The Effects of Contextual and Structural Factors on Patient Safety in Nursing Units

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ABSTRACT

Background: Because of limited research on patient safety from a macrolevel perspective, our understanding of how to reduce the risk of system failures that impact patient safety outcomes in Taiwanese healthcare organizations is limited.

Purpose: We conducted this study to explore the relationships between macrolevel factors and patient safety outcomes.

Methods: Structural contingency theory was used as the framework for the study. A cross-sectional design was used, and data were collected from self-administered questionnaires. Head nurses and registered nurses working in 64 in-patient nursing units at three hospitals participated in the study. A tailored design method was used for data collation, and the data collection lasted 3 weeks during the winter of 2010. Data were aggregated from the individual to the unit level, and path analysis was used to examine the hypothesized model.

Results: Sixty-two head nurses (96.8%) and 977 staff nurses (72%) completed and returned the questionnaire. Eta-squared coefficient ($\eta^2$), interitem consistency ($r_{wg}$), and F ratio results showed that data at the individual level are appropriate for aggregating to the unit level. These findings show that nursing units with high degrees of professional autonomy, comparatively higher proportions of nursing experts, and relatively large unit sizes tend to have higher rates of medication errors. In addition, we found high degrees of unit technology associated with higher rates of medication errors and patient falls.

Conclusions/Implications for Practice: These findings suggest a link between macrolevel factors and patient safety outcomes. This study shows that redesigning continuing education programs encourages nurses to participate in patient safety training and understand the nursing unit characteristics that enhance patient safety outcomes to improve the patient safety of nursing units.

KEY WORDS:
patient safety, structural contingency theory, medication errors, patient falls, tailored design method.

Introduction

Patient safety has long been a major challenge for the healthcare system. To improve patient safety in healthcare systems, scholars have attempted to determine the factors that are critical to patient safety by investigating three levels: individual (the micro level), group/team (the meso level), and organization (the macrolevel; Ferlie & Shortell, 2001; Mick & Mark, 2005). Microlevel factors address healthcare providers’ physiological and cognitive problems. Meso-level factors involve group or team dynamics related to organizational behaviors such as communication and team integration. Macrolevel factors include technology, environment, and size, all of which affect structural adaptations (Ferlie & Shortell, 2001; Mick & Mark, 2005). Few studies have investigated the effects of macrolevel factors on patient safety (Hoff, Jameson, Hannan, & Flink, 2004; Mick & Mark, 2005). This gap in the literature prevents healthcare organizations from identifying the organizational dynamics that affect patient safety. To fill this knowledge gap, we used structural contingency theory (SCT), an organizational theory, as our framework to identify the organizational factors involved in patient safety improvement. The purpose of this study is to explore the organizational factors affecting patient safety outcomes from a macrolevel perspective.

Literature Review

Conceptual framework

The SCT was used as the conceptual framework for this study. The components of SCT include organizational context, structure, and performance. The organizational context consists of two parts: technology and environment. The central theme of SCT is that organizational performance depends on the organizational structure’s degree of adaptation to its context. SCT thus proposes no standard structure or standard procedure for an organization to follow in determining its own structure. Instead, an organization should adopt the
most appropriate organizational structure and managerial method based on the involved context (Donaldson, 1995; Leatt & Schneck, 1981).

This study assumes nursing units to be complete. Therefore, the organizational context includes aspects that affect nursing unit operations, including unit technology and nursing unit characteristics such as skill mix, nursing experts, unit size, and type of unit (Mark et al., 2008; Mark, Salyer, & Wan, 2003). Many managerial studies have categorized organizational structures into two types: mechanistic and organic (Daft, 2009; Liaw, Fan, & Sheu, 2001). These two include the subsets of centralization, formalization, standardization, specialization, and complexity (Zinn & Mor, 1998). Centralization and formalization are the dimensions that organizational theorists commonly use to describe organizational structures (Liaw et al., 2001), whereas autonomy and participation in decision making (PDM) are the major factors used to measure the degree of centralization.

Organizational performance in hospitals generally consists of two aspects: employee-oriented and customer-oriented. Because the focus of this study was on the patient safety aspect of customer-oriented performance, we used the rates of medication errors and patient falls, which are the most common indicators of patient safety, to present the measurement outcomes. Figure 1 shows the framework for applying SCT to nursing.

**Unit technology**

Relatively few nursing studies have discussed unit technology. In developing a technology instrument, Overton, Schneck, and Hazlett (1977) concluded that technology in nursing constitutes the tasks that nurses must accomplish, the characteristics of which are variability, instability, and uncertainty. Instability and uncertainty related to unit technology are the most crucial variables associated with skill mix variance in a nursing subunit (Leatt & Schneck, 1982). Mark et al. (2003) proposed that technology is sometimes viewed as a proxy for patient acuity. Patients in intensive care units (ICUs) have a higher degree of patient acuity than those in general units (Zinn, Brannon, Mor, & Barry, 2003), and patient acuity is a predictor of the need for skill mix in nursing units (Hall, Doran, & Pink, 2004).

Unit technology is also a contextual variable that affects the practice structure. For example, when patient conditions become more complex or unanticipated events occur, nurses require some autonomy to make clinical decisions to execute actions rapidly to manage crises and make accurate prioritization decisions. Leatt and Schneck (1982) determined a correlation ($r = -0.23, p < 0.01$) between technological uncertainty and role specificity as a measure of formalization in 157 nursing units. Leatt and Schneck and Alexander and Bauerschmidt (1987) found that a high quality of care occurs when technology relates negatively to vertical PDM and formalization.

**Nursing unit characteristics**

The characteristics of a nursing unit include skill mix, nursing experts, unit size, and type of unit. Nursing skill mix refers to the proportion of registered nurses on staff in the unit (Aiken, Smith, & Lake, 1994; Burns & Stalker, 1994). Patient care requires skilled and knowledgeable nurses to collect information, exercise judgment, and make decisions to minimize risk and occasionally prevent catastrophes. Thus, nurses require autonomy and PDM to provide safe care in their unit. Some studies have shown that the RN skill mix in nursing units relates inversely to patient safety indicators such as medication errors, patient falls, and wound infections (Hall et al., 2004; Hughes & Blegen, 2008; Lankshear, Sheldon, & Maynard, 2005).

An expert is a well-trained and educated person who has advanced skills and possesses comprehensive clinical knowledge and experience (Zulkowski, Ayello, & Wexler, 2007). Expert nurses provide higher levels of care quality and safety than nonexpert nurses, because expert nurses are better at recognizing the onset of rapid, unanticipated change. Expert nurses can also synthesize all available information and develop a broad perspective of patient care before making decisions and implementing plans. Thus, a nursing unit with more nursing experts should show safer nursing care because these experts can recognize changes, detect errors, and develop and implement a complete nursing plan. For instance, Tang, Sheu, Yu, Wei, and Chen (2007) found that “new graduate” and “new staff” were the two main reasons for medication errors. Moreover, because expert nurses can anticipate and

![Figure 1](https://example.com/figure1.png)

*Figure 1.* Theoretical model depicting the relationships among technology, nursing unit characteristics, practice structure, and patient safety.
manage change, they require a flexible nursing practice structure in which autonomy and PDM are high and rules and regulations are limited (Scott, 2009).

Unit size is another factor that may affect organizational design, management systems, and performance (Leatt & Schncke, 1982). Scholars have noted that unit size is correlated to the complexity of an organization, particularly with regard to communication because increased information flow is difficult to maintain control (Daft, 2009; Valentin et al., 2009). Managers in large units cannot supervise every employee’s daily activities. Therefore, appropriate decentralization and a low degree of formalization are necessary for employees to set their own goals, respond to unexpected change, make appropriate decisions, and monitor their own performance. Many researchers have discussed the relationships between unit size and patient safety. One survey of nurses in 124 units at 64 general short-term acute care hospitals showed a high rate of patient falls in large nursing units (Mark et al., 2003). On the basis of a study of 113 ICUs in 27 countries, Valentin et al. (2009) found that unit size affects parenteral medication errors.

The type of unit is another major factor affecting the distribution of authority in nursing units. For instance, ICU patients require high-level technical devices such as ventilators for treatment. This increases complexity of care and necessitates increased nurse autonomy and PDM (Blanchfield & Biordi, 1996; Morrison, Beckmann, Durie, Carless, & Gillies, 2001). Relationships between type of unit and both medication errors and patient falls are also apparent. For instance, ICUs have higher rates of medication errors than non-ICUs do because the medication types and frequency of medication use in such units increase opportunities for medication errors (Valentin et al., 2009). Mark et al. (2003) found that unit size has a significantly positive effect on patient falls.

**Practice structure**

Autonomy is generally defined as the degree of authority in making decisions regarding a particular practice. Studies on the effects of autonomy on patient safety are also relatively rare. However, scholars have proposed that hospitals with autonomous work environments enable nurses to provide safer patient care (Kramer & Schmalenberg, 2003; Laschinger, Shamian, & Thomson, 2001). In other words, when nurses perceive that they have autonomy in their work environment, they perceive support, trust, and respect from superiors. This in turn enhances the confidence, communication, cooperation, and shared decision making of nurses and optimizes the coordination of patient care. These factors are all crucial for high-quality, safe, and cost-effective patient care (Laschinger et al., 2001).

PDM indicates the degree of authority that employees have in making administrative decisions regarding their practice. As with the effects of autonomy, few studies have discussed the relationship between PDM and patient safety outcomes. Frontline staff members are in a position to recognize the nature of systems and observe the needs of patients. Therefore, when they are authorized to participate in decision making, they can effectively help their unit meet its needs (McDaniel, 1997). For instance, incorporating nurses’ opinions in the adoption of new technologies such as computerized physician order entry and infusion pumps has been shown to effectively prevent medication errors (Ball, Weaver, & Abbott, 2003).

Formalization refers to the use of formal written documents and instructions such as treatment protocols to ensure desired performance in a practice setting (Hage & Aiken, 1969). Hospital nursing units are dynamic, high-intensity environments with highly skilled nurses who must be encouraged to think and act creatively to create a nonformalized structure. However, nursing unit medication administration procedures and patient fall prevention measures are highly regimented tasks that nurses must perform according to protocols. Goldspiel, DeChristoforo, and Daniels (2000) reported a decrease in the number of chemotherapy-related medication errors after protocol development and computer-system enhancements.

**Methods**

**Design**

This study used a cross-sectional design with self-administered questionnaires. We used Dillman’s (2007) tailored design method for data collection because it is a predominant method for improving the quality, confidentiality, and response rates of research surveys. This method includes five stages: initial invitation flyer, first survey package, first reminder flyer, second survey package, and a final flyer to remind participants of the closing date of the study. The study period lasted 3 weeks during the winter of 2010.

**Settings and Sample**

This study was conducted at three teaching and referral hospitals, composed of two local hospitals and one medical center. All target hospitals used the four-level clinical ladder system established by the Taiwan Nurses Association, ensuring uniformity among these hospitals in terms of study variable definitions.

We surveyed 64 nursing units, excluding outpatient units, psychiatric wards, operating rooms, and emergency departments from the survey. Approximately 1,400 registered nurses and 64 head nurses working in these 64 units participated in the study. Directors, supervisors, and nursing assistants were excluded because they do not participate in direct patient care.

**Variables and Their Measurements**

The two data collection tools used were a staff nurse questionnaire and a head nurse questionnaire.
Variables in the organizational context
This study adopted a Chinese version of a unit technology instrument translated by Hung (2011). Five head nurses first examined the 16-item instrument for content validity, and we removed the four items that had content validity index values of less than .80. The final version of the instrument consisted of 12 items with a 5-point scale ranging from 1 (none) to 5 (all). The reliability of the unit instrument was .83.

The operational definition of nursing expert varies greatly in the literature. This study thus defined an expert nurse as a nurse at the N3 or N4 clinical nursing ladder level (Tzeng, 2004) and nursing expert ratio as the percentage of N3 and N4 nurses in a nursing unit. Unit size was defined by the number of patient beds. Unit type was defined according to the unit characteristics registered with the Department of Health, Executive Yuan, Taiwan. Unit types included in this study were general and ICU.

The head nurse questionnaire included the unit technology instrument and the measurement of these four variables of nursing unit characteristics.

Variables in the practice structure
We measured autonomy using Cheng’s Professional Autonomy Scale (Cheng, 1995). Construct validity was established using the contrasted-groups approach, and a t-test was used to identify significant differences (p < .001; Cheng, 1995). Internal consistency reliability was .75. The instrument had 11 items scored on a 4-point scale ranging from 1 (never) to 4 (always).

Hung (2005) translated the Attitudes on Participation Scale by Slate, Vogel, and Johnson (2001) into Chinese to measure the degree of PDM. On the basis of the lack of valid information for the Chinese version of the Attitudes on Participation Scale and unit technology instrument, we determined the correlation between the two measures as an initial test of discriminant validity. The findings showed the concepts of the two instruments to be distinct (γ = −.10, p = .46). The reliability of the Attitudes on Participation Scale was .83. Using this instrument involved adopting a 5-point scale from 1 (strongly disagree) to 5 (strongly agree).

Formalization was measured using John and Martin’s (1984) instrument, as translated into Chinese by Lo (2009). The content validity index was .91, and the internal consistency reliability was .76 for this 10-item instrument that used a response scale ranging from 1 (strongly disagree) to 5 (strongly agree).

We included the above three instruments in the study questionnaire.

Patient safety performance
The term “medication error” refers to a violation of one or more of the “five rights”: right patient, right drug, right dose, right route, and right time (Fogarty & McKeon, 2006; Mark et al., 2008). We measured medication errors as the number of medication errors committed each month divided by the total number of patient days. Patient days were calculated by summing the total days of hospitalization for each patient in a nursing unit during a month.

We defined a patient fall incident as “an accidental descent to the floor or any plane surface” (Currie, 2008) and calculated fall incidence by dividing the number of monthly patient falls by the total number of patient days.

The head nurse questionnaire included the rates of medication errors and patient falls.

Data Analysis
Data analysis consisted of two phases. First, we aggregated data from the individual level, including autonomy, PMD, and formalization, into the group/unit level. The eta-squared (\( \eta^2 \)) coefficient and F ratio exhibited perceptual agreement for reliability of aggregation, and \( r_{wg} \) results verified interitem consistency (Forbes & Taunton, 1994; Hughes & Anderson, 1994). When the criterion of the \( \eta^2 \) coefficient exceeded .20 and the F ratio was less than .05, it was appropriate to refer the group/unit level from the individual level (Georgopoulos, 1986; Shortell, Rousseau, Gillies, Devers, & Simons, 1991). James, Demaree, and Wolf (1993) and Lindell, Brandt, and Whitney (1999) noted that an \( r_{wg} \) value equal to or greater than .70 justifies aggregating the data to the group level.

Second, we conducted path analysis to assess the relationship among the desired variables. A maximum likelihood estimation was used to identify a good fit of the data to the study framework. For evaluating the fit of the model, goodness-of-fit (GFI), comparative fit index (CFI), standardized root mean square residual, root mean square error of approximation (RMSEA), and normed chi-square test were used. A GFI larger than .80 was desired. The general agreement value of the standardized root mean square residual was 0.05 or lower (Byrne, 2009; Kline, 2005). A high value of CFI (between 0.9 and 1.0) indicates reasonably good fit. An RMSEA value smaller than .08 is acceptable, with less than .05 indicating an excellent RMSEA. Normed chi-square results must be less than 5. Finally, we used computer software (SPSS 17.0 and AMOS 16.0) to calculate direct and indirect effects.

The institutional review board of the three study hospitals approved this research, and we obtained formal consent from all participants.

Results

Participant Demographics
Sixty-four head nurses received the head nurse questionnaire, and 62 returned valid questionnaires. One head nurse from an ICU and another from a ward at a medical center did not complete the questionnaire, giving a response rate of 96.8%. The staff nurse questionnaire was distributed to 1,354 nurses, and 1,040 respondents returned valid questionnaires, giving
a response rate of 77%. Staff nurse participants from the two units associated with the two head nurses who did not return the questionnaire (n = 35) were excluded from the analysis. Incomplete questionnaires that had missing responses for any instrument (n = 15) or had three or more total missing responses (n = 13) were also excluded from the analysis. The final analysis included 977 respondents (72%) for data aggregation and 62 nursing units (96.8%) for path analysis. Table 1 shows the demographic characteristics of head nurses and registered nurses.

### Aggregation

The $\eta^2$ ranged from .12 to .76, and the F ratio ranged from 1.44 to 12.68. Although a few $\eta^2$ values were less than the .20 value recommend by researchers (James et al., 1993; Lindell et al., 1999), all F ratios reflected significant differences between within-group and between-group variance. These results confirm the appropriateness of aggregating these three individual-level instruments. The $r_{peg}$ values for the individual-level instrument ranged from .75 to .93, indicating consistency among items. These findings indicate that the aggregation of individual data to the unit level is warranted.

### Analysis of the Model

Because approximately 60% of head nurse participants reported either medication errors or patient falls in their units, we used log transformation to produce a more normal-like distribution for medication error and patient fall rate data (Kline, 2005). Path analysis using a maximum likelihood estimation showed several GFI measures: normed chi-square = 3.36, GFI = .89, CFI = .87, RMR = .04, and RMSEA = .08. Although GFI and CFI failed to reach the standard, they were each close to .90. For simplicity, only significant relationships ($p < .05$) are presented. Figure 2 shows the final model showing the relationships among study variables. Table 2 shows the direct and indirect effects of the contextual variables on structure and patient safety.

### Table 1.

**Participant Demographic Characteristics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Head Nurse (n = 62)</th>
<th>Registered Nurse (n = 977)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Type of hospital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical center</td>
<td>27</td>
<td>43.5</td>
</tr>
<tr>
<td>Local hospital</td>
<td>35</td>
<td>56.4</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>100.0</td>
</tr>
<tr>
<td>Type of unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensive care unit</td>
<td>17</td>
<td>27.4</td>
</tr>
<tr>
<td>Ward</td>
<td>45</td>
<td>72.6</td>
</tr>
<tr>
<td>Age</td>
<td>38.9</td>
<td>6.34</td>
</tr>
<tr>
<td>Clinical ladder system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N2</td>
<td>13</td>
<td>21.0</td>
</tr>
<tr>
<td>N3</td>
<td>16</td>
<td>25.8</td>
</tr>
<tr>
<td>N4</td>
<td>33</td>
<td>53.2</td>
</tr>
<tr>
<td>Type of license</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>62</td>
<td>100.0</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate degree</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>48</td>
<td>77.4</td>
</tr>
<tr>
<td>Masters degree</td>
<td>13</td>
<td>21.0</td>
</tr>
<tr>
<td>Year licensed as a nurse</td>
<td>17.7</td>
<td>6.35</td>
</tr>
<tr>
<td>Years at this hospital</td>
<td>16.5</td>
<td>6.51</td>
</tr>
</tbody>
</table>

Note. N1 = novice; N2 = advanced beginner; N3 = competent; N4 = proficient; RN = registered nurse.
Unit technology directly and positively affected nursing experts \((b = .33, p < .01)\) and type of unit \((b = .78, p < .01)\) and directly and negatively affected skill mix \((b = -.29, p < .05)\) and unit size \((b = -.44, p < .01)\). The indirect effects of unit technology on structure and patient safety variables were conspicuous. The indirect effect of unit technology on autonomy was \(.30 [(0.33 \times .36) + (-0.44 \times (-0.41)) = .30)]\) and on medication error and patient falls was \(.66\) and \(.29\), respectively (Table 2).

Figure 2 shows that RN skill mix did not affect structure or patient safety in this study. The nursing experts had no direct effect on patient safety but had an indirect effect on medication errors through autonomy \((-0.36 \times 0.25 = 0.09\)). Unit size had direct and negative effects on autonomy \((b = -.41, p < .01)\), medication errors \((b = -.38, p < .01)\), and patient falls \((b = -.67, p < .01)\). There was a significantly direct and positive path between the type of unit and medication errors \((b = .54, p < .01)\).

Autonomy had a direct and positive effect on medication errors \((b = .25, p < .05)\). To determine whether autonomy enhanced or buffered the effect of unit size on medication errors, we calculated the path coefficients to medication errors from unit size through autonomy \((-0.41 \times 0.25 = -0.10\)) and added these coefficients to the path coefficient between unit size and medication errors \([(-0.38 + (-0.10) = -.48)]\). The results indicate that the positive impact of autonomy on medication errors enhanced the negative effect of unit size on medication errors. The variables in this model explained 66% of the variance in medication errors and 47% of the variance in patient falls.

### Discussion

The major findings of this study are that unit technology and nursing unit characteristics significantly affect patient safety outcomes and practice structure minimally affects patient safety outcomes. Unit technology exhibited a direct effect on nursing unit characteristics and practice structure and an indirect effect on patient safety outcomes (Table 2). This finding is consistent with previous research (Alexander & Bauerenschmidt, 1987; Leatt & Schneck, 1982). Hall et al. (2004) found that nurses must temporarily abandon regular tasks to manage unanticipated changes in patient conditions and unanticipated events. The rearrangement of nursing hour utilization may cause additional stress and increased workload, which may lead to procedural mistakes or violations (Cox, 2003; Dugan et al., 1996). Nursing continuing education programs should include situation-based techniques to teach learning control skills in complex or uncertain situations. Strategies should include educating nurses to take additional time to think clearly when responding to urgent issues to ensure appropriate prioritization and make sure all work is completed in a timely manner that maintains daily routine safely.

Previous studies have shown the effects of skill mix on medication errors and patient falls to be equivocal (Kendall-Gallaher & Blegen, 2009). This study found no skill mix effect on medication errors and patient falls. We considered the possibility that the high RN skill mix ratio may be insensitive to study outcomes. The RN skill mix in this study ranged from 82% to 100% \((M = 95.27, SD = 4.07)\), with 90% of nursing units having a higher than 90% ratio of RNs in their units. Blegen, Goode, and Reed (1998) found the ratio of RNs in nursing units inversely correlated with the medication error rate, with the RN ratios in their study ranging from 46% to 96% with an overall average of 72%.

Although it seems natural to assume that a high proportion of experienced, highly trained nurses in a unit would correlate with a lower average medication error rate, this study found the opposite. Hammeman (1996) observed and interviewed 27 ICU nurses and 31 ICU patients over a 6-month period and concluded that expert nurses have significantly higher competence in recognizing changes and detecting errors and unsafe events than nonexpert nurses. Kim, An, Kim, and Yoon (2007) also noted that nursing units with higher ratios of expert nurses having either 5–10 years of experience or administrative competence reported higher rates of medication errors. Kim et al. concluded that this positive relationship positively reflects the abilities of expert nurses to detect medication errors and to use complex or Web-based reporting systems. Direct observation has been found to be most useful in detecting errors in medication administration and patient falls, and expert nurses are able to detect and report errors (O’Neil et al., 1993; Michel, Quenon, de Sarasqueta, & Scemama, 2004). Thus, nursing units with large proportions of expert nurses reported more errors than those with

### Table 2.

**Direct and Indirect Effects of Contextual Factors on Structure and Patient Safety**

<table>
<thead>
<tr>
<th></th>
<th>Professional Autonomy (Overall)</th>
<th>Medication Error (Overall)</th>
<th>Patient Fall (Overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct</td>
<td>Indirect</td>
<td>Overall</td>
</tr>
<tr>
<td>Unit technology</td>
<td>0</td>
<td>.30</td>
<td>.30</td>
</tr>
<tr>
<td>Nursing experts</td>
<td>.36</td>
<td>0</td>
<td>.36</td>
</tr>
<tr>
<td>Unit size</td>
<td>−.41</td>
<td>0</td>
<td>−.41</td>
</tr>
<tr>
<td>Type of unit</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The rearrangement of nursing unit characteristics significantly affect patient safety outcomes and practice structure minimally affects patient safety outcomes. Unit technology exhibited a direct effect on nursing unit characteristics and practice structure and an indirect effect on patient safety outcomes (Table 2). This finding is consistent with previous research (Alexander & Bauerenschmidt, 1987; Leatt & Schneck, 1982). Hall et al. (2004) found that nurses must temporarily abandon regular tasks to manage unanticipated changes in patient conditions and unanticipated events. The rearrangement of nursing hour utilization may cause additional stress and increased workload, which may lead to procedural mistakes or violations (Cox, 2003; Dugan et al., 1996). Nursing continuing education programs should include situation-based techniques to teach learning control skills in complex or uncertain situations. Strategies should include educating nurses to take additional time to think clearly when responding to urgent issues to ensure appropriate prioritization and make sure all work is completed in a timely manner that maintains daily routine safely.

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higher ratios of nonexpert nurses. Our findings thus support greater registered nurse participation in the Nursing Ladder System to receive more patient safety education and training and increase error detection competency. Strategies for simplifying or creating easy-to-use, Web-based error reporting systems are recommended. Moreover, multiple approaches such as incident reports, observations, or chart reviews may also be beneficial.

Type of unit positively affects the medication error rate. Many empirical studies have provided support for this finding (Ulanimo, O’Leary-Kelley, & Connolly, 2007; Valentin et al., 2009). Unit size was the only nursing unit characteristic found to have a direct effect on structure and patient safety, negatively affecting autonomy, medication errors, and patient falls. This indicated that units with a low degree of autonomy and a low rate of medication errors and patient falls had more patient beds. Unit size was also the only variable that had a significant effect on patient falls in this study, although the model explained 47% of overall variance in patient falls. Thus, the variables tested in this study may be more relevant than patient falls in explaining medication errors. For instance, Dunton, Gajewski, Taunton, and Moore (2004) noted that workload attributable to inadequate staffing levels is a predictor of patient falls in nursing units. However, variables used in that study such as skill mix and nursing experts explained the degree of skill and knowledge deficits. Therefore, future research should use a measure related to nursing workload such as nurse–patient ratios or hours of nursing care.

Although autonomy was the only variable to show significance, practice structure also influenced patient safety outcomes in this study. The positive effect of autonomy on the medication error rate suggests that this rate is higher in units with nurses with relatively high degrees of autonomy. One reasonable explanation for this is that nurses have the authority to make decisions regarding their practice, with urgent situations representing critical priorities. Medication administration is a daily routine to which nurses may not pay significant attention, compromising patient safety outcomes. This study indicates no PDM effect on patient safety. Although autonomy and PDM are derived from the identical concept of centralization, PDM refers to nurses’ freedom to make decisions related to their units or organizations rather than clinical practices relative to patient safety outcomes. These results suggest that nurses may try to do as much as possible to protect patients in individual situations, although not believing that they have the power to change the system to prevent error recurrence. The effect of formalization on patient safety outcomes is not apparent. This is likely because the instrument used in this study addressed the general practices of nurses rather than the specific policies, procedure, or protocols related to medication administration and patient fall prevention. However, these results facilitate the identification of nurses’ attitudes toward adherence to rules and procedures. Negative consequences follow serious error incidences unless nurses follow precise safety guidelines and protocols.

This study identified autonomy as the only structural variable affecting patient safety and as the mediator between nursing unit characteristics and patient safety. Future studies should add other elements of organizational structures considered to be determinants of patient safety. Zinn and Mor (1998) mentioned that the theoretical structure in contingency theory focuses on control mechanisms rather than on organizational capacity or capability and named centralization, formalization, standardization, specialization, and complexity as the contingency theory structural elements.

This study has some limitations. First, sample-related issues limit generalizability. Our sample is composed of three hospitals that accredit medical centers and local hospitals and that use the four-level clinical ladder system. It is uncertain how differences in hospital characteristics may affect results. Second, data on medication errors and patient falls in the nursing unit were obtained from hospital reports. Although Evans et al. (2006) showed that incident reports are adequate for routine and immediate outcomes, some scholars have expressed opposing views (Edmondson, 2004; Flynn, Barker, Pepper, Bates, & Mikeal, 2002; Prot et al., 2005). Prot et al. conducted a prospective cohort study on four units at a pediatric teaching hospital in Paris, France, and found that direct observation detected seven times more administrative errors than the incident report. Subsequent work should consider using other methods of data collection such as direct observation to validate data. Finally, lengthening the period of study and obtaining data as close to the actual practice as possible is needed to validate research data.

Conclusions

Patient safety has long been identified as the primary objective of healthcare systems. Therefore, improving safety practice in nursing remains crucial. The findings of this study indicate that macrolevel factors impact patient safety outcomes. Technology and nursing unit characteristics both have direct and indirect effects on patient safety outcomes. Professional autonomy is the only structural factor that affects patient safety. On the basis of these findings, continuing education programs should be redesigned to incorporate situation-based techniques, encourage nurses to participate in patient safety training, and assess the direct and indirect effects of nursing unit characteristics to enhance patient safety outcomes.

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References


護理單位背景及結構對病人安全的影響

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背 景  目前探討造成病人安全的原因，仍多著重於個人層級的探討而非組織層級。

目的  本研究以組織理論為基礎，探討組織的鉅觀因素對病人安全的影響。

方法  本研究以「結構框變理論」為基礎，採横向性、自填問卷方式，以64個住院單位的護理長及護理人員為收案對象，以Tailored Design Method方式收集資料，收案期間為2010年12月至2011年2月。問卷進行資料集縮（data aggregation）之後，以AMOS軟體進行路徑分析並完成整體模式的估計。

結果  本研究共計回收62份有效護理長問卷（98%）及977份護理人員問卷（72%）。資料集縮結果顯示，個人層級量表適用於單位層級之分析。路徑分析結果顯示，高專業自主程度、高護理專家比率、及重症照護特性的護理單位，其給藥錯誤率也高。此外，單位技術性複雜的護理單位，也間接的造成高給藥錯誤率和病人跌倒率。

結論與應用  研究結果顯示，組織鉅觀因素（包括組織背景及結構因素）確實對護理單位病人安全有影響。依據組織背景及結構因素的影響，調整在職教育內容，鼓勵護理人員參與病患安全訓練，及瞭解單位組織特性等，為建議提升病患安全的策略。

關鍵詞：病人安全、結構框變理論、給藥錯誤、病人跌倒、tailored design method。

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