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Approach

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Influences on Nurse Perception of Hospital Unit Safety Climate: an HLM Approach

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Abstract

Patient safety is a critical issue in health care. The Institute of Medicine [1] estimates up to 98,000 hospitalized patients die annually as a result of medical error. Nurses serve as a hospital unit's twenty-four hour surveillance team [2]. Assessment of patient condition, evaluation of physician orders, administration of medications, and supervision of patient activity are all safety functions which fall within the nurse's scope of practice. Health care organizations have introduced a variety of technological upgrades and structural changes in an effort to encourage a system, or root cause, approach to error reduction. However, these changes have failed to provide an adequate reduction in error. Because nurses play an integral role in patient safety, the solution may potentially lie within the work of nurses. Using data collected from a survey of 430 Registered Nurses, this study seeks to determine the influence staff composition has on individual nurse perception of patient safety. Results indicate Registered Nurses who work on hospital units with more experienced nurses perceive their workplaces to be significantly safer for patients. Previous work has found information technology, such as electronic medical records, decision support systems, and error reporting systems may play an important part in the reduction of medical errors [3,4]. This analysis indicates a combination of social and technological changes may best provide nurses with environments which promote the reduction of error.

1. Introduction

Health care delivery demands both safety and efficiency. These conflicting demands are negotiated within the work of direct care nurses. Nurses receive role expectations from hospital management and reimbursing agencies demanding high workloads. Conversely, patients, families, training mechanisms, and society in general convey an expectation that one taking the role of nurse is to act as an agent of caring and protection, above all allowing no harm to come to patients [5]. When conflicting role demands inhibit a nurse from carrying out what he/ she believes to be legitimate role expectations, a distressing workplace contradiction occurs [6]. Because the patient experience is directly linked to the work of nurses, it is not illogical to deduce that Registered Nurse distress would be related to adverse patient outcomes. In attempting to negotiate the safety/efficiency dichotomy, nurses may inadvertently be jeopardizing patient safety.

The connection between nursing work and patient safety is affirmed by research linking nurse staffing levels to patient outcomes. In hospital environments where nurse-to-patient ratios are high, risk of patient injury is high as well. Adjusting for patient and hospital characteristics, each additional patient added to a nurse's workload increases the odds of 'failure to rescue', or death from medical complication, by seven percent [7]. Additionally, a recent survey finds 96% of nurses and 90% of physicians, pharmacists, and administrators believe nursing staff has the primary responsibility for assuring patient safety [8]. Because many of the most serious medical errors are preventable [9], and nurses play a crucial role in patient safety, further examination of Registered Nurse perceptions of patient safety is warranted.

Health care workers commonly face disjuncture between the realities of their work and organizational procedures put in place to increase work efficiency [11]. This discord is especially salient for direct care nurses, who historically have not had the power and position to direct organizational processes [12]. Errors and near misses blamed on nurse incompetence may very often be the result of inadequate workplace environments. Tucker and Edmondson's [13] observation of hospital nurses, in which 91% of identified problems which could potentially result in error were related to the inability of a nurse to access necessary information or materials, illustrates the effect of workplace environment on a nurses' ability to deliver safe care.

Support from co-workers can be important in the reduction of environmental demands among nurses [10]. A 1998 study of role demands experienced by staff members in England's National Health Service Trust finds 79% of staff report 'support from colleagues' is a primary factor in the reduction of workplace stress [14]. Eisenberg et al. [15] finds hospital nurses report lack of available support from qualified co-workers to be a major source of stress. Consistent with this finding, Salmond and Ropia [16], in an examination of stress related to job demands among hospital and home care nurses, find nurses identify frequent requests for assistance from needy co-workers as a prime source of stress. Nurses appear to

experience decreased levels of stress when co-workers are qualified and available to provide assistance, yet become more stressed when co-workers require frequent support.

Healthcare continues to reinforce an image of the heroic individual achieving safety through exemplary knowledge and skill, an image left behind by industries such as aviation that successfully embrace a more collective approach to safety [17]. Health care workers are significantly less likely than those in the aviation industry to acknowledge the universal potential for human error and significantly more likely to feel their organization handles error poorly [18]. The inability of healthcare organizations to acknowledge that nursing work is imbedded in a social environment may be a factor in the inability of healthcare to consistently reduce error [19,20].

The current study seeks to determine the influence a hospital unit’s overall level of nurse education and experience has on individual nurse perceptions of their patient’s opportunity to receive safe care. Survey data from 430 Registered Nurses is analyzed through multi-level modeling to determine the extent co-worker characteristics effects nurse perception of patient safety. Results contribute to the present body of knowledge by shifting the focus of study away from individual nurse qualifications and acknowledging the potential effect of available collegial support on patient safety [10].

2. Methods

Nursing work is intimately linked with patient safety, and Registered Nurses working in acute care settings have a unique vantage point in determining the realities of their own working conditions. Examination of factors influencing Registered Nurse perception of patient safety may provide invaluable information regarding improving the safety of hospitalized patients. Because previous literature finds nurses who are well supported by qualified co-workers report lower levels of work related distress, it is predicted that individual nurse perceptions of patient safety will be increased on units with more highly qualified nurses.

Hypothesis 1: The percent of nurses working on a hospital unit with a Baccalaureate degree or higher will have a positive effect on individual Registered Nurse perception of patient safety.

Hypothesis 2: The percent of nurses working on a hospital unit who are Registered Nurses, as opposed to Practical or Vocational nurses, will have a positive effect on individual Registered Nurse perception of patient safety.

Hypothesis 3: The percent of nurses working on a hospital unit who are classified as full time employees will have a positive effect on individual Registered Nurse perception of patient safety.

Hypothesis 4: Average tenure in years of nurses working on a hospital unit will have a positive effect on individual Registered Nurse perception of patient safety.

This study analyzes data provided by a 2004 survey of hospital nurses conducted at two Midwestern hospitals. Selected survey questions address staff attitudes regarding perceptions of patient safety. Surveys were administered to 850 nurses, each with at least six months of tenure within their respective hospital. Using Dillman’s [21] multi-contact method, potential subjects were contacted regarding survey completion in four separate mailings: (a) an introductory letter, (b) the survey, (c) a reminder post card, and (d) a replacement survey for non-respondents. This method yielded a response rate of 72%. Hospital personnel records were used to assess for non-response bias. There were no significant demographic differences between respondents and non-respondents. Respondents were 95% female and 98.6% Caucasian, a composition consistent with the United States nursing workforce as a whole [22,2]. Only Registered Nurses are included in the present analysis, resulting in a sample size of 430.

Table 1 – Characteristics of Registered Nurses Included in Study Sample

Level of Education	
Diploma/Technical Degree	23.6%
Associate Degree	26.3%
Bachelor’s Degree	46.7%
Master’s Degree	3.4%
Employment Category	
Part Time	33.6%
Full Time	66.4%
Years Employed on Unit	
1-3	31.3%
4-9	30.3%
10-14	12.3%
15 and above	20.3%

Unit level variables *Percent of nurses on unit with Baccalaureate Degree or higher*, *Percent of nurses on unit who are Registered Nurses*, *Percent of nurses on unit who are full time employees*, and *Average tenure of nurses on unit in years*, are taken directly from data supplied by hospital personnel records. Measurement of the outcome variable *Nurse Perception of Patient Safety* is achieved through use of confirmatory factor analysis. Survey items dealing with nurse perception of patient safety were selected.

Selected Survey Items

1. People in my department view patient safety as their highest priority.
2. People in my department think highly of anyone who volunteers for initiatives to improve patient safety.
3. In my department, we always seek opportunities to make procedures safer for our patients.
4. In my department, everyone, junior and senior, is expected to take responsibility for improving patient safety.
5. People in my department do not value correcting the root causes of patient safety problems
6. In my department, people who continuously try to improve patient safety are valued.
7. People in my department care about improving patient safety only when a patient has been seriously harmed.
8. If someone close to me needs medical help, I will confidently recommend treatment at my department.

Specified survey items were designed with five-point Likert type scales (1=strongly disagree, 5=strongly agree). Confirmatory factor analysis, conducted using the AMOS statistical package, indicates the eight items related to patient safety load significantly on the latent variable *Nurse Perception of Patient Safety*. Model fit statistics are as follows: Chi Square 120.65, Degrees of Freedom 20, Chi Square/df 6.032, CFI .931, RMSEA 1.08. Reliability analysis yields a Cronbach's Alpha of .874 (8 items).

Assessing the effect of unit level characteristics on individual nurse perceptions requires the use of multilevel modeling. A multilevel or hierarchical approach is also necessary to address the nesting, or clustering, of nurses within hospital units. Unit level nurse characteristics, (*Percent of nurses on unit with Baccalaureate Degree or higher, Percent of nurses on unit who are Registered nurses, Percent of nurses on unit who are full time employees, Average tenure of nurses on unit in years*), the independent variables in the present analysis, do not vary within groups of nurses who work on the same hospital unit. The assumption of independent error terms, necessary for single level modeling, is violated. Hierarchical Linear Modeling, through use of the HLM version 6.0 statistical program, allows for accurate analysis of multilevel and clustered data, and is therefore the chosen method of analysis [23,24].

3. Results

Variation in *Nurse Perception of Patient Safety* occurs at two levels. First, there is 'within' hospital unit variation, or variation in levels of safety perception as reported by individual nurses positioned in the same hospital unit. Because there are twenty-nine hospital units reporting data, there are twenty-nine within unit models. Second, there is 'between' unit variation. This is variation not among individual nurses, but between hospital units. The between unit models assess for significant variation in nurse perception of unit safety between the twenty-nine within unit models.

The initial HLM analysis seeks to answer the question, "How much of the variation in *Nurse Perception of Patient Safety* can be accounted for by between unit variation?" A significant amount of total variance that is attributable to between unit variance supports the hypothesis that unit level characteristics are predictive of individual nurse perceptions of unit safety. For the outcome variable *Nurse Perception of Patient Safety*, the following initial results were obtained: Coefficient 3.934, Standard Error .047, *t*-ratio 83.045, $p < .000$. A significant amount of the variation in *Nurse Perception of Patient Safety* is attributable to between unit variation. This leaves open the opportunity to further test our hypotheses that unit level characteristics account for variation in individual perceptions of patient safety.

Because variance in individual nurse perception of unit safety may be affected by a nurse's level of education, years of experience on the unit, and employment category (full vs. part time), the analysis was re-run controlling for these variables. The amount of variance in *Nurse Perception of Patient Safety* that can be accounted for by 'between' unit variance remains significant after controlling for these individual characteristics. The results for the analysis included control variables are as follows: Coefficient 3.932, Standard Error .046, *t*-ratio 85.655, $p < .000$.

To test the hypothesis that as co-worker qualifications increases nurse perception of unit safety increases as well, an analysis was run to determine the amount of 'between' unit variance in unit safety perception that can be explained by unit level nurse characteristics. It is hypothesized that the outcome variable *Nurse Perception of Patient Safety*, measured at the individual level, would increase significantly with increased co-worker qualifications, measured at the unit level by the following independent variables: *Percent of Nurses with a Baccalaureate Degree or higher, Percent of licensed nurses who are Registered Nurses, Percent of nurses who are classified as full time employees, and Average tenure in years of nurses on unit*.

Average tenure in years of nurses on a unit was found to have a significant, positive relationship to nurse perception of patient safety on his/her hospital unit ($p < .052$). This indicates a significant amount of the 'between' unit variance in nurse perception of patient safety can be explained by variance in the average tenure of nurses on individual hospital units. Consistent with Hypothesis 4, Registered Nurses working on units with nurses who on average have many years of experience perceive their unit to be safer for patients than Registered Nurses working on units with less experienced nurses. The analysis yielded no significant relationships between the independent variables

Table 2 – HLM Results: Influence of Unit Level Variables on Nurse Perception of Patient Safety

	<u>Coefficient</u>	<u>Standard Error</u>	<u>t-ratio</u>	<u>p</u>
Intercept	3.923	0.04	94.67	0.000
Tenure in Years	0.03	0.015	2.046	0.052
Percent with BA Degree or higher	-0.247	0.28	-0.882	0.387
Percent RN	0.004	0.003	1.416	0.17
Proportion Full Time	-0.003	0.003	-0.868	0.394

Percent of Nurses with a Baccalaureate Degree or higher, Percent of licensed nurses who are Registered Nurses, Percent of nurses who are classified as full time employees and the outcome variable Nurse Perception of Patient Safety.

4. Discussion

The positive, significant relationship between average nurse tenure on a hospital unit and individual perception of patient safety appears to confirm the assertion of previous literature that providing nurses with co-workers who are able to provide collegial support improves nurse perception of his/her workplace environment. The established link between perception of workplace distress among nurses and errors of both commission and omission [25, 26, 27] support the conclusion that factors which have been shown to decrease workplace stress, such as collegial support, may also work to improve patient safety.

The lack of significance between *Percent of Nurses with a Baccalaureate Degree or higher*, *Percent of licensed nurses who are Registered Nurses*, *Percent of nurses who are classified as full time employees* and the outcome variable *Nurse Perception of Patient Safety* perhaps speaks to influence nurse experience has on the ability to provide collegial support to co-workers. Though staffing hospital units with nurses who have increased education, licensure, and work more hours per week may result in positive outcomes in other areas, it appears to have little effect on nurse's perception of their unit's ability to deliver safe care.

A primary contribution of this work is to highlight the potential importance of collegial support in nursing practice. Much analysis of nursing stress and safety involves objective measures of nursing workload, such as nurse-to-patient ratios and levels of patient acuity. Though these objective measures are indeed important, the current study brings to light the potential importance of social support in determining a nurse's workplace burden, as well as the effect this may have on a hospital unit's safety environment.

Previous work has found the addition of information technology, such as electronic medical records, decision support systems, and error reporting systems, to the hospital setting reduces medical error [3,4]. Technological upgrades may also provide nurses with informational support similar to that of experienced co-workers. An adequate reduction in medical error, however, has not been achieved through technological upgrades alone. The present analysis indicates a combination of social and technological modifications, or technology to better mirror the support given by experienced co-workers, may best provide nurses with the environments needed to reduce error.

This work has several limitations. Nurses included in the sample were employed in similar hospital environments within close geographical proximity. Also, the data is cross sectional in nature, leaving open the possibility that nurse responses were based upon events or incidents temporally close to data collection. The cross sectional nature of the data also limits the ability to infer causality in the examined relationships. Further research is needed to assess for the effect differing levels of available information technology has on nurse perception of patient safety and the influence of experienced co-workers.

References

1. Institute of Medicine. *To Err is Human: Building a Safer Health System*. Washington DC: National Academies Press, 2000.
2. Institute of Medicine. *Keeping Patients Safe: Transforming the Work Environment of Nurses*. Washington DC: National Academies Press, 2004.
3. D. Bates, L.L. Leape, D.J. Cullen, N. Laird, L. A. Peterson, J.M. Teich, E. Burdick, M. Hickey, S. Kleeffeld, B. Shea, M. Vander Vliet, D.L. Seger. "Effect of Computerized Physician Order Entry and a Team Intervention on Prevention of Serious Medical Errors". *Journal of the American Medical Association*, vol. 280, no. 15, 1998, pp. 1311-1316.
4. J.G. Anderson. "Information Technology for Detecting Medication Errors and Adverse Drug Events". *Expert Opinion on Drug Safety*, vol. 3, no. 5, 2004, pp. 449-55.
5. G. Ramsey. "Nurses, Medical Errors, and the Culture of Blame". *The Hastings Report*, vol. 35, no. 2, 2005, pp. 20-21.

6. G.L. Ingersoll, M. Fisher, B. Ross, M. Soja, N. Kidd. "Employee Response to Major Organizational Resign". *Applied Nursing Research*, vol. 14, no. 1, 2001, pp. 18-28.
7. L.H. Aiken, S.P. Clarke, D. M. Sloane, J. Sochalski, J. H. Silber. "Hospital Nurse Staffing and Patient Mortality, Nurse Burnout, and Job Dissatisfaction". *Journal of the American Medical Association*, vol. 288, no. 16, 2002, pp. 1987-1993.
8. A.F. Cook, H. Hoas, K. Guttmanova, J.C. Joyner. "An Error By Any Other Name". *American Journal of Nursing*, no. 104, vol. 6, 2004, pp. 32-43.
9. D. Bates, D. Cullen, N.Laird, L. Petersen, S. Smal, D. Servi, G. Laffel, B. Sweitzer, B. Shea, R. Hallisey, M. Vandervleit, R. Nemeskal, L. Leape. "Incidence of Adverse Drug Events and Potential Adverse Drug Events: Implications for Prevention". *Journal of the American Medical Association*, vol. 274, 1995, pp. 29-34.
10. M. R. Shirey. "Social Support in the Workplace: Nurse Leader Implications". *Nursing Economics*, vol. 22, no. 6, 2004, pp. 313-319.
11. M.L. Campbell. "The Structure of Stress in Nurse's Work. In B. S. Bolaria and H. D. Dickinson. *Sociology of Healthcare in Canada*. Toronto: Harcourt Brace Jovanovich, 1988.
12. S. Reverby. "A Caring Dilemma: Womanhood and Nursing in Historical Perspective. In P. Conrad. *The Sociology of Health and Illness*. New York: Worth Publishers, 2005.
13. A.L. Tucker, A.C. Edmondson. "Why Hospitals Don't Learn from Failures". *California Management Review*, vol. 45, no. 2, 2003, pp. 55-72.
14. L. Quine. "Effects of Stress in an NHS Trust: A Study". *Nursing Standard*, vol. 13, no. 3, 1998, pp. 36-41.
15. J. Eisenberg, C. Bowman, N. Foster. "Does a Healthy Health Care Workplace Produce Higher Quality Care?". *Joint Commission Journal on Quality Improvement*, vol. 27, no. 9, 2001, pp. 444-457.
16. S. Salmond, P.E. Ropia. "Job Stress and General Well-Being: A Comparative Study of Medical-Surgical and Home Care Nurses". *MedSurg Nursing*, vol. 14, no. 5, 2005, pp. 301-309.
17. Kaissi, T. Johnson, M.S. Kirschbaum. "Measuring Teamwork and Patient Safety Attitudes of High Risk Areas". *Nursing Economics*, vol. 21, no. 5, 2003, pp. 211-218.
18. J.B. Sexton, E.J. Thomas, R.L. Helmreich. "Error, Stress, and Teamwork in Medicine and Aviation". *British Medical Journal*, vol. 320, no. 7237, 2000, pp. 745-750.
19. B. Liang. "A System of Medical Error Disclosure". *Quality and Safety in Healthcare*, vol. 11, 2002, pp. 64-68.
20. Pearson. "Minimizing Errors in Health Care: Focusing on the Root Cause Rather Than the Individual". *International Journal of Nursing Practice*, vol. 11, no. 4, 2005, p. 141.
21. D.A. Dillman. *Mail and Internet Surveys: The Tailored Design Method*. New York: Wiley, 2000.
22. S. Tangirala, S. Green, R. Ramanujam. "In the Shadow of the Boss's Boss: Effects of Supervisors' Upward Exchange Relationships on Employees". *Journal of Applied Psychology*, in press.
23. K. Leung, R. M. Elashoff, K. S. Rees, M. H. Hasan, A. P. Legorreta. "Hospital and Patient Related Characteristics Determining Maternity Length of Stay: A Hierarchical Linear Model Approach". *American Journal of Public Health*, vol. 88, no. 3, 1998, pp. 377-381.
24. C. Arnold. "An Introduction to Hierarchical Linear Models" *Measurement and Evaluation in Counseling and Development*, vol. 25, no. 2, 1992.
25. B.J. Bowers, C. Laurant, N. Jacobson. "Managing Time and Work in Long Term Care." *Journal of Advanced Nursing*, vol. 33, no. 4, 2001, pp. 484-491.
26. M.C. Balas, L.D. Scott, A.E. Rogers. "The Prevalence and Nature of Errors and Near Errors Reported by Hospital Staff Nurses" *Applied Nursing Research*, vol. 17, no. 4, 2004, pp. 224-230.
27. P. Potter, L. Wolf, S. Boxerman, D. Grayson, J. Sledge, C. Dunagan, B. Evanoff. "An Analysis of Nurses' Cognitive Work: A New Perspective for Understanding Medical Errors". *AHRQ Publications*, vol. 1-4, no. 050021, 2005.