (TLI) = 0.993}\]. The parameter estimates in the hypothesized model revealed that the safety climate had a direct positive effect on safety knowledge and safety motivation (\(\beta = 0.88, \text{ p <0.001}\) and \(\beta = 0.46, \text{ p <0.001}\), respectively). Safety climate had a direct negative effect on personal strain (\(\beta = -0.27, \text{ p <0.001}\)). Safety motivation had a direct positive effect on safety compliance and safety participation (\(\beta = 0.16, \text{ p <0.01}\) and \(\beta = 0.95, \text{ p <0.001}\), respectively). Personal strain had a direct positive effect on safety compliance (\(\beta = 0.74, \text{ p <0.05}\)) and had a direct negative effect on safety participation (\(\beta = -0.11, \text{ p <0.05}\)). In contrast, safety knowledge had only a direct effect on safety compliance (\(\beta = 0.94, \text{ p <0.001}\)). The path from safety knowledge to safety participation was not statistically significant. The results of this study supported the hypothesis in the proposed model that safety climate had an indirect effect on safety compliance by affecting safety knowledge, safety motivation, and personal strain. However, safety motivation and personal strain only mediated the link between safety climate and safety participation. The model accounted for 29% of the variance in safety compliance, 30% of the variance in safety participation, and a substantial proportion of the variance of the mediating variables. The path coefficients for this model are presented in Fig 2.

**TABLE 1.** Demographic characteristics of the respondents.

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
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<tr>
<td>Female</td>
<td>220</td>
<td>98.21</td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>1.79</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>77</td>
<td>34.38</td>
</tr>
<tr>
<td>31-40</td>
<td>73</td>
<td>32.59</td>
</tr>
<tr>
<td>41-50</td>
<td>58</td>
<td>25.89</td>
</tr>
<tr>
<td>&lt;50</td>
<td>16</td>
<td>7.14</td>
</tr>
<tr>
<td>Status</td>
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<td></td>
</tr>
<tr>
<td>Single</td>
<td>137</td>
<td>61.16</td>
</tr>
<tr>
<td>Couple</td>
<td>80</td>
<td>35.71</td>
</tr>
<tr>
<td>Divorce/widow/separate</td>
<td>7</td>
<td>3.13</td>
</tr>
<tr>
<td>Education</td>
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<td></td>
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<tr>
<td>Bachelor’s Degree</td>
<td>193</td>
<td>86.16</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>31</td>
<td>13.84</td>
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<tr>
<td>Experience (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>52</td>
<td>23.21</td>
</tr>
<tr>
<td>6-10</td>
<td>54</td>
<td>24.11</td>
</tr>
<tr>
<td>11-15</td>
<td>39</td>
<td>17.41</td>
</tr>
<tr>
<td>16-20</td>
<td>34</td>
<td>15.18</td>
</tr>
<tr>
<td>&lt;20</td>
<td>45</td>
<td>20.09</td>
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</tbody>
</table>

**TABLE 2.** Descriptive statistics and correlation matrix of the variables in the study.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety climate</td>
<td>65.686</td>
<td>11.902</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety knowledge</td>
<td>14.973</td>
<td>2.379</td>
<td>0.667***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety motivation</td>
<td>47.576</td>
<td>7.201</td>
<td>0.369***</td>
<td>0.494***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal strain</td>
<td>51.179</td>
<td>6.562</td>
<td>-0.245***</td>
<td>-0.220**</td>
<td>-0.074</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety compliance</td>
<td>15.482</td>
<td>2.543</td>
<td>0.555***</td>
<td>0.627***</td>
<td>0.519***</td>
<td>-0.253***</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Safety participation</td>
<td>15.563</td>
<td>2.423</td>
<td>0.444***</td>
<td>0.490***</td>
<td>0.657***</td>
<td>-0.183**</td>
<td>0.625***</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**Note:** ** p <0.01, *** p <0.001
DISCUSSION

It is evident from Fig 2 that the overall model has an acceptable fit to the data except for the coefficients from safety knowledge to safety participation which is a weak association. The results of the structural equation modeling revealed that most of the study results supported the validity of the theoretical propositions of the established model based on performance theory. In line with many studies conducted in Western countries and industrial organizations, the results of the recent study show that safety climate predicts safety performance. The consistency of the findings within prior researches and the current study lends support to the elements of Griffin and Neal’s framework which described the relationship between the antecedent of performance (safety climate) and the determinants of performance (safety knowledge and safety motivation). This study also lends support to the study of Siu OL and colleagues that described the relationship between safety climate, personal strain, and safety performance. We should be able to assess perioperative registered nurses’ perceptions to predict safety performance, so that proactive actions can be taken.

However, unlike previous studies, we found that the relationship between safety knowledge and safety participation was not significant. This result suggested that safety knowledge only partially mediated the link between safety climate and safety performance.

Past research and the results of the current study has provided conflicting evidence for this part of Griffin and Neal’s framework. For instance, Neal, Griffin and Hart found that this relationship was supported. Similarly, in the first model within Griffin and Neal’s study the relationship between knowledge and compliance was significant, yet the relationship between knowledge and safety participation was not significant. In contrast the second study of Griffin and Neal’s found the opposite relationship. The relationship between safety knowledge and safety participation was found to be stronger than that between safety knowledge and safety compliance. This implied that safety compliance was predominantly a function of cognitive ability and safety participation was predominantly a function of personality. One explanation for these findings may be that, individuals who have received safety-related training and understand organizational safety incentive systems are expected to adhere to proper safety protocol more frequently than individuals who have less normative knowledge.

Safety knowledge and safety motivation may have interactive effects, suggesting that persons who have high levels of safety knowledge will also have more safety motivation, resulting in a largely positive effect on safety performance. Clarification of the mediation role of the determinants of performance is important. Neal, Griffin and Hart highlighted that if the framework is correct, then this had implications for the management of safety. If improvements in safety climate are to have any impact on safety performance then they must first produce changes in knowledge or employee motivation. This aspect requires further investigation.

This finding would endorse the literature that personal strain was a mediating factor between safety climate and safety performance. It appeared that perioperative registered nurses who perceived a negative safety climate in their workplace would feel distressed. This study demonstrated the importance of the negative impact of strain. Interestingly, there was a significant negative relationship between personal strain and the safety performance variable, safety participation. The implications of this model were such that, when people did not perceive stress, they became involved in safety. In the context of this research model, it appeared that unless individuals felt some degree of strain associated with their work, they did not perceive safety to be important. The importance of these factors was based within the theory of social exchange, which has increasingly been incorporated into safety research. When people perceive that their personal safety and well being is of concern to management, they will reciprocate this commitment by aspiring to perform at the highest standards to benefit the organization. Hofmann and Stelzer stated that if the respondents in the study have perceived work pressure from quality performance, they would focus their attention more on completing the work in hand and less on safety. It was possible that when the respondents perceived a good safety climate at work, they then perceived pressure for good performance. However, there was a significant positive relationship between personal strain and safety compliance. The literature would also suggest that individual performance improved with increased levels of stress, up to certain limits. After a point, stress became dysfunctional and reduced performance. This was
evidenced in the Yerkes-Dodson model of the effect of anxiety on performance. Both too much and too little stress had a detrimental effect on performance.

CONCLUSION

The results of the current study contribute to the body of work examining the impact of safety climate factors on perioperative registered nurses' performance. This study found that safety knowledge, safety motivation, and personal strain mediated the relationship between safety climate and safety performance in perioperative registered nurses. The model derived from the present study is somewhat different from the previous causation models. Future research could further clarify the nature of the relationship between safety knowledge and safety participation. Additional research should also investigate other variables that affect safety performance such as organizational climate and leadership style. Recognition of the factors surrounding the safety climate may assist nursing administrators in their activities of providing appropriate care and conserving valuable resources. Health care managers can use the resulting data to design effective safety management and identify areas for improvement. Finally, it focuses on a topic of significant importance to the delivery of safe, high-quality health care in hospitals.

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