Patient Falls: Association With Hospital Magnet Status and Nursing Unit Staffing

Lake, Shang, Klaus, & Dunton, 2010, *RINAH*

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Background and Significance

- 1 to 8 patients fall per 1,000 inpatient days depending upon the type of nursing unit (Enloe et al, 2005)
- Patient falls are 1 of the 8 patient outcomes included in the nursing care performance measures adopted by the National Quality Forum (NQF, 2004, 2009)

Background and Significance

- Better understanding of the multiple factors that influence patient safety may:
 - assist hospital managers in making evidencebased recruitment and staffing decisions
 - encourage consideration of the potential benefits of Magnet recognition

Purpose and Innovation

- To examine the relationships among nurse staffing, RN composition, hospitals' Magnet status, and patient falls
- Few researchers evaluating falls have examined all types of nursing staff, the RN staff composition or considered the hospital's Magnet status

"The Organization of Hospital Nursing" Lake, 1999



Theoretical Reasoning – I

- Adequate evaluation, support and supervision of patients by hospital staff can minimize the fall rate.
- The capacity for staff to evaluate, support and supervise patients may depend on how a nursing unit is staffed with RNs, LPNs and NAs, as well as the proportion of RNs with bachelor's degrees in nursing, specialty certification, or who are hospital employees.
- Hypothesis: Patient fall rates on similar units would differ based on nurse staffing and their RN composition (i.e., education, certification, and employment status)

Theoretical Reasoning – II

- The relationships between staffing and Magnet status with patient falls are presumed to operate through evaluation, support, and supervision, which were not measured in this study.
- Evaluation:
 - pertain principally to the RN role.
 - influenced by nurse knowledge, judgment, and assessment skills, which may vary according to education, experience, certification, and expertise.
- Supervision : predominantly by RNs and LPNs
- Support : predominantly by NAs.
- Supervision and support would be directly influenced by staff *availability*, measured here as hours per patient day (Hppd).

Literature Review

- Lake, E.T., & Cheung, R. (2006). Are patient falls and pressure ulcers sensitive to nurse staffing? Western Journal of Nursing Research.
- Burnes Bolton, et al. (2007). Mandated nurse staffing ratios in California: A comparison of staffing and nursing-sensitive outcomes pre- and post-regulation. *Policy, Politics, & Nursing Practice*.
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- Dunton et al. (2007). The relationship of nursing workforce characteristics to patient outcomes. OJIN: *The Online Journal of Issues in Nursing*.
- Mark, et al.(2008). Exploring organizational context and structure as predictors of medication errors and patient falls. *Journal of Patient Safety*.
- Schubert, et al. (2008). Rationing of nursing care and its relationship to patient outcomes. International Journal for Quality in Health Care
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Methods

- Design: Retrospective cross-sectional observational study using 2004 NDNQI data
- Dependent Variable:
 - *Patient fall*: defined by the NDNQI as an unplanned descent to the floor, with or without an injury to the patient
 - Nursing unit fall rates calculated as falls per 1,000 patient days

• Independent Variables:

- Nurse staffing- measured as Hppd
- RN staff composition— include nurse education level, national specialty certification, and proportion of hours supplied by agency employee nurses
- Hospital Magnet status

NDNQI Database Complexity

- 667 hospitals and 7,920 nursing units in 2004
- Four raw subsets:
 - quarterly data on RN education and certification
 - monthly data on staffing and patient days
 - individual data on patients who fell
 - individual data on all patients examined for pressure ulcers during observational prevalence studies.
- Observations: 24,000 quarters, 66,000 months, 117,000 patient falls, and 312,000 patients observed for pressure ulcers.

NDNQI Data Analysis Challenges

- Multiple levels of observation (patient, nursing unit, hospital)
- Multiple periods of observation (day, month, quarter, year)
- Multiple data sources (human resources, utilization management, primary observational data)

Compare Staffing in NDNQI Hospitals and U.S. General Hospitals

- Because the NDNQI is a benchmarking database, we speculated that the overall nurse staffing may differ from typical general hospitals
- Different staffing levels might influence the relationships we detect within the NDNQI vs. those that may be observed in a more typical sample
- To explore this sampling implication, we analyzed AHA staffing data to compare US general hospital to NDNQI hospitals by using *t-tests*

Compare Staffing with NDNQI Hospitals: Magnet and Non-Magnet

- We speculated further that NDNQI Magnet hospitals may staff at higher levels than NDNQI non-Magnet hospitals
- We compared staffing levels at the hospital level using AHA Hpapd data and at the nursing unit level using NDNQI Hppd data

Results

- The average CMI for NDNQI hospitals was 1.65, indicating that NDNQI hospitals cared for more complex Medicare patients than the average hospital.
- In 2004, the sample nursing units reported 113,067 patient falls.
- The observed fall rate across all nursing units was 3.32 per 1,000 patient days (1,000PD).

Nursing Staff Hours (per patient day) and Fall Rate by Unit Type

Nursing Unit Type	RN	LPN	NA	Fall Rate
Critical Care	14.84	0.13	1.67	1.38
Stepdown	7.03	0.39	2.51	3.35
Medical	5.11	0.55	2.39	4.51
Surgical	5.22	0.58	2.38	2.79
Medical-Surgical	5.04	0.65	2.39	3.93
Rehab	4.02	0.75	2.87	7.33

Multivariate Model

- The dependent variable is fall count; patient days was the exposure on the right side of the equation
 - Approach equivalent to having the *fall rate* as the dependent variable
- Advantage of analyzing the actual fall count and patient days is the all available information in the data is used for estimated
- A negative binominal model was used because the fall count follows a negative binominal distribution (i.e., its variance exceeds its mean)
- Coefficients were estimated using Generalized Estimating Equations, which take into account repeated measures and clustering

Model Sequence Part I

- *Model* 1:
 - Used only independent variables
 - Revealed the initial effect sizes of the independent variables alone
- *Model* 2:
 - Added all control variables
 - Showed the final effect sizes accounting for control variables

Model Sequence Part I

	Model 1, IRR (n=50,810)	Model 2, IRR (n=50,810)
Nurse Staffing		
RN Hppd	0.910***	0.984***
LPN Hppd	1.015	1.030**
NA Hppd	1.043***	1.011*
Magnet Hospital	0.948***	0.947***
Nursing Unit Type		
ICU		0.211***
Stepdown		0.484***
Medical		0.632***
Surgical		0.397***
Med-surg		0.545***
Rehab		Reference
R ²	0.030	0.049

 Notes: p < .001, p < .01, p < .05. Observations are nursing unit months.

Model Sequence Part II

- Models 3 and 4:
 - For ICUs and non-ICUs separately
 - Fundamental differences between ICUs and non-ICUs may result in different patterns of relationships among nursing factors and falls
 - ICUs
 - High level of RN hours and a nearly all RN-level staff
 - Patients may be at lower risk for falling because they are critically ill and frequently sedated
 - Non-ICU units (stepdown, medical, surgical, medical-surgical, rehabilitation)
 - Staff with RNs, LPNs, and NAs
 - Care for less critically ill patients who are physically able to move enough to fall

Model Sequence Part II

Incident Rate Ratios of Patient Falls Based on Negative Binomial Regressions					
	Model 3 (ICU), IRR (n=11,520)	Model 4 (non-ICU), IRR (n=39,290)			
Nurse Staffing					
RN Hppd	0.967***	0.994			
LPN Hppd	1.098**	1.035**			
NA Hppd	0.989	1.015*			
Magnet Hospital	0.860***	0.960**			
Nursing Unit Type					
ICU					
Stepdown		0.471***			
Medical		0.627***			
Surgical		0.396***			
Med-surg		0.544***			
Rehab		Reference			
R ²	0.008	0.019			

 Notes: p < .001, p < .01, p < .05. Observations are nursing unit months.

Multivariate Results

- Hospital Magnet recognition was negatively associated with patient falls. The fall rate was 5% lower in Magnets.
- RN hours were negatively associated with falls; an additional hour of RN care per patient day reduced the fall rate by 2%
- LPN and NA hours had positive relationships with falls; an additional hour of LPN care increased the fall rate by 2.9% and an additional hour of NA care increased the fall rate by 1.5%
- One RN hour is only 1/3 of a standard deviation in ICUs
- At the other extreme, one LPN hour is two SDs in ICUs

Scenario 1

Predicted Patient Fall Rate per 1,000 Patient Days on Different Types of Nursing Units by Hospital Magnet Status

Unit Type						
	ICU	Stepdown	Medical	Surgical	Med-Surg	Rehab
Magnet	1.12	3.29	4.35	2.67	3.75	6.84
Non-magnet	1.30	3.44	4.54	2.79	3.92	7.15

Scenario 2

Estimated Number of Patient Falls Per Year in Magnet and Non-Magnet Hospitals by Nursing Unit Type

Unit Type						
	ICU	Stepdown	Medical	Surgical	Med-Surg	Rehab
Magnet	4.5	24.0	23.1	34.8	31.1	43.3
Non-magnet	5.2	25.1	24.2	36.3	32.5	45.3

Summary of Findings

- Principal findings suggest
 - Staffing levels have small effects on patients falls
 - RN hours are negatively associated with falls in ICUs
 - LPN and NA hours are positively associated with falls principally in non-ICUs
 - Fall rates are lower in Magnet hospitals
- Two potential mechanisms for enhancing safety:
 - Becoming or emulating a Magnet hospital
 - Adjusting staffing patterns the unit level

What did we learn about the NDNQI hospitals?

- Higher fraction of Magnet hospitals in the NDNQI database (17%) vs. 7% nationally in 2004
 - Magnet requirement that a hospital participate in a quality benchmarking system
 - Interest in quality improvement that is common to the Magnet hospital ethos.
- Lower SD for RN staffing from AHA data
 - .50 vs. .75 HPAPD
 - Benchmarking feedback may yield similar staffing patterns and less variability in nursing hours than typical hospitals

What else did we learn about the NDNQI hospitals?

- NDNQI hospitals have higher staffing than the average U.S. hospital (7.86 and 6.06 RN hours per patient day, respectively)
- Magnet NDNQI hospitals have higher staffing than non-Magnets (8.50 and 7.70 RN HPAPD, respectively)
- All differences significant at <.01

Alternative Explanations for RN Hours Effect in ICUs

- Providing more RN hours will lead to fewer falls
- ICUs with higher RN hours have patients who are too ill to move and accordingly have a lower fall risk will lead to fewer falls
 - In this case, the lower risk, rather than the better staffing, accounts for the fewer falls

Alternative Explanations for NA Hours Effect in Non-ICUs

- Higher NA staffing somehow causes a higher fall rate
- Nursing units attempted to address high fall rates by increasing their least expensive staffing component– NAs;
 - so temporally, staffing follows falls rather than falls following staffing.

High Fall Rate on Rehab Units

- Fall rate substantially higher on rehab units than on medical units, the next highest fall rate (7.33 vs. 4.51 per 1,000D)
- High rate likely due to people learning to walk again postsurgery
- How to reduce falls on rehab units is compelling for future study
 - Research questions could include role of physical therapy or the effectiveness of alternative fall prevention protocols

Explanations for Lower Fall Rate in Magnet Hospitals

- Confirmed in two different data sources that Magnet hospitals in the sample had higher RN staffing levels than non-magnet
- In multivariate regression analyses, we identified a Magnet hospital effect independent of RN staffing level
 - Therefore, higher RN staffing was NOT the reason for the lower fall rates identified in Magnet hospitals
- Basis for lower fall rates in Magnet hospitals remains open question for future research

Using the NDNQI for Research

- Two aspects of the NDNQI sample may yield effect sizes different from those that might be estimated in a representative sample of general hospitals
 - Benchmarking purpose of the NDNQI attracts hospitals oriented towards quality improvement through nursing systems decisions.
 - The feedback provided may lead these hospitals to implement similar staffing patterns.
 - Yields less variability in nursing hours than would be observed in all general hospitals.

Using the NDNQI for Research

- Significantly higher RN staffing was detected in NDNQI hospitals as compared to U.S. general hospitals
 - Suggests that the multivariate model results apply to hospitals at the high end of the staffing range
- Magnet hospital effect identified may underestimate the "true" Magnet effect to compare Magnets with all general hospitals because the "comparison" hospitals in the sample already participate in a quality benchmarking initiative.
 - The "non-Magnet" group includes some Magnet applicants in various stages of implementing Magnet standards

Using the NDNQI for Research

- NDNQI remains useful for research questions that incorporate new measures including
 - Other nursing workforce characteristics (e.g., expertise, experience)
 - A survey measure of the nursing practice environment
 - Nursing unit types (psychiatric) and outcomes (restraint use)
- To test fall-prevention interventions by comparing the preand post- intervention fall rate

Limitations

- Cross-sectional design
- Limited data to adjust for patient characteristics
- Age of the data
- Convenience sample

Cross-sectional Design

- Hypothesized causal sequence: the nursing excellence acknowledged by Magnet Recognition translates into safer practice and fewer patient falls.
- However, converse may be plausible: hospitals with fewer falls happen to become Magnet hospitals

Limited Case-Mix Adjustment

- NDNQI data do not contain
 - Patient diagnosis
 - Cognitive impairment
 - Time or shift of the fall
 - Acuity mix within nursing unit types
- Better risk adjustment may yield other findings

Age of the Data

- Since 2004, national initiatives have heightened attention to the prevention of patient falls
 - In 2005, the Joint Commission implemented a new National Patient Safety Goal to reduce the risk of patient harm resulting from falls with a requirement of fall risk assessment and action
 - By 2009, the requirement had evolved to implement and evaluate a falls reduction program
 - In 2008, Medicare stopped reimbursing hospitals for care due to preventable falls
 - Changes may have altered roles of nursing staff, the incidence of patient falls and the associations between them.

Age of Data

- Age also limits how well the results generalize to NDNQI hospitals presently
 - Database has doubled in past 5 years and hospitals under 100 beds are now larger share of participants
- Study variables have been stable during years 2004-2010, except for a few minor clarifications in the data collection guidelines

Implications

- Hospital executives can improve patient safety by creating environments consistent with Magnet hospital standards
- Fewer falls can yield cost savings and prevent patients' pain and suffering
- Nursing unit managers can used these nursing hours and falls statistics for their nursing unit type as reference values to support staffing decisions
- Current study strengthens the evidence base on how nurse staffing patterns and practice environments support patient safety.