

Professional Nursing Practice

Impact on Organizational and Patient Outcomes

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Objective: To test a causal model of the impact of (a) nursing unit context on professional nursing practice; (b) professional practice on selected organizational (nurses' work satisfaction, nursing turnover, average length of patient stay) and patient outcomes (patient satisfaction, rate of reported medication errors, and falls); and (c) nursing unit context on these same organizational and patient outcomes.

Summary Background Data: Professional nursing practice has been linked to positive outcomes for both nurses and patients. In contrast to other studies, this study focuses on professional nursing practice specifically at the nursing unit level, and uses a new analytic technique that permits examination of the simultaneous effects of professional nursing practice on both organizational and patient outcomes.

Methods: Data were collected from 1682 registered nurses, and 1326 patients on 124 general medical-surgical nursing units in 64 general short-term acute care hospitals in the southeast. Multilevel structural equation modeling was used to analyze the data.

Results: We found that professional nursing practice had consistent effects across model levels on nursing satisfaction, but very limited effects on other outcomes. Important differences in the hospital- and nursing unit level models support continued use of multilevel modeling techniques in the study of organizational and patient outcomes.

There is an accumulating body of evidence suggesting that "professional nursing practice"—defined as "a system that supports registered nurse control over the delivery of nursing care and the environment in which care is delivered"^{1, p 354}—contributes to improved outcomes for the organization and its patients.² Professional nursing practice is characterized by decentralization of nurses' clinical decision-making, enhanced autonomy, and collaborative relationships with physicians. For example, Havens and Aiken³ report that nurses' job satisfaction is significantly higher,^{4,6} and patient mortality significantly lower,⁷ in hospitals enacting professional nursing practice. Lower mortality on dedicated AIDS units that promote professional nursing practice has also been documented.⁸ In addition, less emotional exhaustion, safer work environments,⁹ and lower rates of needlestick injuries¹⁰ have been reported in hospitals engaging in professional nursing practice.

However, most research in this area has focused either on the individual nurse, and relies predominantly on primary data, or on the hospital, and relies on secondary data. Yet, it is likely that variability in nursing unit organization can best be seen, and the relationship of nursing unit organization to outcomes understood most clearly, at the nursing unit level. Second, since organizations produce multiple, concurrent outcomes, it is important to use an analytic technique that permits investigation of several outcomes simultaneously. Finally, because a nursing unit's behavior is partly determined by the hospital in which it is located, a multilevel perspective allows examination of this important interplay.

To address these issues, in the Outcomes Research in Nursing Administration Project (ORNA), we used a long-established theoretical framework, focused on the nursing unit as the focal unit of analysis, and used multilevel structural equation modeling

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as the analytic technique. The primary purpose of the ORNA project was to test a theoretically derived model of the impact of professional nursing practice on selected organizational (nurses' work satisfaction, nursing turnover, average length of patient stay) and patient outcomes (patient satisfaction, rate of reported medication errors, and falls). In addition, we were interested in examining the impact of (a) nursing unit context on professional nursing practice, and (b) nursing unit context on the same organizational and patient outcomes.

Theoretical Framework

Structural contingency theory (SCT) suggests that organizations are effective to the extent their structures take into account the nature of the environment in which they operate and the nature of the tasks they are trying to accomplish.¹¹⁻¹⁴ More specifically, SCT suggests that the "fit" or the "match" between the organization's *context* and its *structure* contributes to its effectiveness. Unfortunately, conceptual and operational issues have prevented development of any consensus definition of "fit" or "match." Therefore, it was not our intent to test the "fit"/"match" hypothesis directly, but rather to use the major theoretical constructs to identify variables to be included. Thus, we included key variables as follows.

Context is comprised of both the *external* as well as the *internal environment* of the nursing unit, represented by key hospital and nursing unit characteristics, describing respectively, the external and internal environments of the nursing unit. For hospital characteristics, we considered the complexity of services offered (technological complexity and case mix index), the hospital's teaching status, the volatility of its pattern of inpatient admissions, and the number of hospital beds (size). With regard to nursing unit characteristics, we included both the experience and education level of the unit's nurses, nursing skill mix (the proportion of RNs to the total complement of nursing staff), the number of patient beds on the unit (unit size), the availability of support services, and the complexity of patient care provided (patient technology). These variables were selected because their hypothesized relationships to both organizational structure and outcomes are consistent with the assumptions underlying contingency theory, as well as the need to evaluate their impact on professional nursing practice.

Organizational structure was conceptualized as professional nursing practice, consistently defined in the recent nursing literature as nurses' active par-

ticipation in decision-making, and their freedom to practice independently, and to engage in collaborative relationships with physicians.^{1-8, 10}

Outcomes Because of the multifaceted nature of organizational effectiveness, we selected multiple outcome measures, reflecting both organizational and patient outcomes. The organizational outcomes included nurses' satisfaction with their work, nursing turnover, and average length of patient stay; the patient outcomes were patient satisfaction with their care, as well as rates of reported medication errors and patient falls. A more complete description of the theoretical framework has been reported elsewhere.¹⁵ Figure 1 provides a diagram of the relationships investigated in the study.

Methods

Design

The ORNA project was a longitudinal study with the nursing unit as the unit of analysis. Consistent with contingency theory, we hypothesized that context would influence professional nursing practice, which would, in turn, affect organizational and patient outcomes. Nurse executives with whom we consulted believed that the effects of professional nursing practice on outcomes would be visible in 6 months. Data collection was planned to capture first the influence of context on professional practice, and the subsequent influence of professional practice on outcomes. Thus, data about the nursing unit's context (ie, hospital characteristics) and the nursing unit characteristics of experience, education, skill mix, and unit size were collected first. Two additional nursing unit characteristics—availability of support services and patient technology (which were believed to have a proximate impact on professional nursing practice)—were measured contemporaneously with professional nursing practice. Data on outcomes were collected 6 months later.

Study Sample

The sample consisted of 136 general medical-surgical nursing units in 68 randomly selected non-federal, nonpsychiatric, not-for-profit, accredited acute care hospitals with more than 150 beds in 10 southeastern states, Texas, and the District of Columbia. Where there were only two eligible units in a hospital, both participated. When there were more than two eligible units, a random selection was made. On each unit, all registered nurses with more than 3 months' experience were invited to participate. In addition, we selected a random sample of 10 pa-

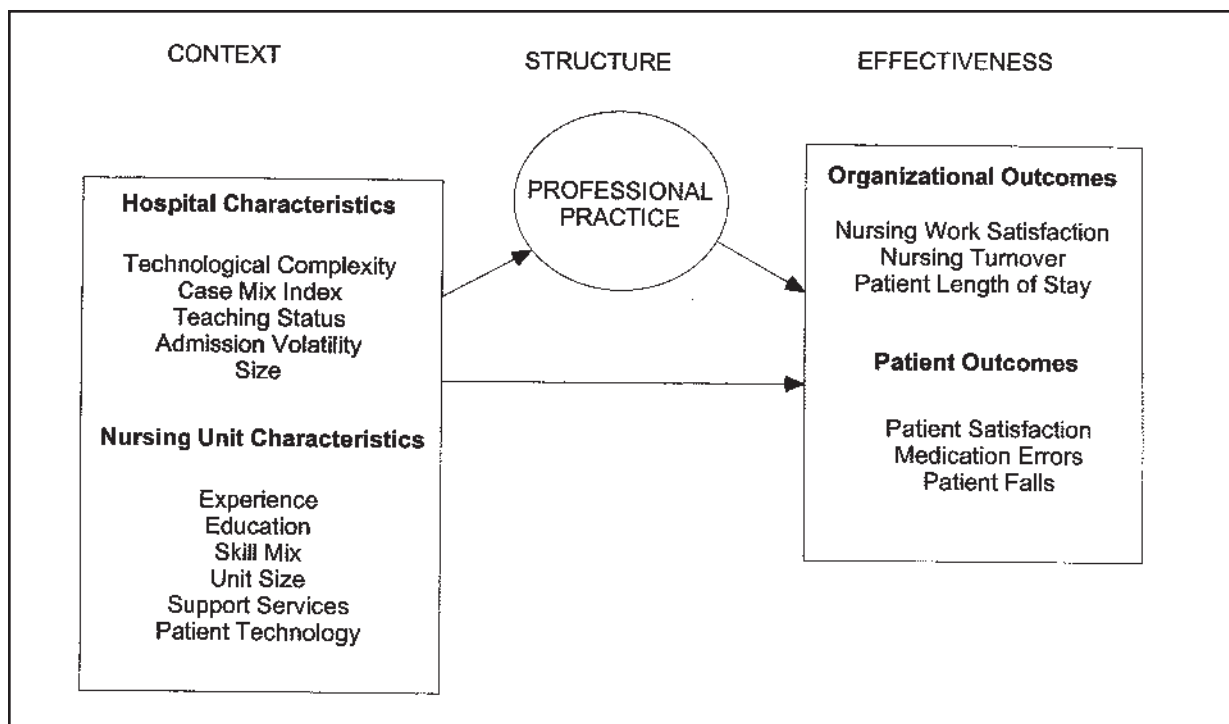


Figure 1. Theoretical model of the relationships between context, structure (professional practice), and effectiveness (outcomes).

tients on each unit who had been hospitalized a minimum of 24 hours, and who were able to respond to an English-language questionnaire.

At the time the study was initiated, sample size calculations for structural equation modeling were most often based on a “rule of thumb” ratio of four¹⁶ or five¹⁷ cases per parameter to be estimated; to reduce the expense of the study, we used four cases per parameter (34 parameters to be estimated \times 4 = 136 nursing units). Due to attrition of one hospital prior to study implementation, we began the study with 134 nursing units. Further attrition occurred because, in one hospital, the study coordinator never initiated the study; at another, a corporate merger prevented full participation. In addition, one nursing unit closed immediately before data collection began. In another hospital, only partial data were provided. Thus, at the completion of the early period of data collection, we had data from 127 nursing units. Three additional units left the study during the later period of data collection because work pressures made data collection impossible. Four hospitals provided data from only one nursing unit, resulting in a final sample of 124 units in 64 hospitals.

Based on advancements in determining statistical power in structural equation modeling (SEM) published after the study was initiated,¹⁸ we were able to

complete a post-hoc power analysis. This approach is based on the logic that the primary hypothesis tested in SEM is the fit of the relationships observed in the data to those proposed in the theoretical model.¹⁹ Consequently, power is conceptualized as the ability to distinguish a “good” fitting from a “poor” fitting model using the fit statistic Root Mean Square Error of Approximation (RMSEA). After accounting for the fact that units were “clustered” in hospitals (ie, two units in each hospital),²⁰ power was .83. Using this approach increases confidence that, although our final sample size was less than originally planned, we did have sufficient power to distinguish between a “good” and “poor” fit of the model to the data.

Ninety percent of nursing units had better than 70% staff nurse response rates (with 45% of units achieving 100% response rates). A total of 2279 staff nurse questionnaires were distributed, of which 1749 were returned, and 1682 were usable: an overall response rate of 73.8%. Response rates for patient data were greater than 80% on 80% of units; a total of 1346 patient questionnaires were returned; 1326 were usable.

Data Collection

Each hospital appointed a “study coordinator” who was responsible for the conduct of the study in that

hospital. Study coordinators were provided 1.5 days of training by the research team to familiarize them with the purpose and goals of the study; to ensure conformity across multiple sites in approaches to data collection; and to assure consistency in the definition of key data elements, thus increasing reliability of data. Study coordinators were given a hard-copy procedure manual with clear operational definitions of all study variables. The research team inspected all data received from study coordinators. If the team identified any potential errors, the study coordinator was contacted, and was asked to recheck the data value and resubmit the information. In addition, rather than relying on study coordinators for calculations involving multiple variables, which may have led to different interpretations of the calculations, the research team completed all calculations using standard formulas.

Following institutional review board approval in each hospital,²¹ data were collected using Dillman's Total Design Method,²² a carefully prescribed strategy that consists of a letter to respondents that accompanies the research instruments emphasizing the importance of their individual response to the success of the study. The method additionally calls for a series of three reminders. The first reminder was delivered approximately 1 week after the questionnaire was distributed. The second was furnished, along with a duplicate copy of the questionnaire, approximately 3 weeks after the questionnaire was originally distributed. The final reminder was sent 2 weeks later.

Measures

Hospital Characteristics

Technological complexity was the number of 16 possible high-technology services offered by the hospital.¹⁵ *Case mix index* was the Medicare case mix index assigned by the Centers for Medicare and Medicaid Services. *Teaching status* was defined as membership in the Council of Teaching Hospitals. *Volatility of admissions* was dummy coded, and defined as follows²³: "stable hospitals" (the reference group) were those hospitals in which admissions varied less than 5% in each interval, 1994 to 1995 and 1995 to 1996; "growers" were those where hospital admissions increased 5% or more in both intervals; hospitals were characterized as "decliners" if admissions decreased 5% or more in both those intervals, and as "unstable" if the pattern of admissions displayed an increase greater than 5% in one year accompanied by a decrease greater than 5% in the other year. *Hospital size* was defined as the num-

ber of open and maintained beds. The study coordinator, who retrieved the required information from appropriate hospital sources, provided these data.

Nursing Unit Characteristics

Experience was defined as the average years of experience in nursing for nurses on the unit. *Education* was defined as the average highest educational level attained by nurses on the unit. *Skill mix* was defined as the proportion of nursing staff who were registered nurses. *Unit size* was defined as the number of beds on the nursing unit. Information about these variables was collected from nurse managers. *Availability of support services* was evaluated with a 27-item, 3-point checklist²⁴ in which staff nurses (n = 1682) indicated whether a variety of support services was available, not available, or inconsistently available (alpha = .85). A wide variety of support services were included; examples are laboratory specimen collection, patient transportation, computerized order entry, use of unit-dose medication system, and coordination of discharge planning. Higher scores indicate support services were consistently available. Data about *patient technology*, a measure of the complexity of care required on the unit, were obtained from staff nurses (n = 1682) using a 12-item scale²⁴ with 5 response categories, in which higher scores indicated a larger proportion of patients had complex nursing care needs (alpha = .76). We completed an initial factor analysis of this scale (and others as reported below) with exploratory factor analysis. Varimax rotation yielded the most interpretable solutions, and we maintained factors with Eigen values greater than one. Three factors, reflecting patient conditions that required comprehensive problem-solving by nurses, changed rapidly and unpredictably, and required the use of technical equipment (ie, intravenous pumps, cardiac monitors, telemetry), explained 48% of the total variance in patient technology.

Organizational Structure

Although other research has referred to *professional nursing practice* as an organizational "climate" or "trait,"² we were interested in it as an integrative construct. Therefore, we conceptualized professional practice as an underlying latent construct, with the indicators of decentralization, autonomy, and nurse-physician collaboration. Data were collected on these indicators from Likert-type rating scales administered to staff nurses. *Decentralization* was measured with a 6-item, 5-point scale²⁵ that asked nurses about the extent of their involvement in unit

decision-making ($\alpha = .81$). A single factor, which we termed "decision-making," explained 48% of total variance in the scale. *Autonomy* was measured with a 21-item, 6-point, Likert-type scale²⁶ that assessed the extent to which nurses on the unit felt free to engage in activities such as consulting with others about complex care problems, influencing standards of care, and acting on their own decisions related to care-giving ($\alpha = .93$). Three factors, reflecting autonomy in nurses' consultative, evaluative, and decision-making roles, explained 54% of the total variance. *Collaboration with physicians* was evaluated with the 6-point, 9-item nurse scale of the Collaborative Practice Scale,²⁷ which evaluates the extent to which nurses on the unit negotiate with physicians to establish their respective responsibilities, suggest to physicians patient care approaches, and tell physicians when orders seem inappropriate ($\alpha = .90$). Two factors, which reflected nurses' negotiating activities regarding general patient care and their direct communication with physicians about particular patients, explained 69% of the total variance in the scale. All of these questionnaires were scaled so that higher scores indicated higher levels of the variable.

Organizational Outcomes

Nurses' work satisfaction was measured by a 4-item index,²⁸ completed by staff nurses, which measured global satisfaction in the job ($\alpha = .84$, a single factor explained 68% of the variance). *Nursing turnover* was defined as a ratio of the number of nurses who left during the period divided by the number of nurses employed at the end of the year. *Average length of patient stay* was defined as total patient days divided by the number of discharges. Study coordinators who retrieved the information from hospital and nursing unit clinical and management information systems provided data about turnover and length of stay.

Patient Outcomes

Patient satisfaction was measured in a random sample of 10 patients from each nursing unit ($n = 1326$), using a 15-item, 6-point questionnaire.^{29,30} The questionnaire focused primarily on patients' satisfaction with nursing care. Patients were asked about their perceptions of the courtesy of the nursing staff; the ability of the doctors, nurses, and other staff to work together; their satisfaction with pain relief; and their level of comfort sharing concerns with nurses ($\alpha = .91$). Two factors, reflecting patients' satisfaction with nursing care in general, as well as their satisfaction with how they were treated per-

sonally, explained 68% of the variance in the scale. Both the *rate of reported medication errors* and the *rate of reported patient falls* were calculated from data retrieved by the nurse manager from the hospital's incident reporting system. The rates were defined as the number of incidents per 1000 acuity-adjusted patient days (ie, patient days multiplied by the unit's technology level, acting as a proxy for patient acuity).

Finally, since the nursing unit, not the individual nurse or individual patient, was the level of analysis, prior to aggregation of individual-level measures for final analysis, perceptual agreement was assessed with an index of within-group agreement³¹ (r_{wg}). In contrast to measures assessing the consistency (reliability) of responses across raters, within-group agreement provides an assessment of the extent to which raters provide essentially the same ratings (consensus). These values varied from .84 to .96, indicating high levels of within-group agreement.

Analysis

The combination of three important aspects of the project called for a new approach to the statistical analysis. First, we conceptualized professional nursing practice as a latent variable; second, we were testing a structural equation model; and third, we had clustered data on nursing units. Multilevel structural equation modeling (MSEM) is the only technique currently available that can incorporate these three approaches.³²⁻³⁴ We used the Mplus Version 2.1 computer program for the analysis.³⁵ MSEM proceeds in two stages.³²⁻³⁴ The first stage is to develop an adequate measurement model of the professional practice latent variable. The measurement model essentially assesses the construct validity of the indicators of professional nursing practice. The next stage tests the actual structural equation model; in other words, the relationships between context and professional nursing practice, and the relationships between professional nursing practice and outcomes. A unique aspect of MSEM is that some of the variance in outcomes can be explained by differences *between hospitals* (ie, the 64 hospitals in the study), and some of the variance in outcomes can be attributed to differences *between nursing units* (ie, the 124 nursing units in the study). When differences between hospitals are the focus, the model is referred to as the "hospital model"; similarly, when differences between nursing units are the focus, the model is referred to as the "nursing unit level model." Referring to Figure 1, the analysis of the hospital level model incorporates all 5 hospital charac-

teristics and all 6 nursing unit characteristics. The analysis of the nursing unit level model incorporates only the nursing unit characteristics. Although this explanation may imply that the hospital level model and the nursing unit level model are analyzed individually, the Mplus computer program runs them simultaneously.

The Mplus computer program provides several goodness-of-fit measures³⁴⁻³⁶: chi-square, root mean square error of approximation (RMSEA; close fit value is .05 or less; acceptable fit is .08 or less³⁶); standardized root mean square residual (SRMS; desirable values are close to zero) for the between and within models; comparative fit index (CFI) and the Tucker Lewis index (TLI). Values of CFI and TLI greater than 0.90 indicate an excellent fit of the model.

Results

Table 1 presents descriptive information on all variables in the model.

Measurement Model

Based on our initial exploratory factor analysis, we first tested a 5-indicator model (the correlation between the two collaboration factors was 0.79, so they were combined). This multilevel confirmatory factor analytic model of the professional practice latent variable, which contained one indicator of decentralization, three of autonomy, and one of collaboration with physicians, yielded poor fit to the data (chi-square 62.8, $P = .000$; RMSEA 0.16; CFI 0.81; TLI 0.72). The correlations among the three autonomy factors ranged from 0.59 to 0.69 (all significant at $P < .001$), suggesting that a 3-indicator model might produce a better fit. In the 3-indicator model, collaboration with physicians was a weaker indicator than either autonomy or decentralization, but was kept in the model because of its theoretical importance for professional practice. The tests of the 3-indicator model demonstrate excellent fit to the data (chi-square = 3.789 with 3 degrees of freedom, $P = .284$; RMSEA = 0.05, CFI = 0.993; and TLI = 0.986).

Table 1. Descriptive Information on Sample Hospitals and Nursing Units Used in Final Analysis

	Mean	SD	Range
Hospital characteristics			
Technological complexity	6.0	3.4	1-16
Health Care Finance Administration case mix index	1.35	0.30	0.37-2.12
Council of teaching hospitals	YES = 22 (34%)	NO = 42 (65%)	
Admission volatility	Stable	(N = 25; 39.00%)*	
	Grower	(N = 4; 6.25%)	
	Decliner	(N = 3; 4.70%)	
	Unstable	(N = 32; 50.00%)	
Hospital size (beds)	352	174	91-902
Mean nursing unit characteristics			
Experience	6-10 years:	41.9	
	11-15 years:	49.2	
	more than 15 years:	8.9	
Basic educational level	Diploma	20.9	
	Associate Degree:	79.0	
Skill mix, %	58	17	16-100
Unit size (beds)	34.5	11.7	10-79
Availability of support services	1.5	0.14	0.98-1.79
Patient technology	3.55	0.25	2.55-4.10
Unit means for professional practice variables			
Participation in decision-making	2.35	0.32	1.25-3.10
Autonomy	4.39	0.34	3.03-5.07
RN/MD collaboration	3.02	0.41	2.24-4.48
Unit means for organizational outcomes			
Nurses work satisfaction	2.17	0.32	1.29-2.89
Nursing turnover, %	17	19	0-105
Average length of patient stay	5.31	1.47	1.52-11.97
Unit means for patient outcomes			
Patient satisfaction	4.70	0.45	3.43-5.47
Rate of reported medication errors per 1000 patient days	1.35	1.78	0-15.74
Rate of reported falls per 1000 patient days	1.15	.885	0-6.42

*Numbers may not add to 100% due to rounding

Results of Structural Equation Modeling

The results are presented in Figure 2, in which the top half of the model presents information on the hospital level analysis and the bottom portion of the model presents information on the nursing unit level of analysis. For simplicity, only significant relationships ($P < .10$) are included in Figure 2.

There were 5 hospital characteristics included in our hypothesized model: technological complexity, case mix index, teaching status, admission volatility, and hospital size. A variety of distributional problems with the data required deletion of hospital size,

teaching status, and case mix index from the analysis. Thus, the two contextual variables remaining in the hospital level analysis were admission volatility and technological complexity.

Hospital-Level Analysis

Professional nursing practice was diminished in hospitals where there was a volatile pattern of admissions (standardized coefficient β -.28) but was enhanced in hospitals that offered many high-technology services (.30). There were also important ecological effects—those that result from aggregation to the hospital level

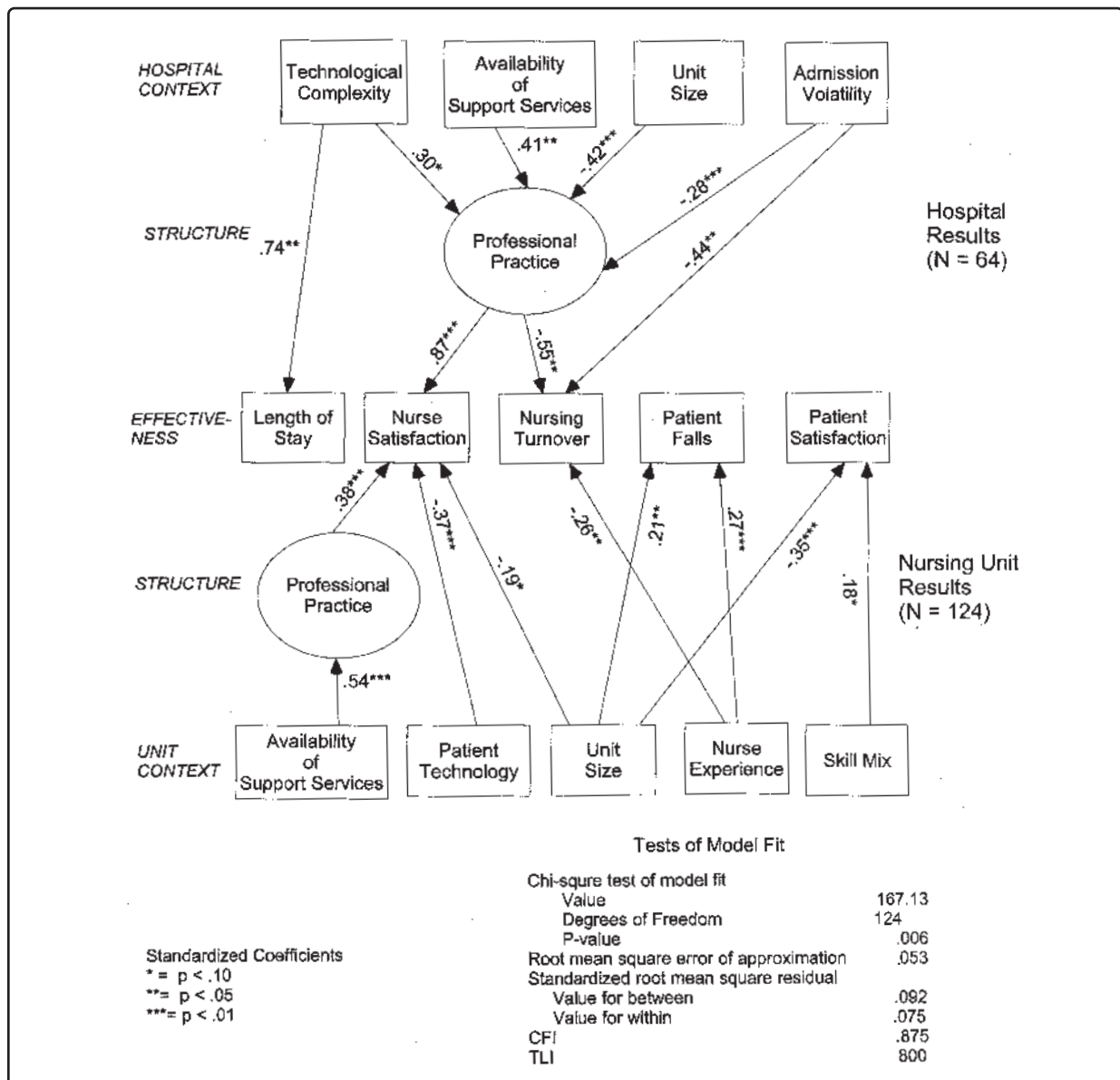


Figure 2. Results of multilevel structural equation model: impact of context and structure on effectiveness.

of unit-level variables. Professional nursing practice was enhanced by the availability of support services (.41), but diminished on larger nursing units (-.42). Professional nursing practice had an extremely strong positive impact on the organizational outcome of work satisfaction (.87), and was associated with lower nursing turnover (-.55). Technological complexity was associated with longer length of patient stay (.74). Surprisingly, admission volatility was associated with lower levels of nursing turnover (-.44). The variances explained by this model are as follows: nursing satisfaction—71.4%, patient satisfaction—39%, average length of patient stay—47%, nursing turnover—36%, and falls—25%.

In addition to these significant direct effects, effects on outcomes of contextual variables mediated through professional practice can be obtained by calculating the product of the parameter estimates for the identified paths; the calculation of total effects involves summing direct and indirect effects. In the hospital level model, the total effect of admission volatility on nursing turnover, mediated through professional practice is -.29, (ie, the indirect effects added to the direct effect $([-.28 \times -.55] + [-.44])$); thus professional practice partially mediates this relationship, but does not negate its statistical significance. Table 2 displays the indirect and total effects for the contextual variables.

Nursing Unit-Level Analysis

Professional nursing practice was solely predicted by the availability of support services (.54), which in

turn predicted higher mean levels of nurses' work satisfaction (.38). There were no significant relationships between professional nursing practice and any other organizational outcomes or patient outcomes, nor were there any mediating relationships.

However, there were a number of significant relationships between nursing unit characteristics and organizational and patient outcomes, with unit size playing a particularly prominent role. Larger unit size contributed to both lower mean levels of nurse's satisfaction (-.19) as well as lower mean levels of patient satisfaction (-.35). In addition, the rate of reported patient falls was higher on larger units (.21). Patient technology, a measure of the complexity of care required on the nursing unit, contributed to lower mean levels of nurse's job satisfaction (-.37). On units with more experienced nurses, turnover was lower (-.26), but the rate of reported patient falls was higher (.27). Registered nurse skill mix was associated with higher mean levels of patient satisfaction (.18). Variances explained in the outcome measures by the nursing unit level model are as follows: nursing satisfaction—37.6%, nursing turnover—14.6%, patient falls—17.5%, and patient satisfaction—14.3%.

Evaluation of Model Fit

The chi-square value was 167 with 124 degrees of freedom ($P = .006$) for the full structural equation model (which incorporates both the hospital level model and the nursing unit level model); chi-square per degree of freedom was 1.35 (desirable values are

Table 2. Effects of Contextual Variables via Professional Nursing Practice on Outcomes

	Indirect Effect	Direct Effect	Total Effect*
Hospital-level analysis			
Technological complexity			
On Nurse Satisfaction	0.261	0	0.261
On Nurse Turnover	-0.165	0	-0.165
Availability of support services			
On Nurse Satisfaction	0.357	0	0.357
On Nurse Turnover	-0.225	0	-0.225
Unit size			
On Nurse Satisfaction	-0.365	0	-0.365
On Nurse Turnover	0.231	0	0.231
Admission volatility			
On Nurse Satisfaction	-0.244	0	-0.244
On Nurse Turnover	0.154	-0.44	-0.286
Nursing unit-level analysis			
Availability of support services on nurse satisfaction	0.205	0	0.205

*The estimated total effect does not include joint or spurious effects

less than 2.0). The RMSEA for the full model was 0.053; CFI was .875; TLI was .80; SRMR for the hospital level model was .09 and for the nursing unit level model was .075. Overall, the fit indices are mixed, and suggest moderate support for the theoretical model.

Discussion and Conclusions

With the exception of medication errors, which were not well explained in either the hospital or nursing unit level model, there was some support for the ability of the multilevel model to predict both organizational and patient outcomes. Consistent with earlier research on professional practice models,^{18,10} in both the hospital and nursing unit level models, the relationship between professional nursing practice and nurses' work satisfaction was large and statistically significant. We also found that, at the hospital level, hospitals in which nursing units exhibited, on average, enhanced levels of professional nursing practice, exhibited lower levels of nursing turnover.

Other findings of particular interest are those pertaining to the following:

1. Importance of support services in enhancing professional nursing practice,
2. Impact of unit size, and
3. Relationship of nursing skill mix to outcomes.

Consistent availability of support services was a significant predictor of enhanced professional nursing practice, providing further evidence of their importance as a "major determinant in the effectiveness of the delivery system."³⁷ As hospitals continue to re-engineer their care delivery processes, providing adequate support services will likely become even more essential. However, the relative costs of providing support services in comparison to other re-engineering strategies should be further explored, particularly when there is simultaneously a call for mandated minimum staffing ratios and a nursing shortage.

Unit size also had important effects: nursing units in hospitals exhibiting enhanced levels of professional nursing practice had smaller nursing units on average, a finding consistent with an information-processing approach to designing organizations.³⁸ Given the coordination requirements to appropriately accomplish the complex task of patient care, units with fewer patients, which also have fewer staff, may exhibit more flexible communication

structures that permit the ongoing interactions so necessary to the success of professional nursing practice. Further, larger nursing unit size was associated with lower levels of satisfaction for both nurses and patients, and there was a higher rate of reported patient falls. With current re-engineering efforts frequently resulting in consolidation of nursing units,³⁹ these relationships require further investigation to examine more clearly the processes underlying the relationship between size and outcomes.

Our findings regarding nursing skill mix and outcomes were mixed. Consistent with earlier research, we found skill mix associated with higher levels of patient satisfaction, but in contrast with other studies,⁴⁰⁻⁴² skill mix was not associated with nursing satisfaction, or with medication errors or patient falls. The most likely explanation for this finding may be related to potential systematic underreporting of patient incidents. However, ours is the first study to consider multiple outcomes simultaneously, utilizing a multilevel analytic technique; thus, until additional research is available, we are hesitant to draw firm conclusions from these findings.

The finding that professional nursing practice had few effects on outcomes at the nursing unit level raises important conceptual and methodological issues. Three particular areas of concern seem most relevant. The first relates to the less-than-strong support for the theoretical model. One factor that may have been operating is that three hospital-level characteristics (teaching status, case mix index, and hospital size)—variables that were selected to represent the hospital's context (a key construct of structural contingency theory)—did not enter the final model because of problems with model convergence. Yet, the hospital's teaching status, the complexity of cases it treats, and its size would be expected to have considerable impact on the organization of nursing care at the unit level. Thus, future research should examine mechanisms to overcome this limitation, perhaps by substituting other relevant indicators. For example, teaching status, rather than being dichotomously coded, might be measured as the number of residents per bed.

The second area at issue is the treatment of professional nursing practice as a latent variable. Although treating professional nursing practice as a latent variable is consistent with our conceptualization of it as an integrated theoretical construct, the multilevel measurement model revealed that, in the nursing unit level model, the indicator of collaboration with physicians did not perform as well as the other indicators. Thus, although the overall fit of the

measurement model was excellent, it is clear that further work is required to improve measurement of this critically important aspect of professional nursing practice.

The third area of concern relates to our finding that patient outcomes were more affected by contextual variables than professional nursing practice. Although patient satisfaction and patient falls are outcomes recognized as clearly important both to hospitals and to nurses, there is a need to incorporate into future studies additional patient outcome variables that might be more sensitive to variations in professional nursing practice, for example, patients' perceptions of their level of symptom distress, as well as their knowledge and understanding of required post-hospital care.

There are several limitations to our study. First, as with the testing of any structural equation model, the goodness-of-fit statistics do not reveal whether the model is "correct," only that the model fit the data. In fact, the fit statistics for our model were mixed, reflecting a need for further model development and testing. Second, the results cannot be generalized beyond general medical-surgical nursing units, and this may have decreased the variance in the measurement of some variables, thus contributing to certain nonsignificant findings. Third, attrition reduced our effective sample size. However, mitigating the concern regarding sample size are the results of the post-hoc power analysis, described earlier, in which power to distinguish between a good-fitting and a poor-fitting model was 0.83. Fourth, although we were able to adjust the patient outcome measures of falls and medication errors by our measure of patient technology (as a proxy for patient acuity), our adjustment might have been more refined with more extensive demographic and health status information about patients. Finally, although we utilized multiple strategies to assure the accuracy of our data on medication errors and patient falls, the data are only as good as the hospitals' incident reporting systems. When this study was carried out, there was some level of concern about errors; how-

ever, more recently that concern has escalated tremendously.^{43,44}

In conclusion, hospitals must maintain their nursing workforce in the face of an emerging nursing shortage and increasing concerns with the quality of nurses' work life. Our findings suggest that professional nursing practice is one strategy that can aid in achieving that goal. However, given the limited impact of professional nursing practice on organizational and patient outcomes, and moderate, rather than strong, support for the theoretical model, it is clear that professional nursing practice is not a panacea for hospitals. Subsequent research should investigate nursing satisfaction's role as a possible mediator of the relationship between professional nursing practice and patient outcomes. Further development and use in research of patient outcomes that are truly sensitive to nursing practice may help to uncover stronger relationships between professional practice and patient outcomes than found in our study. Finally, as hospitals continue to operate in an ever-tightening fiscal climate, decision-making with respect to professional nursing practice must weigh its benefits and monetary costs. Additional research that incorporates the conceptual and methodological recommendations discussed earlier is needed to enable us to develop a more complete understanding of those benefits and costs.

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