Hospital Nurse Staffing and Patient Outcomes

A Review of Current Literature

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An aging nursing workforce, decreased enrollment in nursing schools, financial constraints in healthcare, hospital restructuring and reengineering, and consistent challenges in nursing recruitment and retention have contributed to shortages within the hospital-based nursing workforce. The effects of these shortages have been thought to be associated with various adverse patient outcomes. This article reviews current research studies and presents recommendations for ongoing nursing practice. Keyword: Nursing Shortage. [Dimens Crit Care Nurs, 23(1): 44-50]

Where have all the nurses gone? This decade has witnessed a changing reality of nursing. There is no longer a surplus of caregivers at the bedside providing care to the ill. This developing nursing shortage is due in part to several interrelated factors that ultimately have resulted in a dwindling workforce. The nursing shortage is viewed as both a supply and demand problem.

On the supply side, young people who have traditionally embarked on careers in nursing are choosing other fields, which offer larger salaries and better working conditions.[1] Work intensity within nursing has dramatically increased as patient lengths of stay (LOS) have shortened, individual acuities have risen; an increase in patients entering through the system has led to frequent admission, discharges, and transfers. Students are opting out of nursing careers deeming them not worth the cost. The supply of nurses is additionally hindered by delays in hiring new staff and the continued struggle of hospitals with recruitment and retention issues.[2] The shortage will become frighteningly apparent over the next 2 decades when the largest cohort of RNs will be in the retirement window, leaving the profession with inadequate numbers of replacements.[3]

The demand for healthcare continues at staggering rates as the baby boom generation enters the later stages of their lives. The increased needs of these individuals require intense healthcare services, which entails greater hospital bed occupancy and highly skilled nursing care. A noticeable trend is the increasing hospital occupancy to a current rate of 74.1% of available beds. However, available staffed beds equals only 81% of this demand.[2] Thus, the demand for healthcare will steadily rise and the numbers of nurses to care for these patients will lag behind.

HOSPITAL RESTRUCTURING/ REENGINEERING

In an effort to control escalating operational costs, United States (US) hospitals in the 1990s implemented widespread restructuring and reengineering projects. Hospital restructuring involves large organizational changes such as mergers, acquisitions, conversions of available services, and ownership changes. Reengineering is essentially a process of redesign, which frequently results in modifications in clinical staffing and skill mix and additional reductions in middle management posi-

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tions. One goal of reengineering initiatives is to achieve higher levels of labor productivity and efficiency, thus enabling hospitals to deliver care at a lower cost without decreasing the quality of care.[4]

A generous portion of any hospital's operating expense constitutes labor cost. In efforts to minimize this cost, hospitals opted to decrease their overall labor pool and decrease the number of full-time equivalent nursing positions. This allows lowering the average wages for employees by lowering the necessary skill level for the intended positions. Additionally, reengineering initiatives supported the replacement of professional nurses with the use of unlicensed assistive personnel. To fill the voids left by the reductions in hiring, hospitals began cross-training programs designed to float nurses to various patient care areas in times of staffing shortages, often leaving one area critically low of staff to salvage another.

The consequences of reengineering are multifaceted. RN-to-patient ratios are even lowered when cost-containment initiatives aimed at reducing hospital budgets through job cuts results in loss of valuable RN positions. Despite Medicare's 1984 Prospective Payment System, which created incentives for hospitals to hire more qualified staff by replacing LPNs with RNs, the richer skill mix was created at the expense of the total number of nursing caregivers.[5] Thus, the "do more with less" situation continues even if the "less" are more skilled professionals. Ultimately, the result of declining nurse-to-patient ratios at the hands of reengineering has the potential to affect patient outcomes.

IMPLICATIONS

What are the implications of a nursing shortage? Research is only beginning to demonstrate that staffing levels may be associated with patient outcomes, such as inpatient mortality and other measures of quality of hospital care.[6] Numerous studies have been conducted to describe the relationship between nurse staffing levels and clinical outcomes of patients at both the hospital and unit levels. Most authors agree that the results are uncovering statistically significant relationships between staffing and outcomes; however, they agree that more evaluation is necessary.

The purpose of this article is to review current research literature from the past decade on the effects of nurse staffing on patient outcomes. From this review, recommendations for further research and suggestions to enhance nurse recruitment and retention are discussed.

REVIEW OF THE LITERATURE

Most of the research regarding the association between nurse staffing and patient outcomes investigated the following outcomes: mortality, LOS, and patient complications. Table 1 summarizes the methods and results of 16 studies.[7-10] In the course of the literature review, several areas of concern arose. First, individual results are influenced by the study's setting. Some studies investigated hospital-wide outcomes, whereas others focused on unit-based outcomes. Also, many studies limited their samples to a single hospital or geographic areas, thus limiting the generalizability of the results to other hospitals.[11,12] An exception to this limitation is the recent landmark study conducted with a sample population of over 200,000 patients from 168 hospitals.[13]

Another concern when analyzing the research is the lack of clear operational definitions for the studied variables. There is ambiguity over what constitutes patient outcomes. Several studies offered differentiation of these outcomes as those being unique to nursing care. One study conducted as a request from the Secretary of Health and Human Services to operationally define outcomes, captured those contributions of nurses in providing inpatient care and classified them as Outcomes Potentially Sensitive to Nursing (OPSNs).[14,15] The American Nurse Association has stated that changes in staffing levels, including changes in the overall number and/or mix of nursing staff, should be based on analysis of standardized, nursing sensitive indicators. The effect of these changes should be evaluated using the same criteria.[16]

The variability of the definitions of nurse staffing and the inconsistencies in defining healthcare personnel constitute the last concern. Studies have used several methods to determine nurse staffing, techniques such as observing RN-to-patient day ratios, simple RN-to-patient ratios, RN as a percentage of total nursing care, or hours of direct patient care by RNs.[8-11,17,18] These staffing levels were generally obtained retrospectively from hospital administrative databases. However, a recent study used direct measurement of nurse staffing.[13] Through survey data, the researchers obtained the nurse-patient ratio for the last shift worked to determine staffing levels; thus, reducing the problems of counting RNs not involved in direct bedside care and missing data in administrative databases.[13] Several studies did not account for the staff mix in the various units, such as the use of LPNs, unlicensed assistive personnel,

Table 1 Effects of Staffing on Patient Mortality and Length of Stay

Study	Sample/Method	Results	Comments
Czaplinski (1998)[7] **Purpose:** To test the hypothesis that specialized nursing has an effect on LOS and mortality	11,316 patients from 16 DRGs admitted to an 800-bed teaching hospital on either medical or surgical units; retrospective study	The LOS was decreased in 13 of the 16 DRGs in units with specialized nursing staffs; in the 7 DRGs with recorded deaths, mortality was lower on units with specialized nursing staffs	Physician volume had little to no effect on LOS or mortality; study did not account for severity or acuity of patients within the DRGs
Pronovost (1999)[8] **Purpose:** To determine whether organizational characteristics of ICUs are related to clinical and economic outcomes for abdominal aortic surgery patients	2987 who had abdominal aortic surgery in all Maryland hospitals that performed procedure; observational study; retrospective collection of patient data; prospective collection of ICU data	A decreased ICU NPR in the evening was associated with increased risk of in-hospital mortality and a 20% mean increase in LOS	Multivariate analysis adjusted for patient demographics, comorbid disease, severity of illness, hospital and surgeon volume, and hospital characteristics
Aiken (1999)[9] **Purpose:** To compare differences in AIDS patients' 30-day mortality in various hospital settings	1205 consecutively admitted patients in 40 units in 20 hospitals and survey data from 820 nurses; survey data and verbal interview of sample; retrospective study	Increased NPRs (as seen in magnet hospital settings known for better nursing care) was associated with a decreased 30 mortality; an additional nurse per patient day reduced odds of dying by one-half	Data adjusted for the patient characteristics, HIV risk categories, and illness severity
Bond (1999)[10] **Purpose:** To evaluate associations among hospital characteristics, staffing levels of healthcare professionals, and mortality rates	3763 hospitals in United States; retrospective study using Medicare Hospital Mortality Information and hospital staffing data from American Hospital Association database	Mortality rates decreased as staffing level per occupied bed increased for medical residents, RNs, registered pharmacists, medical technologists, and total hospital personnel. Mortality rates increased as staffing level per occupied bed increased for hospital administrators and LPNs	Database information from 1992; only FTE personnel were used for analysis, part-time employment levels may have influenced the findings; controlled variables included severity of illness and hospital characteristics
Aiken (2000)[4] **Purpose:** To describe changes which have occurred in US hospitals during restructuring and explore possible consequences for nurses and patients with the shifts in organization and staffing	1986 survey data from nurses in 12 hospitals; 2306 survey responses from chief executive officers at 646 hospitals nationwide; survey of more than 2000 nurses in 22 hospitals (12 of those same as 1986); retrospective data on staffing patterns and hospital death rates	A strong negative relationship was noted between FTE RNs and mortality rates; the higher the staffing level, the lower the death rate with respect to expected levels for group of 22 hospitals	A relationship persists but weaker correlations existed when examining variables from larger sample population of 314 nonfederal hospitals
Amaravadi (2000)[11] **Purpose:** To determine if having a NNPR of one nurse caring for one or two patients verses one nurse caring for three or more patients in the ICU is associated with clinical and economic outcomes following esophageal resection	366 adult patients in 35 nonfederal acute care hospitals in Maryland; statewide observational cohort study; prospective survey of hospital characteristics; retrospective study of hospital discharge data	A 39% increase in median in hospital LOS and a 32% increase in hospital costs was associated with a NNPR <1:2; no significant association between NNPR and in-hospital mortality	The impact the NNPR had on LOS was on the total hospital LOS and not simply the ICU LOS
Tourangeau (2002)[12] **Purpose:** To further the understanding of the effects of nursing related variables: RN skill mix, years of experience on clinical unit, and reported number of shifts missed on 30 day mortality rates	46,941 patients in 75 acute care hospitals in province of Ontario, Canada; prospective survey of nurse and hospital characteristics linked to retrospective discharge data using Canadian databases	A richer RN skill mix and the years of experience by RNs on their clinical unit were significantly and inversely related to 30-day mortality	Model accounted for only 32% of the variance in 30 day adjusted mortality so other unknown determinants are factors in patient's deaths
Aiken (2002)[13] **Purpose:** To determine the association between PNR and patient mortality, failure to rescue among surgical patients, and factors related to nurse retention	232,342 patients from 168 nonfederal adult hospitals in PA; prospective survey of nurse staffing linked to retrospective hospital discharge data	In hospitals with high PNRs, surgical patients experience higher risk-adjusted 30-day mortality and failure-to-rescue rates	Used direct measurement of nurse staffing rather than administrative databases

LOS, length of stay; ICU, intensive care unit; DRG, diagnostic related group; NNPR, night-time nurse-to-patient ratio; PNR, patient-to-nurse ratio; FTE, full-time equivalent; PE, pulmonary embolism; UTI, urinary tract infection.

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or the respiratory therapist who may influence outcomes through their treatments. Early hospital restructuring efforts and cost-containment initiatives resulted in personnel reductions, specifically RN positions, leading to greater skill mixes on units and declines in the proportions of RN-to-patient ratios.[4] Research must account for all factors influencing patient outcomes.

Staffing and Patient Mortality

It has been widely recognized through research that nurse staffing variables, such as specialized nursing staffs, increased RN-to-patient ratios and a richer RN skill mix are inversely related to inpatient mortality rates.[4,7,10,12,13] The review of the current literature continues to support this finding. Pronovost[8] revealed in his Maryland hospital study, that decreasing the ICU nurse-patient ratio increased the risk of in-hospital mortality. This study is further enhanced by Aiken's[9] results of magnet hospitals. Magnet hospitals are recognized as providing optimal patient care due in part to employee organizational characteristics that allow for greater nursing autonomy and cohesive working environments. Aiken[13] continued to investigate RN staffing and patient outcomes in her 2002 landmark study. For the first time, research using a large, diversified data set concluded that surgical patients experience a 7% increase in 30-day mortality and a 7% increase in odds of failure to rescue rates (death from complications) with each additional patient per nurse. Bond's[10] research concluded that in addition to RN staffing, other healthcare professionals (eg, medical residents, registered pharmacists, medical technologists) can influence mortality. As staffing levels of certain healthcare professionals increased, including RNs, mortality rates decrease. However, such was not the case when increasing staffing level per occupied bed for hospital administrators and licensed practical nurses. Tourangeau[12] went one step further and added the aspect of clinical experience to the equation. She found that in addition to a richer RN skill mix, the number of years of nursing experience in a particular area was inversely related to mortality rates. Czaplinski's[7] study compliments this trend by uncovering lower mortality rates in units with specialized nursing staff, such as in intensive care units (ICUs) or oncology units. In contrast, a study conducted by Amaravadi[11] concluded that there was no significant association between night-time nurse-to-patient ratios and mortality in postoperative esophageal resection patients within various ICUs located in Maryland hospitals.

Staffing and Length of Stay

Some studies found an increase in mean LOS for patients related to decreased staffing ratios.[9,11] Patients incur longer hospital stays when higher nurse-to-patient ratios result in more complications and, thus, the need for skilled medical care. Although Amaravadi[11] found no link between staffing and mortality, he did note a nearly 40% increase in median in hospital LOS with subsequent elevations in total hospital cost associated with night nurse-to-patient ratios >1:2. When factoring in the level of care on specialized nursing units, Czaplinski revealed a reduced LOS in 13 of 16 DRGs in units with concentrated staff expertise.[7] Thus, patients admitted to specialized care units, such as cardiac intensive care units with nurses specifically educated in cardiac care and rehabilitation, fair better and have shorter LOS.[7]

Staffing and Patient Complications

Mortality and LOS are not the only outcomes influenced by nurse staffing levels. Adverse outcomes measured vary among the research, although all studies determined an inverse relationship between staffing ratios and complications. Several studies focused on specific complications that occur at unit levels, such as falls, medication errors, and rates of decubiti.[13,15,17,19,20] Findings supported their hypothesis that higher staffing ratios by RNs were associated with lower rates of unit-specific complications. Interestingly, another study found that this inverse relationship existed up to a point.[14,17] Once RN staffing proportion exceeded 87.5% of the total staff mix, higher rates of adverse effects were noted. The researchers had no clear explanation for the benchmark; however, they speculated that patient acuity, even though controlled, was a likely factor. The acuity indicators used for the control may have not been sensitive enough to control for the severity of patients' conditions in modern critical care units.

Various measured outcomes are linked to nurse staffing. Researchers are attempting to isolate those indicators depicting quality of nursing care affected by staffing, labeling those outcomes potentially sensitive to nursing (OPSN). Yet, there is no clear definition as to which specific outcomes are nurse sensitive.

Needleman[22] attempted to clarify the confusion by testing numerous patient outcomes:

Table 2 Effects of Staffing on Adverse Outcomes/Patient Complications

Study	Sample/Method	Results	Comments
Blegen (1998)[14] **Purpose:** To determine the relationship between the hours of nursing care and six common adverse outcomes (medication errors, falls, urinary/respiratory infections, decubiti rates and patient complaints)	42 inpatient units in an 880-bed hospital; retrospective study	The proportion of hours of care delivered by RNs was inversely related to the unit rates of medication errors and decubiti; total hours of care from all nursing personnel were associated with higher rates of decubiti, complaints, and mortality; the higher the RN skill mix, the lower the incidence of adverse occurrences	Patient acuity was controlled and data was collected at unit level; study used a limited sample size of one hospital
Kovner (1998)[15] **Purpose:** To examine the relationship between nurse staffing and patient outcomes. Nurse sensitive adverse occurrences included venous thrombosis, PE, UTI, and pneumonia after surgery or invasive procedures	Stratified random population sample of 506 acute care hospitals in 10 states; descriptive-correlational design using retrospective data	A significant inverse relationship noted between nurse staffing (FTE RNs) and three of the five nurse sensitive adverse events: UTI, pneumonia after surgery and thrombosis after surgery; an increase of 0.5 RN hours per patient day is associated with a range decrease of (1.8-4.5%) in UTI, pneumonia, and thrombosis	Adverse events may be correlated to other nonmeasured staffing variables such as staff mix
Blegan and Vaughn (1998)[16] **Purpose:** To examine the relationship between nurse staffing (total hours from all nursing personnel and proportion of hours delivered by RNs) and patient outcomes (medication errors, falls and cardiopulmonary arrest	Convenience sample of 39 units in 11 hospitals; descriptive-correlational design using retrospective data	Higher proportion of RN care is associated with lower rates of adverse outcomes; higher RN proportion associated with lower rates of medication errors (up to a proportion of 85%) and patient falls	Patient acuity was controlled and data was collected at unit level
Pronovost (2001)[17] **Purpose:** To evaluate the association between nurse to patient ratio in the ICU and risk for medical and surgical complications after abdominal aortic surgery	2606 patients from 46 Maryland hospitals; observational study; organizational characteristics of ICUs obtained through survey data; retrospective review of hospital discharge records	Patients in hospitals with fewer nurses were more likely than patients in hospitals with more nurses to have an increased risk for respiratory-related complications after abdominal aortic surgery	Study limited to one type of procedure in one state; study did not account for adjustment in differences in staffing, such as staff mix, training,or experience
Sovie (2001)[18] **Purpose:** To describe restructuring in the organization and delivery of patient care and the effects of nursing structure and processes on patient outcomes (falls, nosocomial pressure ulcers, UTI, and patient satisfaction)	29 university teaching hospitals; prospective data on hospital structure via survey results; retrospective study of structure and outcome data from established databases and hospital incident reports	Increased RN hours worked per patient/day was associated with lower fall rates and higher patient satisfaction; increased hours worked per patient/day by all staff associated with lower UTI rates	Data collected at hospital level; author recommends additional research in topic
Dimick (2001)[19] **Purpose:** To determine if having one nurse for 1-2 patients ("more") versus 1 nurse for 3 or more patients ("fewer") in the ICU at night was associated with differences in clinical and economic outcomes after hepatectomy	Cohort study of 569 posthepatectomy patients; retrospective study	Univariate analysis revealed "fewer" nurses associated with increased risk of pulmonary failure and reintubation of patients; multivariate analysis revealed "fewer" nurses associated with increased risk for reintubation and a 14% increase in total hospital cost	Adjustments for patient acuity used; author acknowledges limitation of lack of survey data addressing nursing experience, skills, or certification
Needleman (2002)[20] **Purpose:** To examine the relationship between levels of staffing by nurses in hospitals and the rates of adverse outcomes among patients	Three samples of hospitals: 1. 799 hospitals in 11 states, 2. 256 California hospitals that were part of the 11 state sample, 3. National sample of 3357 hospitals; prospective data from hospital staffing surveys linked with retrospective hospital patient discharge data	Strong and consistent relationships were found between nurse staffing variables and five patient outcomes, UTI, pneumonia, LOS, upper gastrointestinal bleeding and shock in medical patients; in major surgery patients, only the relationship between failure to rescue and staffing was strong and consistent	Study controlled for influencing variable of acuity, patient risk for complications and hospital characteristics
Dang (2002)[21] **Purpose:** To isolate the effects of nurse staffing on patient outcomes by examining the relationship between ICU staffing and the likelihood of medical complications for patients undergoing abdominal aortic surgery	Nonprobability purposive sampling of 2987 patients in 38 ICUs in state of Maryland; prospective data from hospital staffing surveys linked with retrospective hospital patient discharge data	Decreased nurse staffing was significantly associated with an increased risk of respiratory and cardiac complications	Study controlled for demographic, organizational and acuity variables; study limited to one state

LOS, length of stay; ICU, intensive care unit; DRG, diagnostic related group; NNPR, night-time nurse-to-patient ratio; PNR, patient-to-nurse ratio; FTE, full-time equivalent; PE, pulmonary embolism; UTI, urinary tract infection.

Several studies found an increase in mean length of stay for patients related to decreased staffing ratios.

1. complications established in literature
2. exploratory complications
3. surgical complications
4. other complications (see Table 2).

Others have concurred that urinary tract infections (UTIs) and pneumonia are OPSNs, which are significantly inversely associated with staffing.[15,20] Other studies further reveal associations among upper gastrointestinal bleeding, shock, and failure to rescue with RN staffing.[19-21] The highest rates were for "failure to rescue" defined as the death of a patient with one of five life-threatening complications:

1. pneumonia
2. shock or cardiac arrest
3. upper gastrointestinal bleeding
4. sepsis
5. deep venous thrombosis—for which early identification by nurses and prompt medical or nursing interventions can influence the risk of death.

RECOMMENDATIONS FOR NURSING PRACTICE

Critical care nurses play a key role in influencing patient outcomes. Using research findings, nurses can identify those outcomes sensitive to their care and promote clinical practice procedures to optimize quality of care.

Critical care nurses are encouraged to pursue research activities to strengthen and clarify existing results regarding staffing levels and patient outcomes. With shortages, budget cuts, and retention issues, there is no better time than the present to justify the obvious need for greater numbers of skilled professionals at the bedside. Researchers are calling for studies that offer clear operational definitions for OPSN and a consensus for their inclusion in research projects. Moreover, researchers must incorporate the effects of staff mix, or the use of ancillary personnel within their studies. This will expand the understanding of the consequences (both positive and negative) of reengineering initiatives and the replacement of professional nursing positions with unlicensed assistive personnel.

Enhance Nurse Recruitment

Ensuring an ongoing, vital nursing force through recruitment is a key. Nurses need to embrace their profession and encourage a new generation of college-bound students to make nursing a career. Local, state, and government offices should contribute to recruitment by depicting a positive image of nursing as a profession, similar to the campaigns currently used by the US armed forces. Methods to enhance recruitment could include expanding enrollment from minority groups and hiring more nurses from overseas, providing more regular work hours and flexible schedules, encouraging greater working hours from part-time employees with the lure of incentive programs, and providing government loan payback incentives for those students seeking degrees in nursing.

Evidence has shown that the organization of nurses' work is a major determinant of staff welfare. Restructured hospitals where working environments are more appealing to nurses provide opportunities for increased autonomy and clinical responsibility. Such is the case with the magnet hospital format. Magnet hospitals have demonstrated organizational attributes that provide nurses with the support needed to fully use their knowledge and expertise to provide high-quality patient care. These attributes entail increased autonomy regarding clinical care issues at the bedside, better relationships between nurses and physicians, nurses' preferences for interdisciplinary care, primary nursing, and more patient involvement in care decisions.[9] As a result, employee satisfaction rates may be higher in magnet hospitals, retention rates are greater, and recruitment of new nurses is optimized.

Enhance Nurse Retention

Research has shown that years of clinical experience of nurses on their respective units is associated with lower 30-day mortality rates.[12] Nurses require incentives to enhance retention within the profession. Increased wages is a quick solution, but it is not the sole source of employee happiness. A recent survey of staff nurses in North Carolina found that good mentors/colleagues were the leading reason why nurses remained with their employer.[22] Hospitals should consider enhanced mentorship training and focus on the establishment of worker-friendly environments. Social interaction where the working nurse feels like a part of a larger family network may be a key element missing in today's hectic healthcare system.

Nurses seek empowerment in their workplaces. Equal participation in the multidisciplinary approach is essential to provide the professional nurse with the ability to affect their patient's outcome and experience job satisfaction. As in the magnet hospital format, retention is higher when nurses are afforded the opportunity for decision making, participation, and input into the work

environment. Also, the ability to self-schedule, often referred to as flexible scheduling, allows nurses control over their shifts and may result in greater positive outlooks for balancing work, family, and social demands. Additionally, retention can be enhanced by fostering advanced educational opportunities through challenging continuing education programs and employee-sponsored financial incentives for advanced nursing education if applicable.

Another retention strategy is to offer financial aid incentives to those nurses wishing to return to school for advanced degrees. The promotion of healthy work environments, as in the case with magnet hospitals, can entice preservation of the existing nursing staff. Employers must consciously make greater investments in their present nursing force. By supporting promotion ladders, offering significant salary differentials for the more experienced nurses, and opening avenues for participation in organizational planning, administrators can combat nursing disengagement and improve retention.[26]

CONCLUSION

Staffing continues to plague hospitals in the US. Current research has shown that nurse staffing affects patient outcomes. Measures to enhance nurse staffing are necessary to sustain appropriate and safe nurse-to-patient ratios. Aggressive nurse recruitment measures, such as expanding nursing school enrollment, along with incentives for retention were a few of the methods discussed.

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