



Guiding Principles in Achieving Excellence in Nurse Staffing: Standards of Practice for the State of Wisconsin

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and January 2015

*as defined by the
Wisconsin Organization of
Nurse Executives*

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Standards of Practice for the State of Wisconsin
Wisconsin Organization of Nurse Executives
January 2015***

The Call to Action:

The nursing profession is comprised of the largest group of clinicians participating in the delivery of health care in this country. Numbering over 3 million, nurses are the largest sector of the health professions. (Institute of Medicine of the National Academies, *The Future of Nursing, Leading Change, Advancing Health*, October 2010). Nursing is practiced in virtually every setting in which health care is delivered, from the home, to hospitals, clinics, nursing homes and hospices, to name a number of the most common. Though nursing care has been, or will be, experienced by everyone at some stage of life, it is ironic that the work of the profession is poorly understood by those who are recipients of its services, colleagues in other clinical disciplines and those who administer health care organizations.

Nursing has not clearly communicated the nature of its work to its publics. It has also been less effective than it must be in assuming ownership of all of the accountabilities that comprise any clinical profession including defining practice, managing quality, assuring competence, generating and validating the knowledge base of the discipline and managing the resources essential to the work. The result has been detrimental to the care of patients across the country in many settings, but nowhere more acutely than in hospitals. Since the early 1980's, the pressure of declining reimbursement to hospitals has resulted in decisions related to nurse staffing that have at times created unworkable and even unsafe, practice environments. The Institute of Medicine Report on the Future of Nursing (Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, 2010) identifies that high turnover rates among new nurses continues to be a concern. Nurses, disenchanted with practice environments that do not support excellence, and may even pose risks to patient safety, have left those settings.

Nurses are knowledge workers (Arbon, 2004; Colley, 2003; Tishelman, Bernhardson, Blomberg, Böjesson, Franklin, Johansson, Leveälahti, Sahlberg-Blom, & Ternestedt, 2004; Wainwright, 2003; Sorrells-Jones & Weaver, 1999; Snyder-Halpern, Corcoran-Perry & Narayan, 2001). While much of what nurses do in the form of tasks is observable, such as administering medication, teaching a patient, or changing a dressing on a wound, the essence of nursing practice is not. Nurses, in caring for patients, are engaged in a continuous process of interpreting a broad array of objective and subjective information. The information is gathered through a variety of means including observation, physical examination, conversing with the patient and/or family and review of diagnostic test results. Nurses interpret and assign meaning to the

information by drawing on a vast knowledge base from the physical and social sciences, liberal arts, practice wisdom and intuition (Benner, 1984; Benner, Hooper-Kyriakidis, Stannard, 1999; Christensen & Hewitt-Taylor, 2006)). They make judgments about the significance of the information and decisions concerning appropriate intervention. Continuous evaluation of practice interventions for desired outcomes rounds out what has come to be known as “nursing process”.

Effective nursing practice is dependent upon the nurse’s ability to know the patient’s “story”, including pertinent history, co-morbidities, present illness, culture/beliefs, family support, education and any compounding variables that might impact his/her interpretation of the patient situation. Subtle changes in a patient, which may precede a significant change in condition, can only be noted if the nurse has the opportunity to remain in adequate contact with the patient. Research has demonstrated that the expert nurse can often intuitively detect deterioration in a patient’s condition before there are any objective findings to support that conclusion. (Benner, 1984; Benner, Tanner, Chesla, Dreyfus, Dreyfus & Rubin, 1996; Benner, Hooper-Kyriakidis, Stannard, 1999). Further, studies have shown that an assignment of too great a number of patients to a nurse may result in “failure to rescue”, that is, impending signs of patient deterioration are missed because of inadequate opportunity to observe the patient first hand (Aiken, Clarke, Sloane, Sochalski & Silber, 2002; Clarke, 2004; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002a, 2002b; Schmidt, 2010). Research continues to contribute to the growing, and irrefutable, body of evidence that patient outcomes are improved with increased RN staffing, positive practice environments and greater percentages of BSN prepared nurses (McHugh, Kelly, Smith et al., 2013, McHugh & Ma, 2013, Aiken, Cimiotti, Sloane et al., 2011, McHugh, Berez, & Small, 2013, Needleman, Buerhaus, Pankratz et al., 2011) The Principles and Elements of a Healthful Practice/Work Environment, developed by the American Organization of Nurse Executives in 2004, supports the presence of adequate numbers of qualified nurses as important to the provision of quality care to meet the patient’s needs. In the absence of research-based evidence to guide us, decisions about "adequate numbers of qualified nurses" have historically been largely opinion-based. As we move forward, these methods must be replaced by decisions based on best available evidence.

The Wisconsin Organization of Nurse Executives, as the professional organization of nurses charged with the management of nursing resources in health care organizations, has determined that an evidence-based position paper, which includes the guiding principles for achieving excellence in nurse staffing, is an ongoing priority. Though it is recognized that most of the research addressing nurse staffing has been done in hospitals, these guiding principles are intended to be used as the standard of practice by all organizations in which nurses practice in Wisconsin. The available evidence should be applied to non-acute settings to the extent possible and non-acute settings should contribute to the knowledge base by participating in research studies when the opportunity presents. They have been developed in collaboration with, and are endorsed by, the Wisconsin Nurses Association.

Literature Summary

Purpose

The purpose of this summary is to provide an overview of the research/evidence base which has clarified the relationship between nurse staffing and outcomes. The outcomes may be experienced by patients and/or nurses-as-employees.

Search Strategy

Literature to be included in this summary were limited to those which: 1) were published 1998¹ through November 2014, 2) were conducted in the United States, and 3) include some structure or process element or outcome measure related to nurse staffing.

Medline and CINAHL electronic databases were searched using the key words:

- Nurse staffing
- Hospital nurse staffing
- Nurse staffing
- Nurse-patient ratio
- Staff mix
- RN mix
- Patient safety
- Inpatient outcomes
- Patient outcomes
- Nurse safety
- Quality of care
- Quality of nursing care
- Nursing outcomes
- Nurse-sensitive outcomes
- Failure to rescue
- Nurse surveillance

Additional articles were identified from hand searches of reference lists of retrieved articles. After the abstract of identified articles were reviewed for relevance, 96 published works remained for inclusion in this summary. For this summary the published works were organized into the following categories: 1) Report of Primary Research, 2) Research Review/Evidence Summary and 3) Position Paper/Topic Discussion/ Commentary.

¹ Prior to 1998 studies were marked by data limitations and/or significant design issues, resulting in minimal to no evidence base for the effects of structural measures such as staffing levels and staffing mix. Although studies from 1998 to present continue to have data limitations inherent to the predominant reliance on administrative data sources for clinical outcomes data, progress has been made towards development of more standardized nurse staffing measures & data sets. As more nurse practice settings adopt electronic health records there will be the opportunity to develop more robust data sets that will continue to enhance our understanding of nurse dose at the level of the individual patient (for example, see Manojlovich et. Al, 2011 and Yakusheva et. Al, 2014 included in this review of literature).

Nurse Staffing Literature Summary

Section: Report of Primary Research

Citation	Design	Population/ Sample Size	Primary Outcome Measure(s)	Conclusions/ Comments
<p>Abraham, I, Lindenauer,P, Rose, D., Rothberg,M, (2005) Improving Nurse-to-Patient Staffing Ratios as a Cost-Effective Safety Intervention. <i>Medical Care</i>, 43(8), 785-91.</p>	<p>This was a cost-effectiveness analysis from the institutional perspective comparing patient-to-nurse ratios ranging from 8:1 to 4:1. Cost estimates were drawn from the medical literature and the Bureau of Labor Statistics. Patient mortality and length of stay data for different ratios were based on 2 large hospital level studies. Incremental cost-effectiveness was calculated for each ratio and sensitivity and Monte Carlo analyses performed.</p>		<p>Costs per life saved in 2003 US dollars.</p>	<p>As a patient safety intervention, patient-to-nurse ratios of 4:1 are reasonably cost-effective and in the range of other commonly accepted interventions.</p> <p>We can prevent additional hospital deaths at a labor cost of \$64,000 per life saved by decreasing the average patient-to-nurse ratio from 7:1 to 6:1.</p> <p>Considered as a patient safety intervention, improved nurse staffing has a cost-effectiveness that falls comfortably within the range of other widely accepted interventions.</p> <p>This article recommends that physicians, hospital administrators and the public see safe nurse staffing levels in the same light as other patient safety measures.</p>
<p>Aiken, L.H., Clarke, S.P. & Sloane, D.M. (2000). Hospital restructuring: Does it adversely affect care and outcomes? <i>Journal of Nursing Administration</i>, 30(10), 457-65.</p>	<p>Multi-site, cross-sectional analysis designed to assess the effects of organizational changes in hospitals related to restructuring; the time period is 1986-1998. Purpose of the research is to study the relationship between nurse staffing and patient outcomes.</p> <p>Data sources:</p>	<p>646 CNEs 2000+ RNs</p>	<p>Patient mortality rates</p>	<p>Findings: Nurse staffing variation is a major driver for variation in patient outcomes. Excess mortality is inversely related to nurse staffing.</p> <p>RN surveys RN report deteriorating nurse practice environments; less likely than in the past to have:</p> <ul style="list-style-type: none"> • Enough RNs • Sufficient support services • Supervisors viewed as supportive of nursing • An influential CNE <p>CNE surveys 57% reported work re-design/re-engineering initiatives at their hospitals within the past 5 years, including:</p> <ul style="list-style-type: none"> • Personnel reductions • Cross-training

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	<p>1996 Chief Nurse Executive (CNE) survey; 646 respondents AHA annual surveys HCFA (CMS) CMI data 1998 nurse surveys with 2000+ respondents from 22 hospitals Data set developed from pooled data drawn from AHA staffing data and HCFA mortality data</p>			<ul style="list-style-type: none"> • Skill mix reductions • Management positions eliminated <p>AHA data</p> <ul style="list-style-type: none"> • # RN FTE increased in relation to hospital census; however, intensity of resource requirement increased at the same or higher rate • Nursing personnel comprised the only category of hospital employees that decreased in representation related to adjusted patient days for the time period 1981 – 1993; decreased by 7.3% <p>Conclusions: Authors noted that there is a deficient knowledge/research base regarding the relationship between nurse staffing and patient outcomes. Despite this, a frequent restructuring initiative is to decrease nurse staffing. They call for re-engineering initiatives to be evaluated in terms of capacity to promote the delivery of care that is affordable and effective. In addition, the authors note that restructuring, in general, has “hurt caregiving” and has not produced compensatory positive outcomes.</p>
<p>Aiken, L.H., Cimiotti, J.P., Sloane, D.M., Smith, H.L., Flynn, L. & Neff, D.F. (2011). Effects of nurse staffing and nurse education on patient deaths in hospitals with different nurse work environments. <u>Medical Care</u>, 49(12), 1047-53.</p>	<p>Multi-site, cross-sectional. Descriptive statistics and logistic regression models were used to estimate the relationship between nurse staffing, nurse work environment, risk-adjusted 30-day inpatient mortality, and failure-to-rescue.</p>	<p>665 acute care, general hospitals in California, Pennsylvania, Florida, and New Jersey</p> <p>272,783 nurses in 4 states</p> <p>1,262,120 patients</p>	<p>30-day inpatient mortality and failure-to-rescue</p>	<p>The 665 hospitals in this study are the units of analysis; however, the units of observation are hospitals, patients, and nurses nested within hospitals</p> <p>Increased workloads (unit change in the number of patients per nurse) increase the odds on patient death and failure-to-rescue by 3%</p> <p>Better work environments decrease the risk of patient mortality by 7% 10% increase in BSN prepared nurses decreases the risk of patient mortality by 4%</p> <p>There was significant interaction between nurse staffing and the work environment with the effect of each conditional on the other</p>
<p>Aiken, L.H., Clarke, S.P., Sloane, D.M. (2002). Hospital staffing, organization, and quality of care: Cross-national findings. <u>International Journal for Quality in Health Care</u>, 14(1), 5-13.</p>	<p>Multi-site, cross-sectional survey with nurses as informants Designed to test which organizational features affect patient and nurse outcomes</p>	<p>10,319 nurses working on medical and surgical units in 303 hospitals across 5 jurisdictions in 4 nations (US, Canada, England & Scotland)</p>	<p>Nurse satisfaction and burnout Nurse reports of quality of hospital care</p>	<p>Findings: Nurses in worst-staffed hospitals (based on nurse report) were 1.3 times as likely as those in the best-staffed to rate quality of care on their units as fair or poor Nurses in hospitals with lowest levels of support for nursing care (based on nurse report) were over two times more likely than nurses in hospitals with highest levels of support for nursing care to rate the quality of care on their units as fair or poor.</p> <p>Conclusions: The authors note that multi-national results point to understanding that fundamental changes to the organization of hospitals, the work of</p>

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				<p>nursing, and the nursing workforce will be required to respond to contemporary challenges</p> <ul style="list-style-type: none"> • Models for organizing care that are not based in evidence may be part of the problem, not the solution • Renew attention to the clinical mission of hospitals • Increase managerial engagement/partnership with clinical nursing • Increase understanding of the role(s) nurses play in optimal patient outcomes <p>In addition, practice environments that do not support the work of professional nurses may undermine the benefits that accrue from excellent staffing</p>
<p>Aiken, L.H., Clarke, S.P., Sloane, D.M., Sochalski, J. & Silber, J.H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. <u>Journal of the American Medical Association</u>, 288(16), 1987-93.</p>	<p>Multi-site, cross-sectional analysis of linked nurse, patient and organizational data</p> <p>Context for discussion is nursing shortage and mandated patient-to-nurse ratios</p> <p>Nurses are the informants about hospital staffing and organizational characteristics Patient outcomes information drawn from hospital discharge abstracts Administrative databases used to determine hospital characteristics for control variables (size, teaching status, technology)</p>	<p>10,184 staff nurse survey respondents 232,342 general, orthopedic, and vascular surgery patients 168 nonfederal adult general hospitals</p>	<p>Nurse job dissatisfaction Burnout Nurse-rated quality of care</p>	<p>Findings: At the hospital level, a high patient-to-nurse ratio is associated with:</p> <ul style="list-style-type: none"> • Higher risk-adjusted 30 day mortality <ul style="list-style-type: none"> ○ 7% increase in likelihood of dying within 30 days for each additional patient per nurse • Higher failure-to-rescue rates <ul style="list-style-type: none"> ○ 7% increase in odds of failure-to-rescue for each additional patient per nurse • Nursing staff more likely to report burnout <ul style="list-style-type: none"> ○ 23% increase in odds of reporting burnout • Nursing staff more likely to report job dissatisfaction <ul style="list-style-type: none"> ○ 15% increase in odds of reporting job dissatisfaction
<p>Aiken, L.H., Clarke, S.P., Cheung, R.B., Sloane, D.M. & Silber, J.H. (2003). Educational levels of hospital nurses and</p>	<p>Multi-site, cross sectional analysis of outcomes data</p> <p>Patient outcomes</p>	<p>232,342 general, orthopedic, and vascular surgery patients discharged from 168 adult,</p>	<p>Risk-adjusted mortality and failure-to-rescue within 30 days of admission</p>	<p>For every 10% increase in the percentage of nurses holding a BSN or higher, there is a decreased risk of mortality and failure-to-rescue of 5%; this is after controlling for hospital and patient characteristics.</p> <p>If all hospitals had a 60% proportion of BSN prepared nurses, 3.6 fewer</p>

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surgical patient mortality. <u>JAMA</u> , 290(12), 1617-23.	data linked to administrative and survey data	general Pennsylvania hospitals. Time period is April 1, 1998 and November 30, 1999. 10,184 nurses on the rolls of the Pennsylvania Board of Nursing		deaths per 1000 patients is predicted and 14.2 fewer death per 1000 patients with complications (failure-to-rescue). The effect of increasing BSN preparation by 20% is roughly equivalent to a reduction in nurse workload of 2 patients; increasing BSN preparation while reducing nursing workload would likely have a cumulative effect on mortality and failure-to-rescue RN credential nurses with less than a BSN was not demonstrated to be a factor in patient outcomes
Aiken, L.H., Clarke, S.P., Sloane, D.M., Lake, E.T. & Cheney, T. (2008). Effects of hospital care environment on patient mortality and nurse outcomes. <u>JOURNAL OF NURSING ADMINISTRATION</u> , 38(5), 223-9.	Descriptive (Included use of the Hospital-Level Practice Environment Scale of the Nursing Work Index to classify the care environment and a survey of the RNs) Analyze effect of nurse practice environments on nurse and patient outcomes.	10, 184 RNs 232, 342 surgical pts 168 Pennsylvania hospitals	Care environments, Patient outcome RN job satisfaction, burnout, intent to leave, reports of quality of care	Surgical mortality rates were greater than 60% higher in hospitals poorly staffed with the poorest care environments than in hospitals with better care environments, the most highly educated nurses and the best staffing levels. Care environments, nursing staffing and nursing education must be optimized to achieve quality patient care. Study identified that in hospitals with poor care environments, nurses reported high burnout, dissatisfaction with their jobs and a lower level of quality of care (poor or fair vs. good or excellent). Improved RN staffing, more educated nurses and improved care environment each independently contribute to better patient outcomes.
Aiken, L.H., Sloane, D.M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., Diomidous, M., Kinnunen, J., Kozka, M., Lesaffre, E., McHugh, M.D., Moreno-Basbas, M.R., Rafferty, A.M., Schwendimann, R., Scott, P.A., Tishelman, C., van Achterberg, T. & Sermeus, W. (RN4CAST Consortium) (2014). Nurse staffing and education and hospital mortality in nine European	Observational study linking administrative data and nurse survey data from 9 European countries to assess the effect of nurse staffing and nurse education on patient outcomes	422,730 patients discharged from the study hospitals 26,516 nurses practicing in the study hospitals	Patient mortality	This study was conducted by the Center for Health Outcomes and Policy Research, University of Pennsylvania School of Nursing. The primary investigator is Linda Aiken. The funding for the study came from multiple international sources. For purposes of inclusion this was not considered an international study, but rather a replication of research conducted in the US. Increasing a nurse's workload by one patient was associated with a 7% increase in likelihood of inpatient mortality within 30 days of admission Every 10% increase in the proportion of nurses with baccalaureate preparation or higher was associated with a 7% reduction in likelihood of inpatient mortality within 30 days of admission These findings are consistent with studies conducted in the US

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countries: A retrospective observational study. <u>The Lancet</u> , 383, 1824-30.				
Aiken, L.H., Douglas, M.S., Cimiotti, J.P., Clarke, S.P., Flynn, L., Seago, J.A., Spetz, J. & Smith, H.L. (2010). Implications of the California nurse staffing mandate for other states. <i>Health Services Research</i> , 45(4), 904-21.	Multi-site, cross-sectional analysis of linked nurse, patient and organizational data Survey data merged with data about hospitals, patients, and outcomes for patients and nurses; multivariate analysis & robust estimation procedures.	22,336 nurses working in nonfederal hospitals in California (N=9257), New Jersey (N=5818) & Pennsylvania (N=7261). Secondary data consisted of information about patient characteristics, complications, mortality & failure to rescue (FTR) from state agencies and American Hospital Association data on hospital size, teaching status, & technology	Mean nurse workloads for all staff nurses Mean workloads for nurses working on different types of units (e.g. med-surg, pediatrics) 30-day inpatient mortality Failure to Rescue	Lower nursing workloads in California translate into better evaluation of the work environment Significantly lower proportion of California nurses reported high burnout California nurses less likely to report being dissatisfied with their jobs For every nurse-reported outcome, when patient-to-nurse ratios are in line with levels set by California mandates, there are significantly lower reports of unfavorable conditions After extensive risk adjustment the effect of adding one patient to nurse workload increases the odds of mortality by a factor of 1.13 in California, 1.10 in New Jersey, and 1.06 in Pennsylvania. The odds ratios for Failure to Rescue were 1.15 in California, 1.10 in New Jersey, and 1.06 in Pennsylvania. Conclusion: outcomes are better for patients and nurses when hospitals meet a staffing "benchmark" based on California nurse staffing mandates.
Armstrong, R.A. (2004). <u>Mandated staffing ratios: Effect on nurse work satisfaction, anticipated turnover, and nurse retention in an acute care hospital</u> . UMI Dissertation Services. (UMI Number 3136243).	Survey of inpatient California nurses pre- and post-implementation of mandated minimum nurse-to-patient ratios Pre-implementation survey was administered in December 2003 Post-implementation survey was administered in May 2004.	101 nurses from one acute care California hospital participated in the pre-implementation survey and 96 nurses from the same hospital participated in the post-implementation survey	Nurse overall work satisfaction Anticipated turnover Nurse retention	The implementation of mandatory minimum nurse-to-patient ratios did not have a statistically significant effect on work satisfaction and anticipated turnover in the acute care California hospital MANOVA indicated overall work satisfaction and task satisfaction was related to assigned nursing unit
Berkow, Jaggi, Fogelson, Katz and Hirschhoff/ 2007	Qualitative			<ul style="list-style-type: none"> Analyzed participants' staffing allocations via phone interview using nurse-to-patient ratios, RN education, RN experience

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		Chief Nursing Officers (CNO) from Pediatrics, Emergency Department, Medical and Intermediate Care units/ 32 participants	To provide CNO's with common attributes that drive staffing priorities	<p>level and support staff level.</p> <ul style="list-style-type: none"> • Analyzed using unit response by attribute versus unit type • Fourteen Unit Attributes were identified that drive CNO staffing priorities • Identified the means by which these attributes can improve patient outcomes • Staffing priorities were chosen by CNO perception of challenges or attributes of a given unit, not by the type of unit. <p>Limitations: research was exploratory and subjective, small sample size, used only one hypothetical situation to gather data, not generalizable.</p>
Berkow, S., Vonderhaar, K. & Stewart, J. (2014). Analyzing staffing trade-offs on acute care hospital units. <u>Journal of Nursing Administration</u> , 44(10), 507-16.	Online survey of nurse leaders to quantify how nurse leaders make trade-offs regarding nursing workload, education, specialty certification, experience, and level of support staff	2,633 nurse leaders From 617 institutions		<p>The goal of this research was to develop a database containing nurse staffing and outcomes data across multiple clinical settings including acute care hospitals, outpatient departments, physician offices, ambulatory centers, and post-acute care institutions.</p> <p>There were 3 versions of the survey based on work site:</p> <ul style="list-style-type: none"> • Acute care hospital • Outpatient site • Post-acute care site <p>The survey report was published for members of the Advisory Board Nurse Executive Center in September 2013.</p> <p>Key findings:</p> <ul style="list-style-type: none"> • 25% of respondents reported that they require new hire non-BSN nurses to earn their BSN within 5 years • 15% of respondents reported that they only hire RNs with a BSN degree • Units in teaching and larger hospitals tended to have a greater proportion of BSN nurses • On medical-surgical units RNs caring for more patients generally had more unlicensed assistants • When RNs on medical-surgical units caring for more patients, they tended to have less than 1 year experience • Higher BSN proportion on medical-surgical units was associated with higher rates of specialty certification • Higher BSN proportion on medical-surgical units was associated with few patients per RN <p>They survey report is meant to provide nurse leaders with quantitative information about tradeoffs made when balancing their investment across a care team</p>

Citation	Design	Population/ Sample Size	Primary Outcome Measure(s)	Conclusions/ Comments
<p>Blegen, M.A., Goode, C.J. & Reed, L. (1998). Nurse staffing and patient outcomes. <u>Nursing Research</u>, 47(1), 43-50.</p>	<p>Single site, cross-sectional analysis of linked nurse, patient and organizational data</p> <p>Level of analysis is the nursing unit; study designed to describe the relationship among total hours of nursing care, RN skill mix, and adverse patient outcomes.</p> <p>Nursing acuity system data used to control for patient severity</p>	<p>21,783 discharges/ 198,962 patient days 42 inpatient units of 880 bed hospital 1074 total nursing FTE with 832 RN FTE</p>	<p>Medication errors Patient falls Skin breakdown Patient & family initiated complaints Infections Deaths</p>	<p>Findings: Higher RN staff mix inversely related to medication errors, pressure injury rate, and patient/family complaints (statistically significant) Higher RN staff mix inversely related to UTI and respiratory infection (not statistically significant; effect present up to 87.5% RN staff mix)</p> <p>Total hours of nursing care not associated with better outcomes Total hours of nursing care associated with higher rates of pressure injury, patient/family complaints, and mortality Note: Total hours of care also associated with acuity so this finding must be interpreted very carefully Key finding: Higher RN staff mix is associated with better patient outcomes</p>
<p>Blegen, M.A., Goode, C.J., Park, SH., Vaughn, T. & Spetz, J. (2013). Baccalaureate education in nursing and patient outcomes. <u>Journal of Nursing Administration</u>, 43(2), 89-94.</p>	<p>Cross-sectional to analyze the association between RN education and risk-adjusted patient outcomes; nurse staffing and hospital characteristics were controlled for.</p>	<p>21 University Health System Consortium hospitals</p> <p>84 quarters of operational and clinical data</p> <p>CNOs provided data about nurse education via a mailed survey</p>	<p>LOS > than the DRG prescribed LOS</p> <p>Rates for adverse events (AHRQ PSI) demonstrated to be sensitive to nursing care: HF mortality, HAPUs, failure-to-rescue, infections due to medical care, post-op VTE.</p>	<p>Hospitals with a higher proportion of baccalaureate prepared nurses had more total hours per patient day for general units and for ICUs</p> <p>Patient adverse events and LOS decreased as proportion baccalaureate preparation increased; the declines were statistically significant for 1) heart failure mortality, 2) hospital-acquired pressure ulcer, 3) failure-to-rescue, 4) VTE, and 5) LOS > expected.</p> <p>The correlation between RN education and infection due to medical care was in the predicted direction, but was not statistically significant</p> <p>These findings held when nursing staffing and organizational characteristics were controlled for.</p> <p>The authors note that this is the first study to detect a positive effect of BSN proportion on the rates of hospital-acquired pressure ulcer; in addition, the education effect was stronger than the staffing effect.</p>
<p>Blegen, M.A., Goode, C.J., Spetz, J., Vaughn, T. & Park, S.H. (2011). Nurse staffing effects on patient outcomes: Safety-net and Non-safety-net hospitals. <u>Medical Care</u>, 49(4), 406-14.</p>	<p>Cross-sectional to: 1) determine relationship between nurse staff in general and intensive care units and patient outcomes 2) determine if safety</p>	<p>54 University Health System Consortium hospitals</p> <p>1.1 million adult discharges; clinical data set drawn</p>	<p>LOS > than the DRG prescribed LOS</p> <p>Rates for adverse events: in-hospital HF mortality, HAPU, failure-to-rescue, infections due to medical care, post-op</p>	<p>For general units:</p> <ul style="list-style-type: none"> • Higher total staffing in general, non-safety net hospitals was associated with lower rates of <ul style="list-style-type: none"> ○ heart failure mortality ○ infections due to medical care ○ LOS > expected • Higher total staffing in general, safety net hospitals was associated with lower rates of

Citation	Design	Population/ Sample Size	Primary Outcome Measure(s)	Conclusions/ Comments
	net status affects the relationship between staffing and outcomes	from administrative data; operational data set for direct caregiver hours at the patient care unit level		<ul style="list-style-type: none"> ○ LOS>expected • Higher RN skill mix was associated in all general hospitals with lower rates of failure-to-rescue • Infections due to medical care were lower in non-safety net hospitals who reported higher total staffing and RN mix <p>For intensive care units:</p> <ul style="list-style-type: none"> • Higher total hours per patient day was associated with lower infections due to medical care • Lower rates of post-op sepsis was associated with higher RN mix in all hospitals • Higher RN mix in safety net hospitals was associated with lower rates of failure-to-rescue <p>Higher heart failure mortality rates on general units were associated with higher total staffing in safety net hospitals Higher heart failure mortality rates on intensive care units were associated with higher RN mix</p> <p>In general, the results of this study are consistent with prior research</p>
Blegen, M., & Vaughn, T. (1998). A multi-site study of nurse staffing and patient occurrences. <u>Nursing Economics, 16</u> , 196-203.	Multi-site, cross-sectional analysis of the relationship between nurse staffing and patient outcomes Nurse staffing variables are: Total hours of nursing care Proportion of total hours of nursing care delivered by Registered Nurses Type of Unit (Med-Surg, ICU, OB, Skilled Care) and Hospital-wide CMI were used to account for acuity	39 nursing units in 11 hospitals <ul style="list-style-type: none"> • 24 med-surg • 8 intensive care • 4 maternal-child • 3 skilled nursing 	Medication Administration Errors (MAE) Falls Cardiopulmonary Arrest	<p>Findings:</p> <ul style="list-style-type: none"> • Richer staff mix (higher RN proportion) was associated with <ul style="list-style-type: none"> ○ Lower MAE rates per 10,000 doses administered ○ Lower number of falls per 1000 patient days • There was a nonlinear relationship between staff mix and MAE <ul style="list-style-type: none"> ○ Staff mix > 87.5% RN was associated with higher MAE • Units in hospitals with higher acuity had <ul style="list-style-type: none"> • Lower MAE • Lower cardiopulmonary arrest rates • ICUs had <ul style="list-style-type: none"> • Lower MAE • Higher cardiopulmonary arrest rates <p>Conclusions: The authors call for further research:</p> <ul style="list-style-type: none"> • Explicate the non-linear relationship between RN proportion > 87.5% and higher MAE • Build a systematic knowledge/ research base regarding the relationship between nurse staffing variables and patient outcomes • Recommend standardized indicators • Use patient outcomes variables that demonstrate a positive effect of quality nursing care, rather than available data based on reported adverse outcomes of care

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<p>Bolton, L.B., Aydin, C.E., Donaldson, N., Brown, D.S., Nelson, M.S. & Harms, D. (2003). Nursing staffing and patient perceptions of nursing care. <u>Journal of Nursing Administration</u>, 33(11), 607-14.</p>	<p>Prospective, cross-sectional study designed to explore the relationship between nurse staffing and patient perceptions of nursing care.</p> <p>Data from 40 hospitals using standardized tools with demonstrated reliability and validity.</p> <p>Nurse Staffing was assessed using the California Nursing Outcomes Coalition (CalNOC) Patients' Evaluation of Performance in California (PEP-C) was used to assess patient perceptions of care.</p>	<p>40 California hospitals</p>	<p>Patient perceptions of care</p>	<p>The authors note that decisions about nurse staffing should be based on nursing effectiveness research</p> <p>Findings: Wide variation in patient perceptions of care and in staffing across organizations There was one statistically significant relationship among the nurse staffing and the indicators for patient perceptions of care; that relationship was between total nursing hours per patient day and patients' assessment of respect for patient's values, preferences, and expressed need.</p> <p>Hospitals with 4-5 total hours of care per patient day had similar problem scores to those with over 10 hours of care per patient day. Also found no threshold above or below which patient perceptions of care changed significantly. The authors conclude that nurse staffing is only one of several variables that influence patient perceptions of care. The authors call for nurse staffing research using unit and patient level data.</p>
<p>Bowlblis, J.R. (2011). Staffing ratios and quality: An analysis of minimum direct care staffing requirements for nursing homes. <u>Health Services Research</u>, 46(5), 1495-1516.</p>	<p>Cross-sectional analysis with facility level outcomes regressed on MDCS requirements.</p>	<p>17,552 nursing homes 94,371 survey observations</p>	<p>Nurse staffing levels Nurse skill mix Quality measures are care practices, resident outcomes, and regulatory deficiencies</p>	<p>This study used nursing home facility data drawn from the Online Survey Certification and Reporting (OSCAR) System merged with Minimum Direct Care Staffing (MDCS) requirements</p> <p>For all nursing homes, higher MDCS requirements are associated with an increase in total staffing; skill mix experienced a slight movement towards higher utilization of CNAs, while LPNs were substituted for RNs among licensed staff.</p> <p>When nursing homes are differentiated by their reliance on Medicaid in 2 separate staffing regression models:</p> <ul style="list-style-type: none"> • Reliance on Medicaid is associated with larger increases in staffing • High reliance on Medicaid is associated with an increased RN proportion without a change in overall licensed skill mix • Low reliance on Medicaid is associated with no change in RN

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				<p>mix but a decrease in licensed nurses</p> <p>For all nursing homes, higher MDCS is associated with fewer residents experiencing restraint, more foley catheter and antipsychotic use</p> <p>When nursing homes are differentiated by their reliance on Medicaid</p> <ul style="list-style-type: none"> • Reliance on Medicaid is associated with decreased use of foley catheters ; there is little difference in restraint use; other care practices are mixed <p>The overall effect of MDCS on quality measures is mixed</p> <ul style="list-style-type: none"> • Higher MDCS is associated with fewer pressure injuries & rashes, but more bowel incontinence and significant weight loss • 4 of 6 quality measures show improvement in association with higher MDCS in nursing homes more reliant on Medicaid <p>Across all measures higher MDCS requirements are inversely related to number of deficiencies and probability of receiving a specific deficiency</p> <p>MDCS requirements are associated with changes in staffing levels and skill mix, appear to improve some quality indicators. However, higher MDCS requirements may lead to care and staffing practices associated with lower quality of care.</p>
<p>Cho, S., Ketefian, S., Barkauskas, V.H. & Smith, D.G. (2003). The effects of nurse staffing on adverse events, morbidity, mortality and medical costs. <u>Nursing Research</u>, 52(2), 71-9.</p>	<p>Cross-sectional study designed to examine the effects of nurse staffing, hospital characteristics, and patient characteristics on the incidence of patient adverse events, morbidity, mortality and medical costs.</p>	<p>232 acute care hospitals in California 124,204 patients from the following diagnosis groups: Craniotomy Cardiac valve procedures Coronary bypass Major CV procedures Amputation for circulatory disorders Rectal resection Major small & large bowel procedures Stomach, esophageal & duodenal</p>	<p>Incidence of: Adverse events</p> <ul style="list-style-type: none"> • Fall/injury • Pressure ulcer • ADE • Pneumonia • UTI • Wound infection • Sepsis <p>Morbidity Mortality Medical costs</p>	<p>Findings: An increase of 1 hour per day worked by RN was associated with an 8.9% decrease in the odds of developing pneumonia A 10% increase in RN proportion of staff mix was associated with a 9.5% decrease in the odds of developing pneumonia A greater # of nursing hours per patient day was associated with a higher probability of developing pressure ulcers</p> <p>Hospital characteristics had minimal influence on patient outcomes</p> <p>Each adverse event was associated with a statistically significant prolonged length of stay and increased medical costs</p> <p>Patients who developed pneumonia, wound infections, and sepsis were more likely to die during hospitalization</p> <p>Conclusions: The author notes the recognized difficulty related to nurse staffing measurement issues An area for future research will be to test the ability of administrative and coding data for the assessment of patient outcomes, especially</p>

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		<p>procedures Pancreas, liver & shunt procedures Major joint & limb reattachment Hip & femur procedures</p> <p>Data was drawn from existing databases</p> <p>Hospital Financial Data from the California Office of Statewide Health Planning and Development (OSHPD) (hospital characteristics, nurse staffing data, and financial information)</p> <p>State Inpatient Databases (SID) California – 1987 released by AHRQ (patient data)</p>		<p>those conceptualized as nurse sensitive.</p>
<p>Clarke, S.P., Rockett, J.L., Sloane, D.M. & Aiken, L.H. (2002). Organizational climate, staffing, and safety equipment as predictors of needle stick injuries and near-misses in hospital nurses. <u>American Journal of Infection Control</u>, 30(4), 207-16.</p>	<p>Cross-sectional study designed to assess the relationship between nurse & hospital characteristics (organizational climate – support for nursing practice, average nursing experience), protective equipment, and the likelihood of needle stick injuries</p>	<p>2287 medical-surgical nurses from 22 US hospitals</p>	<p>Likelihood of sustaining a needle stick injury or near miss</p>	<p>Findings: Poor organizational settings and high workload were associated with a 50% to 2 fold increase in the likelihood of sustaining a needle stick or near miss The presence of safer needle systems were associated with a 20-30% lower risk of sustaining a needle stick or near miss</p> <p>Conclusion: Nurse staffing and organizational climate are key determinants of nurse needle stick injury/near miss</p>

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	<p>and near misses</p> <p>Nurses reported the # of patients cared for on last shift worked</p>			
<p>Cramer, M.E., Jones, K.J. & Hertzog, M. (2011). Nurse staffing in critical access hospitals: Structural factors linked to quality care. <u>Journal of Nursing Care Quality</u>, 26(4), 335-43.</p>	<p>Descriptive study</p>	<p>Convenience sample of 10 critical access hospitals in Nebraska</p> <p>Nurse administrators surveyed about 5 nurse staffing variables: Nurse skill level mix Nurse credential (RN, LPN, CNA) RN education RN specialty certification RN years of experience</p>	<p>n/a</p>	<p>Mean nurse staffing was 4.1 personnel (58% RN/23% LPN/19% CNA) The majority of RNs did not have a BSN (40% BSN proportion)</p> <ul style="list-style-type: none"> • Diploma RNs tended to have the most years of experience <p>Only 1 nurse in the sample had earned specialty certification The average nurse to patient ratio was 1:4</p> <p>RN to patient ratios do not capture RN workload in critical access hospitals</p> <ul style="list-style-type: none"> • Wide fluctuations in census, specialty patients, changing levels of care • RNs are not infrequently reassigned to cover other departments and procedure areas <p>A focus on numbers of nurses in critical access hospitals may be less important than developing strategies to increase the number of RNs with a BSN</p>
<p>Dang, D., Johantgen, M.E., Pronovost, P.J., Jenckes, M.W. & Bass, E.B. (2002). Postoperative complications: Does intensive care unit staff nursing make a difference? <u>Heart & Lung</u>, 31(3), 219-28.</p>	<p>Multi-site, retrospective review; data for analysis consists of hospital (nonfederal, acute care) discharge data linked to ICU characteristics</p> <p>Data sources: Uniform Health Discharge Data Set maintained by the Maryland Health Services Cost Review Commission</p> <p>Survey of physician ICU directors who</p>	<p>2606 patients from 38 Maryland hospital ICUs who underwent abdominal aortic surgery for the time period January 1994 through December 1996.</p>	<p>Incidence of complications</p> <ul style="list-style-type: none"> • Cardiac • Respiratory • Other <ul style="list-style-type: none"> ○ ARF ○ Septicemia ○ Platelet transfusion ○ Any other 	<p>Findings: Nurse staffing intensity was significantly associated with Cardiac, Respiratory, and Other complications</p> <p>13% of patients experienced cardiac complications 30% of patients experienced respiratory complications 8% of patients experienced other complications</p> <p>There was an increased likelihood of respiratory complications for patients cared for in ICUs with low vs. high intensity nurse staffing (Odds Ratio 2.33/CI 1.5-3.6)</p> <p>There was an increased likelihood of cardiac complications for patients cared for in ICUs with medium vs. high-intensity nurse staffing (Odds Ratio 1.78./CI 1.16-2.72)</p> <p>There was an increased likelihood of other complications for patients cared for in ICUs with medium vs. high-intensity nurse staffing (Odds Ratio 1.74/ CI 1.15-2.63)</p>

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	<p>were ask to complete the survey in collaboration with ICU nurse managers was source of nurse staffing data</p> <p>Study designed to explicate the relationship between ICU nurse staffing and the likelihood of experiencing a complication for patients having abdominal aortic surgery</p>			<p>Conclusion: studies using more robust and sensitive measures sensitive to nursing care should be conducted.</p> <p>Study limitations include: physician respondents as main source of nurse staffing data, retrospective design with secondary data analysis limited robustness of outcomes measures studied, and recognized limitations with the use of administrative data to assess clinical effectiveness.</p>
<p>de Cordova, P.B., Phibbs, C.S., Schmitt, S.K., & Stone, P.W. (2014). Night and Day in the VA: Associations Between Night Shift Staffing, Nurse Workflow Characteristics and Length of Stay. <u>Research in Nursing & Health</u>, 37, 90-97.</p>	<p>Longitudinal (panel) dataset developed to explore the impact of nurse staffing and nurse workforce characteristics on length of stay (LOS).</p> <p>Research question: What is the relationship between LOS and RN staffing levels, skill mix, and experience on the night shift (Day hours were defined at 7am to 6pm; night hours were 6:01pm through 6:59am)?</p> <p>Independent variables: staffing (HPPD) and human capital (educational preparation & years of experience).</p>	<p>138 VA acute care hospitals for the period October 2002 through 2006. Units included medical, medical/surgical, surgical, step-down, and telemetry units.</p>	<p>Length of Stay</p>	<p>RN staffing was greater during the day hours than the night hours (4.3 HPPD vs. 3.4).</p> <p>The percentage of care hours provided by RNs at night was higher than the percentage of care hours provided by RNs during day hours (64.6% vs. 60.2%).</p> <p>The percentage of care hours provided by Unlicensed Assistive Personnel (UAP) was higher during day hours than at night.</p> <p>BSN educational preparation of nurses was higher during the day (BSN 37% during day hours vs. 35.4% during night hours [$p < 0.1$]).</p> <p>ADN educational preparation of nurses was higher during the night (ADN 45.3% during night hours vs. 43.2% during day hours [$p < .01$]).</p> <p>This study explicitly explored the relationship between night shift staffing and poor patient outcomes. Nurse managers need to be aware of the impact of reducing staffing levels at night in order to reduce costs. Night staffing reductions can lengthen patient stay and ultimately increase hospital expenditures by increasing the risk for infection and other complications.</p> <p>Patient acuity, level of care, and volume can change at any time, and nurse staffing models should be flexible and facilitate shift-to-shift decisions in response to patient needs and census. Nurse managers are encouraged to consider the education level and experience of the workforce in off-shift planning. Differences in workforce characteristics at</p>

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<p>Dunton, N., Gajewski, B., Klaus, S. & Pierson, B. (2007). The relationship of nursing workforce characteristics to patient outcomes. <u>The Online Journal of Issues in Nursing</u>, 12(3), Manuscript 3.</p>	<p>Exploratory analysis to examine the relationship between multiple workforce indicators and patient falls and HAPUs.</p> <p>The hospital unit participating in the National Database of Nursing Quality Indicators was the unit of analysis</p>	<p>1610 critical care, step down, medical, surgical, medical-surgical and rehabilitation units</p> <p>Time period July 1, 2005 – June 30, 2006</p>	<p>Total falls per 1000 patient days</p> <p>Hospital-acquired Pressure Ulcer (HAPU) prevalence</p>	<p>night as compared to during the day may be associated with LOS as well as other patient outcomes.</p> <p>Lower fall rates were associated with higher total nursing hours, a higher RN staff mix, and a higher proportion of nurses with greater than 10 years of nursing experience</p> <p>Lower HAPU rates were associated with lower total nursing hours, a higher RN staff mix, and a higher proportion of nurses with greater than 10 years of nursing experience.</p> <ul style="list-style-type: none"> For every 1 hour increase in total nursing hours HAPU rates were 4.4% higher <p>The researchers speculate that units with higher total nursing hours may also have sicker patients at risk for pressure injury and call for research that more specifically controls for patient acuity and/or risk adjustment in order to understand the unexpected finding that lower HAPU prevalence is associated with lower total nursing hours.</p>
<p>Flynn, L., Liang, Y., Dickson, G.L. & Aiken, L.H. (2010). Effects of nursing practice environments on quality outcomes in nursing homes. <u>Journal of American Geriatrics Society</u>, 58, 2401-6.</p>	<p>Cross-sectional design linking nurse survey data with Hospital Compare data.</p>	<p>63 Medicare and Medicaid certified facilities in New Jersey</p> <p>340 RN who provide direct resident care surveyed about practice environment</p>	<p>Total number of deficiency citations</p> <p>Percentage of residents with pressure ulcers</p>	<p>The nursing practice environment is a significant predictor of the percent of residents experiencing pressure injury and the number of deficiency citations received by the nursing home</p> <p>For-profit facilities had a mean practice environment score that was significantly lower than not-for-profit nursing homes</p> <p>For-profit facilities had percentage of residents with pressure injury that was significantly higher than that for not-for-profit nursing homes</p> <p>In terms of number of deficiency citations, there was no significant difference between for-profit and not-for-profit nursing homes.</p> <p>The researchers call for improvements in nurse practice environments in order to improve care and outcomes in nursing homes, particularly for-profit facilities.</p>
<p>Frith, K.H., Anderson, F., Caspers, B., Tseng, F., Sanford, K., Hoyt, N., Moore, K. (2010). Effects of Nurse Staffing on Hospital-Acquired Conditions and Length of Stay in Community Hospitals. <u>Quality Management in Health Care</u>, 19(2), 147-155.</p>	<p>Cross-sectional, multisite, quantitative retrospective study designed to examine predictive relationships between nurse staffing and patient outcomes in hospitals.</p> <p>Data sources: 2 administrative</p>	<p>35,000 patients from 11 medical-surgical units in 4 hospitals of the Catholic Health Initiatives Corporation in 3 states</p>	<p>RN and LPN HPEqPD</p> <p>Outcome variables:</p> <ul style="list-style-type: none"> Total number of adverse outcomes Pressure ulcers Catheter-associated urinary tract infections Hospital-acquired injuries Length of stay 	<p>Findings: Higher RN staffing significantly decreased LOS when the research methodology controlled for patient age and complication index ; Higher LPN staffing was not as effective as an increase in RN staffing.</p> <p>Higher RN and LPN HPEqPD did not decrease in the incidence of single adverse events (pressure ulcers, catheter-associated urinary tract infections, hospital-acquired injuries) when controlled for patient covariates (age, complication index) as hypothesized.</p> <p>An increase of 1% in RN percentage in staffing reduced the number of adverse events by 3.4% and a 5% increase in RN percentage decreased</p>

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	databases <ul style="list-style-type: none"> • Solucient Operational Insights • Catholic Health Initiatives (CHI) Business Intelligence 		Unit variables: <ul style="list-style-type: none"> • RN hours per equivalent patient day (HPEqPD) • LPN HPEqPD • Percent RN staff • Percent LPN staff Patient data: <ul style="list-style-type: none"> • Patient age Complication index	the number of adverse events by 15.8%. For each percent increase of RNs in the RN/LPN skill mix, expected LOS would decrease by 4.18%. The authors report that they were unable to separate conditions present on admission from those that were hospital-acquired. Conclusions: Findings demonstrate that increasing the number of RN hours and percentage of RNs in the skill mix of medical-surgical units decrease the incidence of adverse effects and LOS.
Halm, M., Kandels, M., Blalock, M., Gryzman, A., Krisko-Hagel, K., Lemay, D., & Topham, D. (2005) Hospital nurse staffing and patient mortality, emotional exhaustion, and job dissatisfaction. <i>Clinical Nurse Specialist, 19</i> (5), 241-250.	Cross-sectional, correlational design	2709 general, orthopedic and vascular surgical patients 140 staff RNs, at one acute care hospital licensed for 572 beds	A) Patient outcomes: Mortality Failure to rescue B) Nurse outcomes: Emotional exhaustion Job dissatisfaction	A) Logistic regression was used to predict mortality and failure-to-rescue based on staffing and patient characteristics. Nursing staff levels were not found to be significantly associated with mortality (odds ratio = 1.01, $p = 0.969$). Examination of staffing ratios and failure to rescue revealed no significant relationship (odds ratio & p-value not reported). B) Emotional exhaustion was measured using the Maslach Burnout Inventory tool. Clinical specialty was examined as well. No association was found between emotional exhaustion and clinical specialty was found. High emotional exhaustion was significantly influenced by the number of years of service. With every one year increase of employment, the risk of high emotional exhaustion increased by 5.2% ($P = .01$) Satisfaction results 70% in sample were either satisfied or very satisfied with their job 7.8% were dissatisfied No significant relationship between clinical specialty and job dissatisfaction was found. Job dissatisfaction was significantly influenced by age and number of years of service: For every year of increased service, the risk of job dissatisfaction increased by 6.8% ($P = .03$) For every year of aging, the nurse is 2.5 times more likely to be dissatisfied ($P = .02$) When emotional exhaustion and job satisfaction were examined

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				<p>together: 23% with high emotional exhaustion were also dissatisfied ($P = .0001$) 37.5% with both high emotional exhaustion and dissatisfaction intended to leave their current job within next 12 months</p> <p><i>Limitations of study:</i> Retrospective data collection Unable to retrieve 100 % of death records (some from other states not available) Average nurse-to-patient ratio was calculated from census and staffing data Minimal variation in staffing pattern due to collective bargaining unit</p>
<p>Harless, D.W., Mark, B. A. (2010). Nurse Staffing and Quality of Care With Direct Measurement of Inpatient Staffing. <u>Medical Care</u>, 48(7), 659-663</p>	<p>Longitudinal regression analysis of California general acute care hospitals where inpatient staffing is measured directly.</p> <p>Data source: California's Office of Statewide Health Planning and Development (OSHPD)</p>	<p>11,945,276 adult inpatients at 283 general, short-term acute care hospitals in California from 1996 to 2001.</p>	<p>To estimate the impact of changes in RN staffing on changes in quality of care with direct measurement of staffing levels.</p> <p>Patient outcomes are in-hospital mortality ratio and surgical failure-to-rescue ratio.</p> <p>The ratios were calculated by comparing actual in hospital mortality and surgical failure to rescue rates to expected rates calculated using the Medstat disease staging algorithm.</p>	<p>Findings: Changes in RN staffing were associated with reductions in mortality and failure to rescue.</p> <p>A 1-unit (change in the number of deaths per 1000 patients) increase related to a 0.043 decrease in the mortality ratio at 2.97 RN FTEs per 1000 inpatient days.</p> <p>Failure to rescue estimates were significant only at higher staffing levels.</p> <p>Conclusions: The authors note this study is consistent with literature on RN staffing and hospital quality of care but recommend creation of a theory on the causality of this relationship and testing with more refined measures of nurse staffing.</p>
<p>Kelly, D., Kutney-Lee, A., Lake, E.T. & Aiken, L.H. (2013). The critical care work environment and nurse-reported health care-associated infections. <u>American Journal of Critical Care</u>, 22(6), 482-8.</p>	<p>Retrospective, cross-sectional design linking nurse and hospital survey data.</p>	<p>3217 critical care nurses</p> <p>320 hospitals in New Jersey, Pennsylvania, California and Florida</p>	<p>Nurse report of the frequency of health care-associated infections</p> <ul style="list-style-type: none"> • Ventilator associated pneumonia • Urinary tract infection • Infections associated with 	<p>The Practice Environment Scale (PES-NWI) was used to evaluate the practice environments of critical care nurses; there are 5 subscales:</p> <ul style="list-style-type: none"> • Staffing and resource adequacy • Nurse participation in hospital affairs • Nursing foundations for quality of care • Collegial nurse-physician relations • Nurse manager ability, leadership and support of nurses <p>Mean staffing levels were derived from nurse reports of the number of patients they cared for on their last shift; these were aggregated to the hospital level</p>

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			central venous catheters	<p>The staffing and resource adequacy subscale was deleted as it was found to be highly correlated with the separate staffing measure</p> <p>Nurses working in better working environments were 36-41% less likely to report the frequent occurrence of health care-associated infections on their unit</p> <p>Improving the nurse work environment may be an effective strategy for preventing health care-associated infections in critical care units</p>
<p>Kelly, D.M., Kutney-Lee, A., McHugh, M.D., Sloane, D.M. & Aiken, L.H. (2014). Impact of critical care nursing on 30-day mortality of mechanically ventilated older adults. <u>Critical Care Medicine</u>, 42(5), 1089-95.</p>	<p>Cross-sectional, multi-state study linking nurse survey data with Medicare claims data and hospital administrative data. Multi-level logistic regression analysis was used to assess the relationship between critical care nursing variables and 30-day mortality.</p>	<p>303 adult acute care hospitals in California, Florida, New Jersey and Pennsylvania</p> <p>55,159 mechanically ventilated older adults</p> <p>Registered Nurses self-reported variables: staffing levels, the nurse work environment, education and experience</p>	30-day mortality	<p>Patient characteristics were risk-adjusted; factors include age, sex, race, primary diagnosis, type of admission, and comorbid conditions.</p> <p>Nurse education and nurse experience (nurse practice environment) demonstrate a significant effect on mortality</p> <ul style="list-style-type: none"> • Each 10 point increase in a hospital's proportion of BSN-prepared critical care nurses is associated with a 2% lowering of the odds of death • The odds of death is lowered by 11% for patients cared for in hospitals with a better work environment. <p>The effects of critical care nurse staffing and years of experience did not reach statistical significance.</p>
<p>Kovner, C. & Gergen, P. (1998). Nurse staffing levels and adverse events following surgery in U.S. hospitals. <u>Image: Journal of Nursing Scholarship</u>, 30, 315-21.</p>	<p>Cross-sectional, descriptive</p> <p>1993 discharge data (Nationwide Inpatient Sample from AHCPH) from a 20% stratified probability sample of US community hospitals were used to determine adverse events</p> <p>Hospital level data were matched to AHA data on hospital characteristics,</p>	<p>Patient level data for patients age 18 and over from 589 acute care hospitals from 10 states</p>	<p>Incidence of adverse events conceptualized as nurse sensitive and non-nurse sensitive.</p> <p>Nurse-sensitive outcomes:</p> <ul style="list-style-type: none"> • Venous thrombosis (VT) or pulmonary embolism (PE) after major surgery • VT or PE after invasive vascular procedure • UTI after major surgery • Pneumonia after major surgery 	<p>Findings:</p> <p>There was a significant inverse relationship between nurse staffing and 3 out of the 5 adverse events that were conceptualized as nurse-sensitive</p> <ul style="list-style-type: none"> • UTI after major surgery (clinically meaningful) • Pneumonia after major surgery • VT after major surgery (clinically meaningful) <p>There was a significant inverse relationship between nurse staffing and 1 of the 4 adverse events that were conceptualized as non-nurse sensitive</p> <ul style="list-style-type: none"> • Pulmonary compromise after major surgery <p>The relationships described above are not independent in that an increase in nurse staffing was related to a decrease in UTI, pneumonia, VT and pulmonary compromise after surgery.</p> <p>Conclusions:</p> <p>The authors note that the relationship between nurse staffing and</p>

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	<p>including nurse staffing level.</p> <p>Purpose is to examine the relationship between nurse staffing and adverse events believed to be sensitive to nursing care. Hospital characteristics were controlled for.</p> <p>Nurse staffing was measured as the number of RN FTEs working per adjusted patient day.</p>		<ul style="list-style-type: none"> • Pneumonia after invasive vascular procedure <p>Non-nurse sensitive outcomes:</p> <ul style="list-style-type: none"> • Pulmonary compromise after major surgery • AMI after major surgery • GI bleed/ulceration after major surgery • Mechanical complications related to device, implant or grant <ul style="list-style-type: none"> • For the purposes of this analysis, those determined to be at risk for the adverse event prior to the surgery/procedure were excluded from the analysis 	<p>adverse patient events must be considered during redesign initiatives involving the clinical nursing workforce. They also note the implications for policy makers in terms of hospital regulation.</p>
<p>Kovner, C., Jones, C., Zhan, C., Gergen, P.J. & Basu, J. (2002). Nurse staffing and post-surgical adverse events: An analysis of administrative data from a sample of U.S. hospitals, 1990-1996. <u>Health Services Research,37(3)</u>, 611-29.</p>	<p>Cross-sectional, descriptive</p> <p>This study extends the analysis of Kovner & Gergen, 1998.</p> <p>1990-1996 discharge data (Nationwide Inpatient Sample from AHCPH) from a 20% stratified probability sample of US community hospitals were used to determine adverse events</p>	<p>Patient level data for patients age 18 and over from 530-570 (# varies by year within the study time period) acute care hospitals from 13 states</p>	<p>Incidence of adverse events conceptualized as sensitive to nurse staffing levels:</p> <p>VT/PE Pulmonary compromise after surgery UTI Pneumonia</p>	<p>Findings: RN hours per adjusted patient day, after all other variables were controlled for, were inversely related to all adverse events The relationship was statistically significant only for pneumonia</p> <p>LPN hours per adjusted patient day did not show a significant relationship to any of the adverse events</p> <p>Conclusions: This study adds to knowledge base regarding the relationship between nurse staffing and patient outcomes, but is limited by the use of administrative data for determining quality indicators as well as analysis at the hospital level. In addition, the metric for RN staffing is drawn from paid hours, rather than direct care hours. Finally, the metric includes managerial as well as clinical RNs. Ongoing research is called for using increasingly accurate and consistent measures of acuity and quality. The nurse staffing level that produces patient care that is of high quality and cost-effective has not been determined.</p>

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	<p>Hospital level data were matched to AHA data on hospital characteristics, including nurse staffing level.</p> <p>Purpose is to examine the relationship between nurse staffing and adverse events believed to be sensitive to nursing care. Hospital characteristics were controlled for.</p> <p>Nurse staffing was measured as the number of RN FTEs working per adjusted patient day. Medicare CMI for each study year, proportion of patients with Medicare as principle payer, and source of admission were included to adjust for acuity.</p>			
<p>Kutney-Lee, A., Lake, E.T. & Aiken, L.H. (2009). Development of the hospital nurse surveillance capacity profile. <i>Research in Nursing & Health</i>, 32, 217-28.</p>	<p>Descriptive, Secondary analysis of RN survey data; survey developed to examine the relationships between nurse staffing, work environment, and patient outcomes</p> <p>Survey was conducted in 1999</p>	<p>9232 RN from 174 Pennsylvania hospitals</p> <p>Variables included: Staffing Education Clinical expertise Years of experience Nurse practice environment</p>	<p>Falls with injury Nosocomial infections</p>	<p>The purpose of this analysis was to describe the nurse surveillance capacity of hospitals by rank order and to associate average ranking with indicators of care quality</p> <p>Nurses practicing in hospitals ranked in the top decile for surveillance capacity took care of 2 fewer patients than those in the lowest decile.</p> <p>The study suggests that a high ranking for staffing, nurse education, nurse expertise, nurse experience, and a supportive practice environment is associated with the prevention of falls with injury and nosocomial infections.</p> <p>The proposed mechanism is more effective nurse surveillance across individuals nurses and over time</p>

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				<p>The researchers suggest that the modification of specific organizational characteristics is a potential strategy for improving care and reducing adverse patient outcomes.</p>
<p>Kutney-Lee, A., Sloane, D.M. & Aiken, L.H. (2012). An increase in the number of nurses with baccalaureate degrees is linked to lower rates of post surgery mortality. <i>Health Affairs</i>, 32(3), 579-86.</p>	<p>Retrospective, two-stage panel design to investigate the association of post surgery mortality and the proportion of RNs with a baccalaureate degree</p> <p>Data from 1999 was compared to 2006 data</p>	<p>134 Pennsylvania hospitals</p> <p>67,000 Pennsylvania RNs</p> <p>General, orthopedic, or vascular surgical patients aged 20-85</p>	<p>Post surgery mortality Failure to Rescue</p>	<p>Patient level mortality and failure-to-rescue data were aggregated and standardized, risk-adjusted rates were produced for each hospital. The risk-adjustment model included age, sex, admission type, and surgical DRG. Also included was a set of 27 comorbid conditions.</p> <p>A 10 point increase in the proportion of a hospital's BSN prepared nurses was associated with a reduction of 2.12 deaths for every 1000 patients. For the subset with complications (failure-to-rescue) a 10 point increase in BSN preparation was associated with a mortality reduction of 7.47 deaths per 1000 patients</p> <p>Significant reductions in mortality and failure-to-rescue rates in association with staffing levels, skill mix, or years of experience were not detected.</p> <p>The authors state that this study demonstrates that years of experience is not a substitute for BSN or higher education in nursing.</p>
<p>Lake, E.T., Shang, J., Klause, S. & Dunton, N.E. (2010). Patient Falls: Association with hospital Magnet status and nursing unit staffing. <i>Research in Nursing & Health</i>, 33, 413-25.</p>	<p>Retrospective, cross-sectional analysis of the relationships between hospital Magnet status, nursing unit staffing, and patient falls</p> <p>Data were derived from National Database for Nursing Quality Indicators for the year 2004.</p> <p>Additional data were derived from AHA 2004 Annual Hospital Survey, the Medicare CMI, and Magnet status.</p>	<p>5,388 nursing units in 636 hospitals</p>	<p>Patient falls</p>	<p>Bivariate Analysis Nursing staff hours and Magnet recognition were associated with fall rate; the association was significant</p> <ul style="list-style-type: none"> • Hours per patient day were negatively associated with fall rate • LPN and CNA hours per patient day demonstrated a positive association with fall rate <p>Specific elements of RN staff composition were examined and no significant associations with detected; specifically assessed were</p> <ul style="list-style-type: none"> • BSN proportions • Specialty certification proportions • Agency nurse hours <p>Multivariate Analysis</p> <ul style="list-style-type: none"> • The likelihood of patient falls was 5% lower in Magnet hospitals • An additional hour of RN care per patient day was associated with a reduction in the fall rate by 2% • An additional hour of LPN and CNA care per patient day was associated with an increase in the fall rate by 2.9% and 1.5% respectively <p>AHA data revealed that NDNQI hospitals provided almost 2 hours higher RN hours per patient day than general hospitals</p>

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				<p>The researchers note the following limitations to this study:</p> <ul style="list-style-type: none"> • NDNQI is a nursing quality benchmark data base and likely does not represent all general hospitals • Hospitals already oriented towards high quality nursing care may be more likely to participate in the NDNQI voluntary reporting program • RN staffing is significant higher in Magnet hospitals and the multivariate model results do not apply to all general hospitals • Does Magnet Recognition translate into safer practice or are safer hospitals with fewer falls more likely to become recognized as Magnet hospitals?
<p>Landon, B.E., Normand, S.T., Lessler, A., O'Malley, A.J., Schmaltz, S., Loeb, J.M. & McNeil, B.J. (2006). Quality of care for the treatment of acute medical conditions in US hospitals. <u>Archives of Internal Medicine</u>, 166, 2511-7.</p>	<p>Estimation of logistic regression models to examine the relationship between hospital characteristics and quality; by linking performance data reported to either the Centers for Medicare and Medicaid Services (CMS) or The Joint Commission (TJC) to data submitted to AHA for the first half of 2004 to data on hospital characteristics obtained from the American Hospital Association (AHA).</p>	<p>Over 4,000 hospitals</p>	<p>Acute Myocardial Infection (AMI), Congestive Heart Failure (CHF), & Pneumonia; as described by quality measures collected by TJC and CMS</p>	<p>Findings for each hospital type:</p> <ul style="list-style-type: none"> • Factor analysis suggested 2 underlying domains of quality spanned across the 3 conditions: 'treatment and diagnosis' and 'counseling and prevention' • For profit hospitals consistently performed worse than not-for-profit hospitals, for each condition • Federal and military hospitals consistently had the highest performance • Joint Commission accredited hospitals also had consistent high performance • Rural hospitals' performance was higher for pneumonia but lower for AMI and CHF • Major teaching hospitals provided higher quality care for patients with AMI, but not for CHF and Pneumonia. Consequently, these hospitals had higher quality for treatment and diagnosis, but lower performance for counseling and prevention composite <p>Overall findings:</p> <ul style="list-style-type: none"> • As the share of Medicaid patients increased, performance decreased • Hospitals with more technology had higher performance with the strongest relationship being the treatment and diagnosis composite • Higher RN staffing patterns were associated with higher quality of care on all of the measures examined • Patients' geographical location to hospitals affected the choice of hospitals <p>Conclusions:</p> <ul style="list-style-type: none"> • Quality performance may vary by functional roles in the hospital, such as treatment and diagnosis vs. counseling and prevention, than by the particular disease being treated • Characteristics of hospitals, including ownership, teaching status, TJC accreditation, and investments of technology and

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				<p>nursing were also strongly related to performance and can influence patient choice</p> <p>Efforts to improve hospital quality of care that focus on domains of treatment that apply across multiple types of conditions are more likely to have more impact than efforts aimed at improving quality for a single condition</p>
<p>Lee, H.Y., Blegen, M.A. & Harrington, C. (2014). The effects of RN staffing hours on nursing home quality: A two-stage model. <u>International Journal of Nursing Studies</u>, 51, 409-17.</p>	<p>Cross-sectional design to explore relationships between staffing and market and facility characteristics relative to 3 outcome measures and 2 process indicators.</p> <p>Descriptive statistics and regression analysis</p>	<p>All nursing homes operating in the state of Colorado in the year 2000</p> <p>Data sources: Online Survey Certification and Reporting (OSCAR) data, Minimum Data Set (MDS), quarterly staffing data from state inspections, Medicaid reimbursement data, and Area Resources File (ARF).</p>	<p>Process Measures: % of antipsychotic drug use; % of indwelling catheter use</p> <p>Outcome Measures: % of low risk pressure ulcers; % of urinary tract infections; % of weight loss</p>	<p>Higher RN hours were associated with 11.3% lower rates of pressure ulcers; the association was significant</p> <p>RN staffing hours were not related to urinary tract infections; facility size was inversely related to urinary tract infections</p> <p>RN staffing hours were not related to weight loss or antipsychotic drug use, while higher weight loss and higher use of antipsychotics was associated with a higher percentage of Medicare clients</p> <p>RN staffing hours were not related to catheter use rates</p> <p>Limitations to this study include:</p> <ul style="list-style-type: none"> • Study may not have been sufficiently powered to detect statistically significant relationships between RN staffing and 4 of the 5 variables of interest • Study only analyzed RN staffing effect and it may that direct care hours or total nursing hours may have a bigger effect on the prevention of urinary tract infection, weight loss, use of antipsychotics and catheter use • Other structural aspects of nurse staffing (e.g. education, experience) were not included in the analysis • The 0.6 RN hours per resident day may not have met a threshold for the effect of interest
<p>Lerner, N.B. (2013). The relationship between nursing staff levels, skill mix, and deficiencies in Maryland nursing homes. <u>The Health Care Manager</u>, 32(2), 123-8.</p>	<p>Secondary analysis of cross-sectional data designed to explore the relationship between survey deficiencies and nurse staffing</p> <p>Two multiple regression analyses were conducted to explore factors influencing number and severity of deficiencies cited</p>	<p>All 225 nursing homes in the state of Maryland; convenience sample from which 3 nursing homes were excluded for lack of data</p>	<p>Total number of deficiencies on the most recent state survey</p> <p>Severity of deficiency on a 1-4 scale where 1 is minimum harm and 4 is immediate jeopardy to resident health and safety</p>	<p>Lower number of nursing home beds, higher CNA hours per patient day, and location of the nursing home were associated with fewer deficiencies</p> <p>Severity of deficiencies was inversely related to RN hours per patient day</p> <p>The authors noted that while increasing RN staffing is a costly option for nursing homes, the prevention of higher level severity of deficiencies may make RNs cost effective, while also increasing the overall quality of care in nursing homes.</p>
<p>Lichtig, L, Knauf, R. & Milholland, D. (1999).</p>	<p>Cross-sectional analysis of publicly</p>	<p>All acute care hospitals in New</p>	<p>Adverse patient outcomes:</p>	<p>Findings: Richer nursing hours per NIW and higher nursing skill mix were</p>

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<p>Some impacts of nursing on acute care hospital outcomes, <u>Journal of Nursing Administration</u>, 29, 25-33.</p>	<p>available data from acute care hospitals in New York (N=229) and California (N = 462)</p> <p>Purpose is to determine the relationship between nurse staffing and nursing-sensitive patient outcomes</p> <p>New York 1992 & 1994 Institutional Cost Reports were source of data about total patient days, total FTE by cost center, total nurse FTEs by skill level (RN, LPN, CNA)</p> <p>California 1992 & 1994 Annual Hospital Disclosure Reports were the source of data about cost center, paid hours for RNs, LVNs and aides/orderlies, and total patient days.</p> <p>For New York and California, patient data source was the Uniform Hospital Discharge Data Set minus items that could be used to identify individual patients.</p>	<p>York (N=229) and California (N = 462)</p> <p>New York Uniform Hospital Discharge Data Set includes information for approximately 2.5 million patients annually</p> <p>California Uniform Hospital Discharge Data Set includes information for approximately 3.5 million patients annually</p>	<ul style="list-style-type: none"> • Pressure ulcers • Pneumonia • UTI • Postoperative infections <p>Length of Stay (LOS)</p> <p>Analyzed at the hospital level and state level.</p>	<p>associated with reduced LOS across all data sets (2 states, 2 time periods each)</p> <p>Richer RN skill mix was associated with lower pressure injury rates</p> <ul style="list-style-type: none"> • Each additional percentage point of RN personnel was associated with a reduction in pressure injury rate between 0.79% and 1.77%. <p>There was no consistent relationship between the staffing variables and pneumonia.</p> <p>There was not a consistent relationship between the staffing variables and post-operative infection</p> <ul style="list-style-type: none"> • In California a significant reduction in post-op infection was associated with richer RN staffing • In New York, the relationship was not significant <p>In 3 of the 4 data sets there was a significant relationship between nursing skill mix and UTI</p> <ul style="list-style-type: none"> • Each additional percentage point of RN personnel was associated with a UTI rate that was close to 0.66% lower. <p>Conclusions: The availability of standardized administrative data sets present the opportunity to measure nursing-sensitive outcomes in relationship to staffing variables and other hospital characteristics</p>

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	Nursing Intensity Weights (NIW), reflecting the relative amount of nursing services required for typical patients within a DRG, were used to adjust for acuity			
McCue, M., Mark, B.A. & Harless, D.W. (2003). Nurse staffing, quality, and financial performance. <u>Journal of Health Care Finance</u> , 29(4), 54-76.	<p>Dependent Variables</p> <p>Financial Performance</p> <ul style="list-style-type: none"> • operating margin • operating expense <p>Independent Variables</p> <p>Hospital Output</p> <ul style="list-style-type: none"> • Inpatient Days • Discharges • Outpatient Visits <p>Input price</p> <p>Hospital Characteristics</p> <ul style="list-style-type: none"> • Case mix index • Payer mix • Nonprofit ownership • For-profit ownership • Location • System affiliation <p>Market Characteristics</p> <ul style="list-style-type: none"> • HSA hospital use • Herfindahl index • Number of HMOs • HMO penetration 	<p>422 acute care hospitals</p> <p>Data sources:</p> <p>American Hospital Association Annual Survey</p> <p>Centers for Medicare and Medicaid Services</p> <ul style="list-style-type: none"> • minimum cost & capital file • provider of services file • case mix index file • Online Survey Certification & Reporting files • HCUP files 	Change in financial Performance	<p>Findings</p> <ul style="list-style-type: none"> • Increasing Registered Nurse staffing was associated with an increase in operating costs; the increase was statistically significant • There was no statistically significant effect on profit margin associated with Registered Nurse staffing • Higher levels of non-nurse staffing was associated with higher operating costs and lower profits • Changes in quality of care did not have a statistically significant effect on operating costs and margin <p>Conclusions</p> <p>The authors note that, at a minimum, their findings should lead to questioning the understanding that cuts in RN staffing will be associated with increased profitability. They suggest that this study provides a baseline analysis (prior to Medicare Payment Reform - Balanced Budget Act) for studies assessing the impact of nurse staffing and quality of care on financial performance.</p>

Citation	Design	Population/ Sample Size	Primary Outcome Measure(s)	Conclusions/ Comments
	Population characteristics <ul style="list-style-type: none"> • Unemployment rate • Per capita income • Percent over age 65 Staffing <ul style="list-style-type: none"> • RN FTEs • LPN FTEs • Non-nurse FTEs Quality Measures <ul style="list-style-type: none"> • Mortality 			
McHugh, M.D., Berez, J. & Small, D.S. (2013). Hospitals with higher nurse staffing had lower odds of readmissions penalties. <u>Health Affairs</u> , 32(10), 1740-47	Cross-sectional design utilizing logistic regression analysis to explore the relationship between RN staffing levels and hospital performance under the Hospital Readmissions Reduction Program	US hospitals with at least 25 cases of heart failure, acute myocardial infarction, and pneumonia; Maryland hospitals were excluded due to the state's unique all-payer hospital payment system The data period was July 1, 2008 – June 31, 2011	Based on readmissions adjustment factor	Applied a matching procedure to create an apples-to-apples comparison between hospitals; hospital pairings were created that were equivalent in all respects with the exception of staffing Hospitals with higher nurse staffing had 25% lower odds of paying a readmission penalty as compared to hospitals with lower nurse staffing Hospitals with higher nurse staffing had 41% lower odds of paying a maximum readmission penalty as compared to hospitals with lower nurse staffing Each additional nurse hour per adjusted patient day was associated with 10% lower odds of receiving a readmission penalty Managing nurse staffing levels and nurse workloads may be potential strategies that hospitals can implement as a response to the regulatory environment and value-based initiatives
McHugh, M.D., Kelly, L.A., Smith, H.L., Wu, E.S., Vanak, J.M. & Aiken, L.H. (2013). Lower mortality in Magnet hospitals. <u>Medical Care</u> , 51(5), 382-8.	Cross-sectional analysis designed to explore the relationship between Magnet status (including nursing characteristics and the practice environment) and lower risk-adjusted mortality and failure-	56 Magnet hospitals and 508 non-Magnet hospitals from 4 states (California, Florida, New Jersey and Pennsylvania) in 2006-2007.	Mortality Failure-to-rescue	3 models were developed Model 1 (effect of Magnet status) demonstrated that the odds of 30-day mortality and failure-to-rescue are lower for surgical patients as compared to non-Magnet hospitals; the effect is statistically significant Model 2 (effect of nursing composite measure) showed a statistically significant reduction in the odds of mortality and failure-to-rescue. Model 3 (combined effect of Magnet status and nursing composite measure) showed that the nursing composite measure was significantly

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	<p>to-rescue</p> <p>Logistic regression was used to examine associations</p>			<p>associated with lower odds of mortality, as was Magnet status, but to a lesser degree. The results for failure-to-rescue were similar; the nursing composite measure was significant and the Magnet status measure approached significance.</p> <p>There did not appear to be a significant interaction between the nursing composite and Magnet status</p> <p>Patients treated in Magnet hospitals have lower mortality and this can be primarily attributed to nursing characteristics; however, there a mortality advantage above and beyond what could be measured in this study. The authors speculate that Magnet status builds on the existing foundation for quality care and leads to organizational behavior that is related to ongoing improvement in patient care.</p> <p>The authors propose that enhanced work environments in Magnet hospitals are the key factor contributing to improved patient outcomes</p>
<p>McHugh, M.D. & Ma, C. (2013). Hospital nursing and 30-day readmissions among Medicare patients with heart failure, acute myocardial infarction, and pneumonia. <u>Medical Care</u>, 51(1), 52-9.</p>	<p>Cross-sectional study designed to explore the relationship between hospital staffing (nurse work environment, nurse staffing levels, and nurse education) and 30-day readmissions of Medicare patients with heart failure, acute myocardial infarction, and pneumonia</p>	<p>Nurse survey data (Practice Environment Scale/PES-RWI) from RNs in California, New Jersey and Pennsylvania</p> <p>Data years were 2005-2006</p> <p>412 hospitals in California, New Jersey and Pennsylvania</p> <p>171,883 HF index admissions 62,394 AMI index admissions 141,404 pneumonia index admissions</p>	<p>30-day readmission</p>	<p>The Practice Environment Scale has 5 subscales</p> <ul style="list-style-type: none"> • Nursing foundations for quality care • Staffing and resource adequacy • Nurse participation in hospital affairs • Nurse manager ability, leadership and support • Nurse-physician relations <p>A categorical measure was used to classify hospitals as having "good" work environments (above median on 4 or 5 subscales); "mixed" work environments (above median on 2 or 3 subscales); and "poor" work environments (above the median on 1 or no subscales).</p> <p>Logistic regression analysis demonstrated: Receiving care in a hospital with a good vs. poor work environment was associated with a 7% reduction in the odds of a readmission for a patient with heart failure, 6% lower odds of a readmission for a patient with acute myocardial infarction, and 10% lower odds of a readmission for a patient with pneumonia.</p> <p>When comparing hospitals with a mixed vs. poor work environment the reductions in odds ratios for patients with heart failure, acute myocardial infarction, and pneumonia were 4%, 3%, and 6% respectively</p> <p>There was no significant association between readmission for heart failure and acute myocardial infarction and nurse education. For pneumonia, each 10% increase in the proportion of BSN nurses was associated with a reduction in the odds of readmission by 3%.</p> <p>The odds of readmission was 7% higher for patients with heart failure</p>

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				<p>for each addition of 1 patient per nurse. For patients with acute myocardial infarction and pneumonia the odds of readmission was 9% and 6% higher respectively.</p> <p>There was no significant interaction between staffing and the work environment.</p> <p>The authors suggest that enhancing the nursing care environment is an attractive strategic intervention for hospitals</p>
<p>Manojlovich, M., Sidani, S., Covell, C.L. & Antonakos, C.L. (2011). Nurse dose: Linking staffing variables to adverse patient outcomes. <i>Nursing Research</i>, 60(4), 214-20.</p>	<p>Cross-sectional designed to examine the construct of nurse dose by determining its association with methicillin-resistant Staphylococcus aureus (MRSA) infections and patient falls</p> <p>Data analysis: bivariate correlations and Poisson regression</p>	<p>26 hospital units in Michigan and Ontario, Canada</p>	<p>MRSA infections Patient falls</p>	<p>As conceptualized, nurse dose has 2 attributes, active ingredient and intensity. Active ingredient is comprised of education, experience, skill mix, while intensity is comprised of full-time employees, RN:patient ratio, RN hours per patient day.</p> <p>The two nurse dose attributes had significant associations with both outcomes of interest (bivariate correlations).</p> <p>The regression analysis revealed that when MRSA infection was the outcome both attributes were significant predictors with nearly identical negative coefficients for both.</p> <p>Similarly, the second regression model revealed that both attributes were significant predictors for patient falls. Coefficients for both were negative, but the sizes differed.</p> <p>The primary purpose of this research was to support the validity of the nurse dose concept.</p> <p>Findings suggest that both active ingredient and intensity work to prevent MRSA infection and likely work through RN monitoring and surveillance functions. Findings further suggest that for the prevention of patient falls the intensity attribute may have more influence than the ingredient attribute.</p> <p>The researcher suggest that the concept of nurse dose may assist nurse managers to make a case for nurse staffing to non-nurse financial managers.</p>
<p>Mark, B., Harless, D.W., MuCue, M. & Xu, Yihua (2004). A longitudinal examination of hospital registered nurse staffing and quality of care. <i>Health Services Research</i>, 39(2), 279-300.</p>	<p>Longitudinal, non-experimental analysis of secondary data from the years 1990-1995 to examine the relationships between nurse staffing and quality of care.</p>	<p>422 acute care hospitals Data sources: American Hospital Association</p> <ul style="list-style-type: none"> • Nurse staffing • Hospital characteristics 	<ul style="list-style-type: none"> • Risk-adjusted observed/expected mortality • Risk-adjusted observed/expected pneumonias • Risk-adjusted observed/expected 	<p>Findings</p> <ul style="list-style-type: none"> • There was a marginal, but diminishing, effect on reducing mortality associated with increasing Registered Nurse staffing • There was no consistent effect on the rates of pressure injury, pneumonia, or urinary tract infection • Selected hospital characteristics, market characteristics, and financial performance had other independent effects on the outcomes of interest

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		InterStudy & Area Resource Files <ul style="list-style-type: none"> • Market characteristics Centers for Medicare and Medicaid Services <ul style="list-style-type: none"> • Financial performance Healthcare Cost & Utilization Project <ul style="list-style-type: none"> • In-hospital mortality Risk-adjusted complication ratios for pressure injury, pneumonia & urinary tract infection	decubitus <ul style="list-style-type: none"> • Risk-adjusted/expected urinary tract infection 	Conclusion The findings of this analysis provide only limited support for the understanding that enhancing RN staffing will provide <i>unconditional</i> (emphasis in the original research report) improvement in quality of care.
Mark, B.A., Salyer, J. & Harless, D. (2002). Factors influencing perceptions of staffing adequacy. <i>Journal of Nursing Administration</i> , 32(5), 234-42.	Independent variables Hospital characteristics <ul style="list-style-type: none"> • Case mix index • Technological complexity • Teaching status • Hospital volatility of admissions Nursing Unit characteristics <ul style="list-style-type: none"> • Total nursing staff • Skill mix • Nursing work load • Education • Unit admission volatility Availability of support services	136 general medical-surgical units in 68 randomly selected nonfederal, not for profit hospitals in the Southeastern United States, Texas, and the District of Columbia.	Staff nurse perception of staffing adequacy	Findings: <ul style="list-style-type: none"> • Larger unit size was associated with perceptions of less adequate nurse staffing • Optimal unit size may be fewer than 27 beds • Additional factors <ul style="list-style-type: none"> ▪ Architectural/spatial design ▪ Occupancy rates ▪ Implementation of computerized information systems ▪ Ergonomics, human factors, & engineering components • Higher levels of patient was associated with perceptions of less adequate nurse staffing • Being an admissions "grower" was positively associated with perceptions of adequate nurse staffing Authors note that operationalization of workload is based on notion of production efficiency <ul style="list-style-type: none"> ▪ Does not account for complexity of patient at the level of the nursing unit ▪ Patient days, a key measure of workload, is derived from midnight census which most likely underestimates nursing workload.

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	Nurse characteristics <ul style="list-style-type: none"> • Experience • Age Patient characteristics <ul style="list-style-type: none"> • Age Dependent variable Perceptions of adequacy of staffing <ul style="list-style-type: none"> • Staff nurse responses to global single item indicator • 5 point Likert scale ranging from "very much above average" to "very much below average." 			
Mark, B.A., Salyer, J. & Wan, T.T.H. (2003). Professional nursing practice: Impact on organizational and patient outcomes. <u>Journal of Nursing Administration</u> , 33(4), 224-34.	Independent variables Hospital characteristics <ul style="list-style-type: none"> • Technological complexity • Case mix index • Teaching status • Volatility of admissions • Hospital size Nursing unit characteristics <ul style="list-style-type: none"> • Experience • Skill mix • Unit size • Availability of support services • Patient technology Organizational structure <ul style="list-style-type: none"> • Decentralization • Autonomy • Collaboration 	1682 RNs and 1326 patients on 124 general medical-surgical nursing units in 64 acute care hospitals in the Southeast United States	Organizational outcomes <ul style="list-style-type: none"> • Nurse work satisfaction • Nursing turnover • Average LOS Patient Outcomes <ul style="list-style-type: none"> • Patient satisfaction • Reported medication errors • Reported patient falls 	Findings: <ul style="list-style-type: none"> • Significant relationship between professional nursing practice and nurses' work satisfaction at both the hospital and unit level • At the unit level, higher levels of professional practice associated with lower nursing turnover • Consistent availability of support services was a significant predictor of professional nursing practice • Richer skill mix associated with higher patient satisfaction • Skill mix not associated with <ul style="list-style-type: none"> ○ Nursing satisfaction ○ Medication errors ○ Patient falls

Citation	Design	Population/ Sample Size	Primary Outcome Measure(s)	Conclusions/ Comments
	<p>with physicians</p> <p>Dependent variables Organizational outcomes</p> <ul style="list-style-type: none"> • Nurses' work satisfaction • Nursing turnover • Average patient length of stay <p>Patient outcomes</p> <ul style="list-style-type: none"> • Patient satisfaction • Reported medication errors • Reported patient falls 			<p>Note: Data collection for the ORNA-2 Project began in 2004. the ORNA-2 Project will continue to study the relationship between RN staffing adequacy, the practice of professional nursing, and patient and organizational outcomes (Mark, 2003).</p>
<p>Martsof, G.R., Auerbach, D., Benevent, R., Stocks, C., Jiang, H.J., Pearson, M.L., Ehrlich, E.D., & Gibson, T.B. (2014). Examining the Value of Inpatient Nurse Staffing. <i>Medical Care</i>, 52 (11), 982-988.</p>	<p>A longitudinal, hospital-fixed effect model was estimated to assess the effect of nurse staffing levels and skill mix on patient care costs, length of stay, and adverse events, adjusting for patient clinical and demographic characteristics.</p> <p>2 models were constructed: 1. RNs and LPNs per 1000 patient days <u>and</u> the proportion of nursing staff that are RNs (Examine the effects of 1 additional nurse per 1000 patient days while holding skill mix</p>	<p>Nurse Staffing and discharge data (Healthcare Cost and Utilization Project – HCUP) for 421 hospitals in California, Nevada, and Maryland in 2008-2011, representing 1600 hospital years of data and 18,474,860 discharges.</p>	<p>Patient care costs, adverse events & length of stay</p>	<p>Increases in nurse staffing levels were associated with reductions in nursing-sensitive adverse events and length of stay, but did not lead to increases in patient care costs.</p> <p>Changing skill mix by increasing the number of registered nurses, as a proportion of licensed nursing staff, led to reductions in costs.</p> <p>These results provide further support for the business case for increasing nurse staffing – suggesting that outcomes can be improved without increasing patient care costs.</p> <p>The study findings provide support for the value of inpatient nurse staffing as it contributes to improvements in inpatient care; increases in staffing number and skill mix can lead to improved quality and reduced length of stay at no additional cost.</p> <p>Bottom line: In a value-based reimbursement model, increasing nurse staffing levels and nursing skill mix reduces costly quality deficits that are especially sensitive to nursing care.</p>

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	constant); 2. Total nursing staff per 1000 patient days and the proportion of all nursing staff that are licensed nurses (examine the effects of changing skill mix while holding nurse staff levels constant).			
Needleman, J., Buerhaus, P., Mattke, S., Stewart, M. & Zelevinsky, K. (2002). Nurse-staffing levels and the quality of care in hospitals. <u>The New England Journal of Medicine</u> , 346(22), 1715-22.	Cross-sectional 1997 administrative data (discharge abstracts) from 799 hospitals in 11 states was used to analyze the relationship between amount of care provided by hospital nurses and patient outcomes. Measures of nurse staffing were determined from a variety of hospital reported sources	5,075,969 medical patient records 1,104,659 surgical patient records	Adverse outcomes <ul style="list-style-type: none"> • UTI • Pressure ulcer • Hospital-acquired pneumonia • Shock or cardiac arrest • UGI bleeding • Hospital-acquired sepsis • DVT • CNS complications • In-hospital death • Failure to rescue • Wound infection • Pulmonary failure • Metabolic derangement The last three outcome indicators were assessed for surgical patients only. Length of Stay	Findings: For medical patients richer RN staffing (higher percentage of hours of care provided by RNs and/or higher absolute number of hours of care per day provided by RNs) was associated with: <ul style="list-style-type: none"> • Shorter LOS • Lower rates of <ul style="list-style-type: none"> ○ UTI ○ UGI bleeding ○ Pneumonia ○ Shock or cardiac arrest ○ Failure to rescue For surgical patients richer RN staffing (higher percentage of hours of care provided by RNs and/or higher absolute number of hours of care per day provided by RNs) was associated with: <ul style="list-style-type: none"> • Lower rates of <ul style="list-style-type: none"> ○ UTI ○ Failure to rescue There was no association between richer RN staffing and in-hospital death There was no association between increased staffing by LPNs or CNAs and the rate of adverse outcomes. Conclusion: Better care for hospitalized patients is achieved when a higher proportion of hours of nursing care are delivered by RNs and when a higher number of hours of care per day are delivered by RNs
Needleman, J., Buerhaus, P., Pankratz, V.S., Leibson, C.L., Stevens, S.R. & Harris, M. (2011). Nurse staffing and inpatient hospital mortality. <u>New</u>	Retrospective, observational study designed to explore the association between mortality and patients exposed	197,961 admissions to adult ICU, step down, medical and/or surgical; units were in a tertiary academic	Inpatient mortality	Cox proportional-hazards regression models were used to conduct a survival analysis; time from hospital admission was the time scale and in-hospital death was the outcome 6.9% of shifts were determined to be "high turnover" while 15.9% of shifts had below target staffing

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<p><u>England Journal of Medicine</u>, 364(11), 1037-45.</p>	<p>to nursing shifts with RN staffing 8 hours or more below the targeted staffing level</p> <p>Association between mortality and high patient turnover was also examined</p> <p>Below target staffing and high turnover were proxies for high-workload shifts</p>	<p>medical center</p> <p>Only the first admission was included in the analysis for patients with multiple admissions</p> <p>Data were from 2003 – 2006 and represented 1,897,424 unit-shifts</p>		<p>Patients exposed to high-turnover and below-target staffing experienced higher mortality; the independent association was significant in both cases</p> <p>The researchers estimated that risk of death was increased by 2% for each shift where a patient was exposed to below target RN staffing and 4% for each shift where a patient was exposed to high-turnover</p> <p>It is suggested that staffing models with shift-to-shift staffing decisions based in the alignment of patient needs and census are desirable</p>
<p>Needleman, J., Buerhaus, P., Stewart, M., Zelevinsky, K. & Mattke, S. (2006). Nurse staffing in hospitals: Is there a business case for quality? <u>Health Affairs</u>, 25(1), 204-11.</p>	<p>National estimates (scenarios) of the cost of increasing nurse staffing are constructed; associated reductions in costs related to days, deaths, and adverse outcomes are explored for each scenario</p>	<p>26% of the discharges from US nonfederal acute care hospitals in 1997</p>	<p>n/a</p>	<p>3 scenarios were constructed</p> <ul style="list-style-type: none"> • Raise proportion of RNs to 75th percentile without changing numbers of licensed hours <ul style="list-style-type: none"> ○ + 37,089 RN FTEs; -37,089 LPN FTEs; cost (in millions) \$811 • Raise number of licensed hours to 75th percentile without changing proportion of RNs <ul style="list-style-type: none"> ○ +114,456 RN FTEs; +13,093 LPN FTEs; cost (in millions) \$7,538 • Raise both proportion of RNs and number of licensed hours to 75th percentile <ul style="list-style-type: none"> ○ +157,894; -30,345 LPN FTEs; cost (in millions) \$8,488 <p>The analysis demonstrated an unequivocal business case for the first scenarios; in this scenario the incremental costs associated with increasing nurse staffing are offset by cost savings; this option was also the least costly</p> <p>In the other two scenarios constructed the incremental costs of increased staffing are not offset by cost savings</p> <p>The researchers note that their estimates of cost savings are upper-bound in that they did not consider savings associated with lower liability, improved reputation & image.</p> <p>Increasing nurse staffing is viewed as a cost from the hospital's perspective, while cost savings largely accrue to payers.</p> <p>From a policy perspective, the central question is how much value patients, payers, and providers of care place on avoided death and</p>

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				adverse outcomes.
<p>Pappas, S.H. (2008). The cost of nurse-sensitive adverse events. <u>Journal of Nursing Administration</u>, 38(5), 230-6.</p>	<p>Nonexperimental, descriptive, retrospective study</p> <p>Describe methodology to determine cost of adverse effect and effective levels of nurse staffing.</p>	<p>3,230 adult inpatients (final sample was 2,495 because 735 cases were excluded due to missing severity information);</p> <p>(2 acute care hospitals. 1 medical, 1 surgical, 1 orthopedic unit from each hospital. 3 discharge diagnosis: CHF (DRG 127), joint replacement (DRG 209, 210, 544, 545) & major bowel surgery (DRG 148)</p> <p>These DRGs were chosen because of high volume or high risk for adverse events and prolonged LOS</p>	<p>Patient cost per case, adverse events (medication errors, patient falls, UTI, PNA and pressure ulcers), nursing staffing (RNHPPD & Non-RNHPPD)</p>	<p>This study described the actual cost of nurse-sensitive adverse events by linking the adverse event occurrence with actual patient costs. Hospital cost accounting systems are useful in determining the cost of adverse events and can aid in decision making about nursing staffing. Adverse events add costs to the patient care and should be measured at the unit level so that staffing can be adjusted to reduce adverse events and avoid costs.</p> <p>The number of adverse events was small (even with the n of 3230) and this decreased the ability of each individual adverse event to reach significance in the analysis so all adverse events were combined into one variable.</p>
<p>Park, S.H., Boyle, D.K., Bergquist-Beringer, S., Staggs, V.S. & Dunton, N.E. (2014). Concurrent and lagged effects of registered nurse turnover and staffing on unit-acquired pressure ulcers. <u>Health Services Research</u>, 49(4), 1205-25.</p>	<p>Longitudinal, observational study using multilevel regressions to test time-lagged effects of study variables on outcomes</p>	<p>10,935 unit-quarters from 2,294 units in 465 hospitals from 47 states</p> <p>The data were derived from the National Database of Nursing Quality Indicators for the period was 2008 through 2010</p>	<p>Unit-acquired pressure ulcers</p>	<p>Concurrent and lagged effects of RN turnover on the development of unit-acquired pressure ulcer rates was explored; also examined was whether RN staffing mediated the effects</p> <p>The odds of a patient developing a pressure ulcer increased by 4 percent in next quarter (lagged effect) for every 10 percentage-point increase in RN turnover in a quarter; there was no concurrent effect detected</p> <p>Higher RN turnover was associated with lower RN staffing in current and following quarters</p> <p>While higher RN staffing was associated with lower pressure ulcer rates, it did not mediate the relationship between RN turnover and pressure ulcer rates</p>

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				The authors conclude that RN turnover negatively impacts RN staffing levels and has adverse effects on unit-acquired pressure ulcer rates regardless of staffing levels; RN turnover is an important factor in terms of the delivery of high quality care
Person, S. D., Allison, J.J., Kiefe, C.I., Weaver, M.T., Williams, O.D., Centor, R.M. & Weissman, N.W. (2004). Nurse staffing and mortality for Medicare patients with acute myocardial infarction. <i>Medical Care</i> , 42(1), 4-12.	Retrospective, correlational design with review of medical records and hospital staffing data	118,940 Medicare patients with Acute Myocardial Infarction American Hospital Association data Cooperative Cardiovascular Project data	In-hospital mortality	After extensive multivariate adjustment for patient and hospital characteristics there is a: <ul style="list-style-type: none"> ▪ Mortality advantage for patients treated in hospitals with high RN staffing <ul style="list-style-type: none"> ○ Lowest mortality associated with RN staffing in top quartile ○ Highest mortality associated with RN staffing in lowest quartile ▪ Mortality disadvantage for patients treated in hospitals with high LPN staffing <ul style="list-style-type: none"> ○ Highest mortality associated with LPN staffing in top quartile ○ Lowest mortality associated with LPN staffing in lowest quartile <p>Hypotheses:</p> <ul style="list-style-type: none"> ○ Those aspects of care that are most relevant to patient well-being are delivered by RNs skilled in delivering those aspects of care ○ The delivery of standardized assessments and orders is a critical RN function ○ RNs alert physicians to complications of Acute Myocardial Infarction ○ In general, higher RN staffing is associated with greater organizational resources, which in turn are associated with better patient outcomes
Potter, P., Barr, N., McSweeney, M. & Sledge, J. (2003). Identifying nurse staffing and patient outcome relationships: A guide for change in care delivery. <i>Nursing Economics</i> , 21(4), 158-166.	Prospective, single-site, correlational design with inpatient units as the analytic units Staffing and patient acuity data were correlated with outcomes of interest Study was designed to: <ul style="list-style-type: none"> ◆ begin to develop a database of outcome 	3418 patients	Fall Index Medication Errors Index Patient self report data (VAS): <ul style="list-style-type: none"> ◆ Pain ◆ Distress ◆ Anxiety ◆ Quality of preceding night's sleep ◆ 4 self-care measures 	Findings: Higher percentages of hours of nursing care provided by RNs was associated with: <ul style="list-style-type: none"> • lower level of pain reported by patients • better patient perception of self-care ability • better patient perception of health status • greater post-discharge patient satisfaction <p>Greater total number of hours of nursing care delivered by all personnel was associated with:</p> <ul style="list-style-type: none"> • decreased patient distress • less problems with symptom management • fewer falls • patient more likely to be able to manage self-care

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	<p>measures that reflect trends in nursing practice and nurse staffing</p> <ul style="list-style-type: none"> ◆ develop a baseline of current practice to be used to assess the effectiveness of changes in nurse staffing and nursing care delivery 			<p>Percentage of RN hours was found to predict 2 post-discharge patient satisfaction indicators:</p> <ul style="list-style-type: none"> • communication • discharge process <p>Average hours of nursing care per patient day was significantly related to:</p> <ul style="list-style-type: none"> • symptom distress (VAS) • willingness to self-care • index of self-care • fall index • symptom management (approached significance) <p>Conclusion: The development of outcome measures that accurately reflect nursing practice can be used to assess the impact of reorganization initiatives and to benchmark for improvement. Nurse-sensitive outcomes act as "barometers" for assessing the adequacy of staffing practices.</p>
<p>Rothberg, M.B., Abraham, I., Lindenauer, P.K., & Rose, D.N. (2005). Improving nurse-to-patient staffing ratios as a cost-effective safety intervention. <u>Medical Care</u>, 43(8), 785-91.</p>	<p>Cost-effectiveness analysis from the institutional perspective; 2003 dollars; comparing nurse-to-patient (PTN) ratios from 8:1 to 4:1</p>	<p>General medical and surgical patients; data were drawn from multiple sources including 2003 Bureau of Labor Statistics, a state database, and previously published studies</p>	<p>Cost per life saved</p>	<p>Base Case Analysis</p> <ul style="list-style-type: none"> • 8:1 PTN ratio least expensive, but associated with highest patient mortality • Mortality decreased and costs increased as PTN ratio declined from 8:1 to 4:1 • Incremental cost-effectiveness did not exceed \$136,000 per life saved <p>Sensitivity Analysis</p> <ul style="list-style-type: none"> • The analytic model was most sensitive to PTN effects on mortality • Incremental cost-effectiveness of 4:1 PTN ratio did not exceed \$449,000 per life saved <p>Conclusion In terms of cost-effectiveness, PTN ratios of 4:1 are in the range of commonly accepted patient safety interventions</p>
<p>Seago JA, Williamson A, Atwood C (2006) Longitudinal analysis of nurse staffing and patient outcomes: more about failure to rescue. <u>Journal of Nursing Administration</u>, 36(1), 13-21.</p>	<p>Descriptive, Retrospective, longitudinal study</p> <p>Variation between staffing and positive patient outcome</p>	<p>Measured nurse staffing and positive patient outcome on 3 nursing units (in one hospital) over a 48 month timeframe</p>	<p>Patient satisfaction with pain management, patient teaching and physical care and medication errors and pressure ulcers.</p> <p>Skill mix, RNHPPD, Non-RNHPPD, Case-mix index, total labor dollars</p>	<p>Controlling for patient acuity, higher levels of patient satisfaction existed as total HPPD (hours per patient day) and RNHPPD increased. As total HPPD increased and the skill mix became leaner (less RNHPPD), medication error rate increased. Varying staffing hours and skill mix may be necessary to reach the desired positive patient outcome.</p>
<p>Sochalski, J. (2004). Is more better?: The</p>	<p>Secondary analysis of data obtained from</p>	<p>Informants were 80,500 RN licensed</p>	<p>Inpatient hospital staff nurses' assessments of</p>	<p>Nurses' assessment of quality of care are significantly associated with:</p> <ul style="list-style-type: none"> ▪ Nurse-to-patient ratio

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<p>relationship between nurse staffing and the quality of nursing care in hospitals. <u>Medical Care, 42(2suppl), II-67 – II-73.</u></p>	<p>survey research conducted in February 1999</p> <p>Assessed RN assessments of quality of nursing care correlated with workload and processes of care indicators</p>	<p>to practice in the state of Pennsylvania</p>	<p>the quality of nursing care</p>	<ul style="list-style-type: none"> ▪ Reported rates of unfinished care for patients (process of care indicator) ▪ Reported frequency of patient safety problems (process of care indicator) <p>Process of care indicators have more pronounced impact on nurses' assessment of quality of care than does workload</p>
<p>Sochalski, J., Konetzka, R., Zhu, J., Volpp, K. (2008). Will Mandated Minimum Nurse Staffing Ratios Lead to Better Patient Outcomes?</p>	<p>Cross-sectional and fixed-effects regression analysis</p>	<p>Sample of 343 hospitals</p> <p>a. 454,351 discharges</p> <p>b. 348,720 Acute Myocardial Infarctions (AMI) cases</p> <p>c. 109,066 surgical Failure to Rescue (FTR) cases</p> <p>d. 3435 cases were in both samples.</p>	<p>To determine whether increases in medical-surgical licensed nurse staffing levels are associated with improvements in patient outcomes for hospitals having different baseline staffing levels.</p> <p>The two outcome measures</p> <p>1) 30-day Acute Myocardial Infarction (AMI) mortality and, 2) surgical FTR.</p> <p>Staffing: 4 baseline staffing levels – 4 to 7 patients per licensed nurse [registered nurses (RN) and licensed vocational nurses (LVN)].</p>	<p>Results from the cross-sectional analysis:</p> <ul style="list-style-type: none"> • Each additional RN hour per patient day was associated with AMI mortality and FTR reductions of 0.22 and 0.47 percentage points, respectively. • RN + LVN hours per patient day were negatively and significantly associated with surgical FTR, with each additional hour per patient day associated with a 0.39 percentage point reduction in FTR. <p>Results from the fixed-effects analysis:</p> <ul style="list-style-type: none"> • An increase in RN and RN + LVN hours per patient day was not significantly associated with reductions in AMI mortality or surgical FTR. <p>The contrasting finding from the cross-sectional and fixed-effect models suggest that estimates of the cost-effectiveness of increased nurse staffing derived using results from cross-sectional studies would not accurately reflect the benefit from increasing staffing. Hospitals with higher staffing seem to have other unmeasured characteristics that contribute to better outcomes. For example, changes in work environment or changes in nursing skill mix may contribute to better patient outcomes, whether or not they are accompanied by increases in nurse staffing. To the extent that benefits exist from increased staffing, they are likely to be the greatest for hospitals with the lowest ratios. Therefore the differences in the strength of association between increasing nurse staffing and outcomes for these 2 measures suggests that a “one size fits all” approach may not be an efficient use of resources.</p> <p>Effect of staffing on AMI mortality:</p> <ul style="list-style-type: none"> • <3.4 hr/patient day (> 7 patients/nurse) – adding one RN hour per patient day was associated with 0.71 percentage points reduction in AMI mortality compared to hospitals where

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				<p>RNs provide care for more than 7 patients on average.</p> <ul style="list-style-type: none"> • < 4.0 hr/patient day (> 6 patients/nurse) – declined 0.52 percentage points among hospitals where RNs care for more than 6 patients on the average. • <4.8 hr/patient day (> 5 patients/nurse) - declined 0.35 percentage points compared to hospitals where RNs care for more than 5 patients on the average. • <6.0 hr/patient day (> 4 patients/nurse) - declined 0.19 percentage points compared to hospitals where RNs care for more than 4 patients on the average. <p>The associations between increases in RN hours per patient day and reductions in AMI mortality were statistically significant amongst hospitals where RNs care for more than 4 patients.</p> <p>Like AMI mortality, the strength of the association between increasing RN + LVN hours and lower FTR rates was attenuated as staffing levels rose, although for RN hours there was little association between increases in RN staffing and FTR rates for any hospital category.</p> <p>The pronounced diminishing returns to nurse staffing increases for 30-day mortality and lack of any significant relationship between increases in nurse staffing and FTR suggest that, at a minimum, policy makers should devote attention and resources to shoring up nurse staffing among hospitals falling well below the current ratio. Further assessment is needed for policy makers to develop policy approaches that efficiently target resource allocation to achieve high-quality care.</p>
<p>Sovie, M.D. & Jawad, A.F. (2001). Hospital restructuring and its impact on outcomes. <u>Journal of Nursing Administration, 31</u>(12), 588-600.</p>	<p>Cross-sectional study designed to explicate the effects of organizational restructuring on patient outcomes.</p> <p>Data were collected, validated & supplied by the hospitals</p> <p>Each hospital identified 1 adult medical unit and 1 surgical unit as study units.</p> <p>Structure, process,</p>	<p>29 university teaching hospitals collected uniform data about organizational structures, processes and outcomes</p>	<p>Selected outcomes:</p> <ul style="list-style-type: none"> • Fall rate • Nosocomial pressure injury rate • UTI rate • Patient satisfaction 	<p>Findings:</p> <p>Fall rates were inversely related to the number of RN hours worked per patient day</p> <p>Pain management satisfaction is positively associated with the number of RN hours worked per patient day.</p> <p>Patient satisfaction is positively associated with increased numbers of RNs providing care.</p> <p>Conclusions:</p> <p>While the analysis confirms that RN hours per patient day and total hours for all staff are important measures, the findings do not support specific ratios or hours by category of staff. Further research into the structural staffing variables is recommended.</p>

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	<p>and outcome variables were collected for the 1997 and 1998 fiscal years.</p> <p>Structural variables included:</p> <ul style="list-style-type: none"> • FTEs for each category of nursing staff • Skill mix • Hours worked per patient day • Labor costs per discharge <p>Process variables:</p> <ul style="list-style-type: none"> • 77 item Management Practices & Organizational Processes Questionnaire • 4 item subscale on autonomy & decision-making from the Quality of Employment Survey <p>Outcomes variables as noted. The patient satisfaction measure included satisfaction with pain management, education, attention to needs/promptness of staff, nursing & the hospital, and preparation for discharge</p>			
Staggs, V.S., Knight, J.E. & Dunton, N. (2012). Understanding unassisted	Cross-sectional with hierarchical Poisson modeling used to	1504 nursing units from 248 US acute care hospitals	Unassisted fall rate	<p>16 explanatory variables were considered in the analysis</p> <p>Hospital characteristic variables</p> <ul style="list-style-type: none"> • Hospital Magnet status

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<p>falls: Effects of nurse staffing level and nursing staff characteristics. <u>Journal of Nursing Care Quality</u>, 27(3), 194-9.</p>	<p>explore hospital & unit characteristics as predictors of the unassisted fall rate</p>	<p>The sample was drawn from monthly National Database of Nursing Quality Indicators for the period October 2009 through September 2010</p>		<ul style="list-style-type: none"> • Hospital teaching status (academic medical center, teaching hospital, community hospital) • Average daily census <p>Unit characteristic variables</p> <ul style="list-style-type: none"> • Percentage of RNs on each unit with a BSN or higher • Total nursing hours per patient day (TNHPPD) • Skill mix • Total turnover • Unit type • Average RN tenure <p>The final model included unit type, month, linear and quadratic effects of TNHPPD, skill mix, and average RN tenure on the unit</p> <p>There was a positive association (but not a simple linear association) between staffing and unassisted falls; expected fall rate increases by 7% when TNHPPD is raised from 4.1 to 9.1</p> <p>There was a negative association between skill mix and average RN tenure; the effects were modest</p> <p>The authors note that average RN tenure might be a proxy for RN experience and/or that units with longer RN tenure might experience better teamwork</p> <p>In terms of the positive association between TNHPPD and unassisted falls, the authors speculate that "diffusion of responsibility" might occur on better staffed units when there a many co-workers to depend upon; units with lower staffing might be associated with heightened individual responsibility and focus on patient safety</p>
<p>Tallier, P.C. (2003). <u>Nurse staffing ratios and patient outcomes</u>. UMI Dissertation Services. (UMI Number: 3091301).</p>	<p>Retrospective medical record review for patient data</p> <p>Survey research for nurse satisfaction data – data collection period was 10/1/2000 through 3/31/2001</p> <p>Purpose was to measure the relationship among structure (staff mix</p>	<p>Convenience sample of adult inpatient admissions to a single acute care, inner-city community hospital</p>	<p><u>Process Indicators</u> Maintenance of skin integrity Nurse staff satisfaction</p> <p><u>Outcomes Indicators</u> Nosocomial Urinary Tract Infection Patient satisfaction with nursing care</p>	<p>Findings:</p> <ul style="list-style-type: none"> ▪ Significant relationships among nosocomial pressure injuries, nosocomial urinary tract infections, nurse satisfaction, patient satisfaction and Nursing Care Hours per Patient Day were not identified ▪ Significant negative correlations between urinary tract infection and the number of RNs were identified ▪ Significant positive relationships between patient satisfaction and the number of RNs and LPNs were identified <p>Conclusion:</p> <ul style="list-style-type: none"> ▪ Adequate numbers of nurse staff and appropriate skill mix are important considerations when making staffing decisions

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	and Nursing Care Hours per Patient Day)indicators and process and outcomes indicators			
Talsma, A., Jones, K., Guo, Y., Wilson, D. & Campbell, D.A. (2014). The relationship between nurse staffing and failure to rescue: Where does it matter most? <u>Journal of Patient Safety</u> , 10(3), 133-9.	Three year, cross-sectional, multi-site study designed to explore the association between nurse staffing levels and failure-to-rescue mortality	<p>All acute care cases from seven hospitals in Michigan that met AHRQ Patient Safety Indicator failure-to-rescue inclusion criteria (19,313 subjects)</p> <p>Only data from surgical discharges are reported in this paper</p> <p>Data for nurse staffing were drawn from nursing management reports in order to determine unit level staffing rates</p> <p>Data were from 2003 - 2005</p>	Failure-to-Rescue mortality rates	<p>Nurse staffing data were: total nursing direct hours per patient day (HPPD), RN HPPD, and RN staff mix</p> <p>The researchers were unable to confirm a significant association between nurse staffing indicators and decreased failure-to-rescue mortality rates when using data at the unit level and multiple risk-adjustment variables</p> <p>For non-ICU discharges the associations approached significance but not in the expected direction</p> <p>The researchers speculated that many patients were too ill to benefit from additional hours of nursing care; there may be a subgroup of patients with low risk of mortality that would derive the most benefit from increased surveillance and timely interventions</p> <p>The unit of analysis was the discharge unit; patients transferred from ICU to a non-ICU were included in the non-ICU analysis; future research using electronic health records to identify all the units on which the patient received care would be useful for future research of this type</p>
Trinkoff, A.M., Johantgen, M., Storr, C.L., Gurses, A.P., Liang, Y. & Han, K. (2011). Nurses' work schedule characteristics, nurse staffing, and patient mortality. <u>Nursing Research</u> , 60(1), 1-8.	<p>Cross-sectional study designed to explore if there is increased mortality associated with nurse reports of adverse work schedules, after controlling for staffing</p> <p>Univariate, descriptive statistics were used for the analysis</p>	<p>633 nurses working 71 acute care hospitals in North Carolina and Illinois surveyed in 2004</p> <p>Staffing data from the American Hospital Association Annual Survey of hospitals</p> <p>Nurses responding to the survey were</p>	Mortality	<p>Work schedule data derived from nurse survey: hours worked per day, hours worked per week, weekends worked per month, number of breaks lasting 10 minutes or more including meal breaks, and shift rotation</p> <p>Additional variables derived from nurse survey: how often nurses worked a) 13 hours or more at a stretch, b) with less than 10 hours off between shifts, c) on a scheduled day off or vacation day, d) while sick, e) with mandatory overtime, f) required on call, and g) the usual number of days in a row</p> <p>Nurses were asked to consider their typical schedule for the past 6 months when completing the survey</p> <p>Staffing data related to numbers of full- and part-time RNs and LPNs</p>

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		matched to the hospital where they practiced		<p>were derived from the AHA Annual Survey</p> <p>Mortality data were derived from discharge data using the AHRQ Inpatient Quality Indicators</p> <p>There was a significant association between pneumonia mortality and nurse reports of schedules that included long work hours and a lack of time away from work</p> <p>Deaths from AAA were associated with lack of time away from work; the association was significant</p> <p>Heart failure and acute myocardial infarction mortality were significantly associated with work while sick and weekly burden for nurses, respectively</p> <p>The staffing analysis revealed that:</p> <ul style="list-style-type: none"> • Significantly lower licensed staffing for hospitals with high mortality for pneumonia, heart failure, and stroke • Significantly lower skill mix for hospitals with high mortality for heart attack and craniotomy <p>The researchers speculate that adverse work schedules affects nurses' ability to maintain continued vigilance and prevents them from detecting and responding to changes in patient condition</p>
<p>Unruh, L. (2003). Licensed nurse staffing and adverse events in hospitals. <u>Medical Care</u>, 41(1), 142-52.</p>	<p>Descriptive analysis of secondary cross-sectional data for the purpose of examining the relationship between licensed nursing staff(RN & LPN) and adverse patient events in hospitalized patients for the time period 1991 – 1997.</p> <p>Data on nursing personnel and hospital characteristics was supplied by the Pennsylvania Department of Health</p>	<p>211 hospitals for each of 7 years</p>	<p>Incidence of:</p> <ul style="list-style-type: none"> • Atelectasis • Pressure ulcer • Falls • Pneumonia • Postoperative/Post treatment infection • UTI 	<p>Findings:</p> <p>The workload for licensed nurses increased for only 2 short periods during the study time.</p> <p>The intensity of patient care increased almost throughout the entire time.</p> <p>The skill mix declined during the study period.</p> <p>Hospitals with higher numbers of licensed nurses had significantly lower incidences of atelectasis, pressure injury, falls and UTI</p> <p>Lower rates of pressure injury and pneumonia were associated with a greater proportion of licensed nurses to total nursing staff.</p> <p>Hospitals with higher numbers of licenses nurses had higher rates of pneumonia (statistically significant)</p> <p>Conclusion:</p> <p>Adequate nurse staffing is an important policy issue for US hospitals. Flexible staffing systems, instead of static ratios, are recommended to assure care that is adequate and cost-efficient</p> <p>Health care organizations should take steps to increase the supply of nurses by making hospital employment more attractive to non-active nurses as well as those considering entry into the profession.</p>

Citation	Design	Population/ Sample Size	Primary Outcome Measure(s)	Conclusions/ Comments
	Patient-level data was obtained from the Pennsylvania Health Care Cost Containment Council.			Improvements in working conditions, especially remedying understaffing, are cited as a strategy for accomplishing this.
Yakusheva, O., Lindrooth, R. & Weiss, M. (2014). Economic evaluation of the 80% baccalaureate nurse workforce recommendation: A patient-level analysis. <i>Medical Care</i> , 52(10), 864-9.	Retrospective, observational patient-level analysis to explore cost and quality implications of IOM call for 80% BSN preparation by 2020 Linear and logistic regression analysis modeling	8526 adult medical-surgical patients matched with 1477 direct caregivers from a US academic medical center Data period is June 1, 2011 – December 31, 2011 Data were drawn from an electronic health record	Hospital mortality All-cause same-facility 30-day readmission Length of stay Total cost of hospitalization	BSN dose is a continuous measure reflecting the proportion of nurse assessments inputted into the patient's electronic medical record Continuous proportion model A 10% increase in proportion of care by nurses with a BSN was associated with a 10.9% reduction in the odds of mortality Categorical model Patients who received 80% or more of their care from BSN prepared nurses had a 18.7% lower odds of readmission as compared to patients who received <80% of their care from BSN prepared nurses Patients who received 80% or more of their care from BSN prepared nurses had a 1.9% shorter LOS as compared to patients who received < 80% of their care from BSN prepared nurses Simulations testing the cost-benefit of increasing the proportion of BSN prepared nurses were developed and provided estimates of a perpetual stream of annual savings of \$5.6 million; a strong business case for investing in nurse education to meet the 80% BSN threshold by 2020 is supported The business case is weakened because savings from averted unreimbursed readmissions accrue to the hospital, while savings from averted reimbursed readmissions accrue to the private and public payers The findings of this study have implications for public policy and organizational decision making It should be noted that a methodological strength of this study is that, by using an electronic health record, patient-level data could be effectively and efficiently directly linked to individual direct care nurses; making it possible to determine the "dose" of BSN prepared nurse care for the individual patient

Nurse Staffing Literature Summary

Section: Research Review/Evidence Summary

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
<p>Agency for Healthcare Research and Quality (2004). Hospital nurse staffing and quality of care. <u>Research in Action</u>, 14, 1-9.</p>	<p>Evidence Summary</p>	<p>n/a</p>	<p>n/a</p>	<p>This evidence summary provides a summary of research, funded by AHRQ & other sources, addressing the relationship between nurse staffing and adverse patient outcomes that are conceptualized as nurse sensitive. Adverse patient outcomes conceptualized as nurse sensitive include:</p> <ul style="list-style-type: none"> • Urinary tract infection (UTI) • Pneumonia • Shock • Upper gastrointestinal (UGI) bleeding • Longer hospital stays • Failure to rescue • 30-day mortality <p>The introduction provides an overview of factors that contribute to the current nursing shortage.</p> <p>Findings:</p> <ul style="list-style-type: none"> ◆ Lower nurse staffing levels were found to be associated with a variety of adverse outcomes including pneumonia, UGI bleeding, shock/cardiac arrest, UTI, failure to rescue, lung collapse, falls, pressure injury, thrombosis after major surgery, pulmonary compromise after surgery, longer hospital stays, and 30-day mortality. The authors recommend that nurse sensitive adverse outcomes be viewed as indicators rather than measures of the impact of nurse staffing on patient outcomes. ◆ More accurate and consistent measures of the impact of nurse staffing on patient outcomes are required before research can indicate appropriate minimal staffing ratios at the unit or hospital level.
<p>Bedecarré, D., Buffum, M. & Habersfeld, M. (2005). Nurse-sensitive patient outcomes: An annotated bibliography. <u>Journal of Nursing Administration</u>, 35(6), 293-9.</p>	<p>Annotated Bibliography</p>	<p>n/a</p>	<p>n/a</p>	<p>This bibliography contains articles that examine the effect of total nursing hours and proportion of licensed nurses on a variety of patient outcomes in acute care settings.</p> <p>The majority of articles in this bibliography found an association between fewer adverse events in hospitals and a higher percentage of RNs with more nursing hours worked per patient day.</p> <p>The evidence for relationships between nurse staffing and patient outcomes is mixed.</p> <p>Issues that remain challenging for improving this science include clarity of definitions, data sources, instrumentation, data collection methodology, analytic strategies, risk adjustment and stratification, and patient populations.</p> <p>Of note is that existing databases of nursing sensitive quality indicators</p>

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
				hold promise for future research. Examples include ANA's National Database of Nursing Quality Indicators, California Nursing Outcomes Coalition, Military Nursing Outcomes Database, and VA Nursing Outcomes Database.
Cho, S. Hwang, J, Kim, J. (2008). Nurse Staffing and Patient Mortality in Intensive Care Units.	Systematic review of international research.	N – 27, 372 ICU patients discharged from 236 hospitals (42 tertiary and 194 secondary).	<p>The purpose of the study was to examine the relationship between nurse staffing and patient mortality in Korean intensive care units (ICUs), controlling for hospital, ICU and patient characteristics.</p> <p><u>Mortality</u>: deaths that occurred in the hospital or on the date of hospital discharge.</p> <p><u>Hospital characteristics</u> included the level of care (tertiary and secondary), ownership (public or private), location, and bed size.</p> <p><u>ICU characteristics</u> consisted of ICU specialization (specialized – hospitals running two or more adult ICUs; mixed – having only one ICU), physician staffing, and RN experience and staffing.</p> <p><u>Patient characteristics</u> included mortality, which was the outcome variable, age, gender, source of payment, primary diagnosis, and comorbid disease.</p>	<p>An important finding of this study was that there was a significant relationship between nurse staffing and mortality at secondary hospitals and physician staffing and mortality at tertiary hospitals.</p> <p>Relationship of Hospital, ICU, and Patient Characteristics to Mortality were studied: Adjusted Odds Ratios (OR) and 95% Confidence Interval:</p> <p>In secondary hospitals:</p> <ul style="list-style-type: none"> • Hospitals (n=194); Patients (n=16,378) • Secondary hospitals tend to have only one mixed ICU. • Patients at secondary hospitals that were public institutions (OR = 1.38, p=.005) and located in metropolitan cities had a greater probability of dying. • Without a physician effect on mortality, secondary hospitals had the significant association that 1 addition patient per RN was associated with a 9% increase in the odds of death and, consequently, 15 excess deaths per 1,000 patients. • The crude overall mortality rate was 17% for tertiary hospitals. <p>In tertiary hospitals:</p> <ul style="list-style-type: none"> • Hospitals (n=42); Patients (n=10,994) • Most tertiary hospitals (86%) operated at least two ICUs that were specialized based on patient and disease groups (medical/surgical). • A greater likelihood of death was found in institutions that operated a mixed ICU (OR = 1.61, p=.011) and no board-certified physician present for 4 or more hours per day (OR = 1.56, p=.022). • Tertiary hospitals where the ICUs had no board-certified physicians attending for 4 or more hours per day had a 56% increase in the odds of dying. • The crude overall mortality rate was 22% in secondary hospitals. <p>More favorable RN staffing (lower Average Daily Census (ADC)/RN ratio) was found in tertiary hospitals when compared with that of secondary hospitals. The mean ADC/RN ratio was 0.76 in tertiary and 0.98 in secondary hospitals. The favorable staffing in tertiary hospitals can be attributed to the greater severity of illnesses at this type of hospital and the larger nursing workload due to the higher level of care required at</p>

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
			Staffing was measured as the ratio of average daily census (ADC) to the total number of full-time equivalent registered nurses in the ICUs.	such institutions. A significant relationship was not found between nurse experience and mortality.
Committee on the Work Environment for Nurses and Patient Safety (2003). <u>Keeping patients safe: Transforming the work environment of nurses.</u> Washington, DC: The National Academies Press.	Evidence Summary	n/a	n/a	<p>This evidence summary addresses multiple aspects of the practice/work environment for nurses across various care setting and within the context of patient safety. This report builds on the prior two Institute of Medicine patient safety reports.² Recommendations that relate specifically to nurse staffing in acute care hospitals are:</p> <p><u>Recommendation 5-2:</u> Health care organizations (HCO) should employ nurse staffing practices that identify needed nurse staffing for each patient care unit per shift</p> <ul style="list-style-type: none"> • Incorporate census methodologies that are more robust than midnight census • Involve direct care nursing staff in determining and evaluating methods used to determine appropriate staffing for each shift • Provide for "elasticity" within each shifts scheduling to accommodate unpredicted variations in volume and acuity; avoid use of external agencies to provide this elasticity. • Empower nursing staff to regulate unit work flow • Involve direct care nursing staff in identifying causes of nursing staff turnover and in developing approaches to improving nursing staff retention <p><u>Recommendation 5-3:</u> HCOs should perform ongoing evaluation of the effectiveness of their nurse staffing methods, levels, and effects on patient safety</p> <p><u>Recommendation 5-4:</u> DHHS should implement a nationwide, publicly accessible system for collecting and managing valid and reliable staffing and turnover data from HCOs; this data should be publicly reported</p>
Garrett, C. (2008) The effect of nurse staffing patterns on medical errors and nurse burnout. <i>AORN Journal</i> , 87, (6) 1191-	Review of literature			<p>Develop nurse retention programs This article is not a study, rather it is simply a literature review. No meta-analysis has been presented.</p> <p>Based on the studies the authors reviewed, her conclusion is "nurse</p>

² Kohn, L.T., Corrigan, J.M. & Donaldson, M.S. (Eds.). (2000). To err is human: Building a safer health system. Washington, DC: National Academy Press.
Committee on Quality of Health Care in American (2001). Crossing the quality chasm: A new health system for the 21st century. Washington, DC: National Academy Press.

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
1204.				staffing patterns can have a positive and negative effect on pt. care, and low levels of nurse staffing can result in medical errors and adverse outcomes."
Heinz, D. (2004). Hospital nurse staffing and patient outcomes: A review of current literature. <u>Dimensions of Critical Care Nursing</u> , 23(1), 44-50.	Review of Literature/ Non-systematic Purpose is to provide an overview of current literature that addressed the relationship between nurse staffing and patient outcomes and to present recommendations for nursing practice.	n/a	n/a	<p>The author summarizes 16 nurse staffing research studies between 1998 and 2002) and concludes: Much of the research investigating the relationship between nurse staffing and patient outcomes use mortality, length of stay, and patient complications as the outcomes of interest; these indicators do not reflect nursing care alone. Some studies have the whole hospital as the unit of analysis, while others use the patient care unit as the unit of analysis; some are limited to a single hospital, while others may include an entire geographical area. In general, across the studies there is a lack of clear operational definitions for outcomes thought to be sensitive to nursing care, a lack of consistent definitions for nurse staffing, and inconsistent definitions for health care workers considered as nurse staffing. Finally, most of this research is based in administrative data obtained retrospectively; this results in limitations in study design. Critical care nurses do play a significant role in patient outcomes and should conduct research designed to identify nurse sensitive outcomes with clear operational definitions. Nurse staffing is associated with patient outcomes.</p> <p>Recommendations for nursing practice are: Enhance nurse staffing through recruitment and retention activities.</p>
Kane, R.L., Shamliyan, T.A., Mueller, C., Duval, S. & Wilt, T.J. (2007a). <u>Nursing staffing and quality of patient care</u> . Evidence Report/Technology Assessment No. 151 (Prepared by the Minnesota Evidence-based Practice Center under Contract No. 290-02-0009.) AHRQ Publication No. 07-E005. Rockville, MD: Agency for Healthcare Research and Quality.	<p>Systematic review using meta-analysis techniques of observational studies conducted from 1990 to 2006.</p> <p>94 eligible studies; overall quality averaged 38 (out of possible 50).</p>			<p>That increased RN staffing in hospitals is associated with better patient outcomes is confirmed by this analysis; however, the relationship is not demonstrated to be causal.</p> <ul style="list-style-type: none"> • Each additional RN FTE per patient day is associated with a 9% relative risk reduction in hospital-related mortality in ICUs and a 16% relative risk reduction in hospital-related mortality in surgical patients • Each additional patient per RN per shift was associated with: <ul style="list-style-type: none"> ○ 7% increase in relative risk of hospital-acquired pneumonia ○ 53% increase in relative risk of pulmonary failure ○ 45% increase in relative risk of unplanned extubation ○ 71% increase in relative risk of complications • Findings vary by clinical settings and patient populations, but a consistent finding was that an additional RN FTE per patient day was associated with a decrease in the relative risk for poor

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
				<p>outcomes</p> <p>Increased total nurse hours per patient day was associated with reductions in in-house mortality, failure to rescue, and other adverse events</p> <p>There was an inconsistent relationship between RN and LPN hours and patient outcomes</p> <p>A negative correlation between percentage of nurses with BSN or higher and patient mortality related to health care</p> <p>Nurse satisfaction and autonomy were found to be associated across studies with a significant reduction in mortality</p> <p>Increased nurse turnover was found to be associated with an increase in patient fall rate</p> <p>The authors point out that further research is needed to better understand the impact of factors including skill, organizational, and leadership on patient outcomes</p>
<p>Kane, R.L., Shamliyan, T.A., Mueller, C., Duval, S. & Wilt, T.J. (2007b). The association of Registered Nurse staffing levels and patient outcomes. <u>Medical Care</u>, 45(12), 1195-1204.</p>	<p>Systematic review and meta-analysis of epidemiologic studies conducted in the United States or Canada between 1990 and 2006 to determine the absolute and relative risk of patient outcomes associated with RN staffing.</p>	<p>n/a</p>	<p>n/a</p>	<p>The authors included 96 studies in the meta-analysis and concluded:</p> <ul style="list-style-type: none"> • Increased RN staffing was consistently associated with a reduction in the adjusted odds ratio of hospital related mortality • An increase of 1 RN FTE per patient day was associated with a reduction in odds of death in ICU, surgical, and medical patients • An increase of 1 RN FTE per patient day was associated with a 1.2% reduction in overall mortality rates • Increased RN staffing was associated with lower odds of adverse events, including: <ul style="list-style-type: none"> ○ Hospital-acquired pneumonia in all patients and ICU patients ○ Respiratory failure, unplanned extubation, and cardiac arrest in ICU patients ○ Failure to rescue and nosocomial sepsis in surgical patients • There was no association found between RN staffing and odds of urinary tract infections or surgical bleeding • The analysis confirms that increased nurse staffing in hospitals is associated with improved patient outcomes; additional studies are needed to determine whether there is a causal relationship • It is difficult to set fixed standard patient-to-nurse ratios

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
<p>Lang, T.A., Hodge, M., Olson, V., Romano, P.S. & Kravitz, R.L. (2004). Nurse-Patient Ratios: A systematic review on the effects of nurse staffing on patient, nurse employee, and hospital outcomes. <u>Journal of Nursing Administration, 34(7/8)</u>, 326-37.</p>	<p>Systematic review of nurse staffing literature for the purpose of determining whether the research literature demonstrates support for developing and promulgating requirements for specific nurse-patient ratios in acute care setting.</p> <p>In addition, the authors assessed the evidence for associations between staffing levels and differences in patient outcomes, nurse-as-employee outcomes and hospital outcomes.</p> <p>43 articles published between 1980 and 2003 were reviewed.</p>	n/a	n/a	<p>The authors systematically reviewed 43 articles published between 1980 and 2003.</p> <p>Conclusions:</p> <ul style="list-style-type: none"> • The literature reviewed does not provide support for setting specific nurse-patient ratios • Minimum nurse-patient ratios are not adequate to assure quality of nursing care • The evidence <u>probably</u> supports the following relationships between nurse staffing and patient outcomes <ul style="list-style-type: none"> ○ Richer nurse staffing and lower rates of failure to rescue, in surgical patients ○ Richer nurse staffing and lower mortality rates ○ Richer nurse staffing and lower length of stay, for medical patients • There is limited evidence for an association between richer nurse staffing and <ul style="list-style-type: none"> ○ Lower nurse burnout rates ○ Lower needle stick injury rates • The evidence is equivocal about the relationship between nurse staffing and the incidence of <ul style="list-style-type: none"> ○ Pneumonia ○ UTI • The evidence does not support a relationship between nurse staffing and the incidence of <ul style="list-style-type: none"> ○ Pressure injury ○ Patient falls ○ Nosocomial infections ○ Additional patient outcomes ○ Documentation • In general, the literature does not use positive outcomes to assess nursing quality. Positive outcomes of nursing care in relation to nurse staffing should be studied.
<p>Lankshear, A.J., Sheldon, T.A. & Maynard, A. (2005). Nurse staffing and healthcare outcomes: A systematic review of the international research evidence. <u>Advances in Nursing Science, 28(2)</u>, 163-74.</p>	<p>Systematic review of research on nurse staffing and healthcare outcomes published from 1990 through March 2004 to examine the relationship between nurse staffing and one or more of the following patient outcomes: mortality rate, complication</p>	n/a	n/a	<p>The authors identified 38 studies in acute care settings and discussed 22 studies determined to be the most robust.</p> <p>Conclusions:</p> <ul style="list-style-type: none"> • The majority of the research is cross-sectional and relies on analysis of data from large data sets to identify correlations between measures • Many studies utilize staffing data from the American Hospital Association (AHA) <ul style="list-style-type: none"> ○ Data does not differentiate RNs involved in direct care from those in management or other indirect roles, failing to accurately reflect direct patient care hours ○ Data reflects paid hours, overestimating productive

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
	rate, failure-to-rescue, incidence of adverse events, length of stay, and patient satisfaction.			<p>hours</p> <ul style="list-style-type: none"> • Studies varied in the quality of methods used for case mix adjustment and adjustment for hospital characteristics • The research generally supports an inverse relationship between RN staffing levels and mortality rates • Some studies found negative associations between nurse staffing and failure to rescue, although the definition of failure to rescue varied • There may be an association between nurse staffing levels and the incidence of pneumonia, urinary tract infections, decubitus ulcers, falls, and wound infections • The evidence does not support a specific recommendation for nurse staffing levels
Penoyer, D.A. (2010). Nurse staffing and patient outcomes in critical care: A concise review. <u>Critical Care Medicine</u> , 38(7), 1521-8.	Comprehensive review of the intensive care/critical care literature from 1998 - 2008	n/a	n/a	<p>Most studies demonstrate association between lower nurse staffing and/or increased workload with adverse ICU patient outcomes; a causal relationship was not demonstrated</p> <p>Nurse staffing is one of many factors that impact patient outcomes</p> <p>There is variability in how nurse staffing is understood and measured: nurse workload, nurse-to-patient ratios, hours of nursing care per patient day</p> <p>Research on additional factors such as fatigue, effectiveness of nurse performance, organizational influences (leadership, teamwork, use of protocols, guidelines & other evidence-based tools) , hospital culture resources & commitment to quality of care should be conducted</p> <p>Front-line decision-makers should incorporate a multitude of factors into staffing decisions</p> <p>Front-line decision-makers should be empowered to base decisions on the needs of patients and the requirements for safe practice</p>
Shekelle, P.G. (2013). Nurse-patient ratios as a patient safety strategy: A systematic review. <u>Annals of Internal Medicine</u> , 158(5, Part2), 404-10.	Systematic review			<p>Cross-sectional studies have consistently demonstrated that high RN staffing is associated with lower hospital-related patient mortality</p> <p>Existing studies cannot demonstrate a causal relationship; this limits the ability to identify increased nurse staffing as a patient safety strategy</p> <p>Research assessing the results of planned change in nurse staffing ratios should be conducted</p> <ul style="list-style-type: none"> • Time series analysis • Controlled before-and-after analysis • Include process variables needed to test a conceptual framework of how patient outcomes are influenced by nurse staffing
Spetz, J. (2005). Public policy and nurse staffing: What approach is best?	Systematic analysis/Literature review	n/a	n/a	<p>In the context of legislative remedies for perceived inadequate nurse staffing levels in hospitals, the author evaluates two policy strategies related to nurse staffing ratios: 1) fixed minimum staffing ratios and 2) patient acuity-based staffing ratios.</p>

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
<p><u>Journal of Nursing Administration</u>, 35(1), 14-6.</p>				<ul style="list-style-type: none"> • Research suggests strong link between nurse staffing ratios and the quality of patient care • Basic principle: When marginal benefit is greater than the cost, more nurses should be utilized • Using an economic analysis, the marginal benefit of higher nurse staffing ratios (social value) should be equal to/greater than the marginal cost of additional nurses. However, a calculation of marginal benefit is dependent upon an agreed upon valuation of life • Disadvantages of fixed staffing levels include: 1) optimal ratios have not been identified, fixed levels may be too high or too low; 2) hospitals may have to reduce capacity if the nursing shortage continues/deepens; 3) hospitals may reduce the non-nurse workforce in order to afford increasing licensed nursing positions; 4) hospitals may be unable to afford higher nurse staffing levels without passing costs on to one or more payers • No clear cut advantages of fixed staffing levels were identified • Advantages of acuity-based staffing levels include: 1) recognition that different patients have varying requirements for nursing care; 2) consideration for how the varying needs of patients can be met by the full range of patient care workers, not just licensed nurses • A disadvantage of acuity-based staffing levels include: 1) the lack of standards for patient classification systems; and 2) shift-to-shift staffing requirements are not readily apparent <p>Conclusion: 1) no single approach can be recommended; 2) policy makers, health care leaders and researchers should continue to evaluate outcomes and develop approaches/regulations that minimize potential harms.</p>
<p>Unruh, L (2008). Nurse Staffing and Patient, Nurse and Financial Outcomes. <i>A literature review examines the impact of staffing levels and offers recommendations.</i> <u>American Journal of Nursing</u>, Vol. 108, No. 1, 62-71.</p>	<p>Comprehensive literature review using five databases covering articles published from 1980 through 2006: <i>Academic Search Premier</i>, the <i>Cumulative Index to Nursing and Allied Health Literature (CINAHL)</i>, <i>EconLit</i>, <i>Health</i></p>	<p>n/a</p>	<p>n/a</p>	<p>The author summarizes nurse staffing research studies examining Patient, Nurse and Financial Outcomes and concludes that although specific nurse-patient ratios for specific clinical situations haven't been scientifically determined, the evidence clearly shows that adequate staffing and balanced workloads are central to achieving good patient, nurse, and financial outcomes. Efforts to improve care, recruit and retain nurses, and enhance financial performance must address nurse staffing and workload.</p> <p>Nursing needs an evidence-based, standardized measure of workload in which the effects of all known contributing factors are assessed.</p>

Citation	Design	Population/ Sample Size	Primary Outcome	Conclusions/Comments
	<i>Source: Nursing/Academic Edition, and Medline.</i>			

Nurse Staffing Literature Summary

Section: Position Paper/Topic Discussion/Commentary

Citation	Discussion
<p>Aiken, L.H. (2014). Baccalaureate nurses and hospital outcomes: More evidence. <u>Medical Care</u>, 52(10), 861-3.</p>	<p>In this editorial Aiken notes that well into the second decade of the 21st century, nursing education pathways remain varied and confusing to potential nursing students, employers, and consumers. In addition, 2 of every 3 new RN have less than a baccalaureate degree on entry into practice. According to Aiken, conceptualizing nurse education as a modifiable property of the health care organization—in addition to an increasing body of literature demonstrating better patient outcomes are associated with more highly educated nurses—may provide the stimulus needed to achieve a nursing workforce that is largely educated at the baccalaureate level or higher.</p> <p>In terms of making the business case for an 80% BSN nursing workforce, a largely BSN workforce:</p> <ul style="list-style-type: none"> • Reap financial benefits for health care organizations and third-party payers • Achieve better outcomes (better health and better health care) for patients • The concept of calculating of dose of BSN care provides a mechanism for demonstrating a threshold effect on RN education on patient outcomes which can then be submitted for economic analysis
<p>Anderson, R., Ellerbe, S., Haas, S., Kerfoot, K., Kirby, K. & Nickitas, D. (2014). In J. Mensik (Ed.), Excellence and evidence in staffing: A data-driven model for excellence in staffing (2nd edition). <u>Nursing Economics</u>, 32(3, Suppl.), 1-36.</p>	<p>The Patient Protection and Affordable Care Act and the IOM Future of Nursing report have challenged the profession of nursing to shift to a value driven model of care, including new payment and priority structures. While nursing is generally conceptualized as a commodity, new ways of thinking and working must demonstrate the value of professional nursing practice in terms of delivering on the aims of better health, better health care, and lower costs.</p> <p>The data-driven model of care articulated in this position paper is organized around 5 concepts:</p> <ul style="list-style-type: none"> • Core Concept 1: Users and Patients of Health Care • Core Concept 2: Providers of Health Care • Core Concept 3: Environment of Care • Core Concept 4: Delivery of Care • Core concept 5: Quality, Safety, and Outcomes of Care <p>This position paper provides a comprehensive review of each core concept and clearly articulates the relationship between each concept and nurse staffing that is designed to produce value for all stakeholders.</p> <p>In addition to the primary goal of generating nurse staffing research and innovation across all practice settings, an additional goal is to stimulate additional conversations about best practice staffing in the nursing and health care literature.</p> <p>Note: This position paper provides a significant update for the 2008 Excellence and Evidence in Staffing: Essential Links to Staffing Strategies, Design and Solutions for Healthcare (Douglas, 2008). In addition, the Data-driven Model for Excellence in Staffing provides an organizing framework for the standards of practice articulated in this document by WONE.</p>
<p>Clarke, S.P. (2003). Balancing staffing and safety. <u>Nursing Management</u>, 34(6), 44-8.</p>	<p>This article offers an overview of:</p> <ul style="list-style-type: none"> • The issues involved in studying the relationships between nurse staffing and patient outcomes (methods) • Nurse staffing research (findings) • Practice and policy implications • Nurse staffing research limitations <p>In order to study the impact of staffing on patient outcomes, detailed information about outcomes must be gathered across like patient care situations. Less detailed Hospital-wide information is often readily available from administrative databases, while gathering data at the unit level remains costly and logistically difficult. Disadvantages of administrative databases include:</p> <ul style="list-style-type: none"> • It is difficult to separate nurses in indirect roles, or those practicing in non-acute roles, from nurses in direct acute patient care positions • Discharge databases are developed primarily to support reimbursement, and not to provide a “logical connection” to nursing care • A third issue had to do with risk adjustment and the ability to use administrative databases to determine patient characteristics and

Citation	Discussion
	<p>conditions that were present at the time of admission</p> <p>Another source of outcomes information at the hospital and unit level is the incident/occurrence system; it is recognized that use of this data may lead to underestimations of the adverse outcome occurrence.</p> <p>The author's prior research demonstrates that outcomes sensitive to RN staffing include:</p> <ul style="list-style-type: none"> • Medication errors • Patient falls • Postoperative infections and other complications in medical and surgical patients • LOS • Mortality • Mortality following complications <p>The author notes that while limitations exist in the measures used to study the relationship between nurse staffing and patient outcomes, the finding across the studies are consistent. The implication of the limitations of individual measures does mean that front line managers may not be able to directly apply results of a particular study to their unit, but the fundamental finding that better RN staffing is associated with better patient outcomes must be factored into decision-making.</p> <p>In addition:</p> <ul style="list-style-type: none"> • Staffing levels provide a context for nursing practice, as well as the most direct constraint • The existing research base cannot inform the manager about particular staffing levels for specific situations or patient populations • The existing research base cannot inform the manager about the ideal skill mix • Given the limitations in our research/knowledge base, clinical nurses and their managers are in the best position to determine staffing adequacy <p>Directions for ongoing research:</p> <ul style="list-style-type: none"> • Research exploring the impact of characteristics of the practice environment, other than staffing, on patient safety <ul style="list-style-type: none"> ○ Decision-making models ○ Interdisciplinary/ Interdepartmental Collaboration • How to enhance patient safety through modifications of the workload of novice nurses • Research-based staffing guidelines developed through the analysis of staffing and outcomes data pooled from hospitals using similar workload metrics
<p>Clarke, S.P. (2004). Failure to rescue: Lessons from missed opportunities in care. <u>Nursing Inquiry</u>, 11(2), 67-71.</p>	<ul style="list-style-type: none"> • This article explores the concept of failure-to-rescue with implications for clinical nurses, managerial nurses, and nurse researchers • Nurse staffing levels are one of the organizational characteristics that are linked to the phenomenon of failure-to-rescue with implications for managerial nurses. <ul style="list-style-type: none"> ○ Failure-to-rescue rates reflect the degree of resource investment at the organizational level in professional nursing practice ○ Failure-to-Rescue rates may reflect an organizational culture and the extent to which professional nurses understand that they have the authority to act in the best interests of patient safety • Related to adequacy of staffing and failure-to-rescue is the loss of expertise and "clinical memory" when experienced nurses leave the organization. The author notes that retention of tenured staff must be a priority for managerial nurses & their organizations.
<p>Clarke, S. P. (2007). Registered Nurse Staffing and Patient Outcomes in Acute Care: Looking Back,</p>	<p>Looking Back: 1996 Institute of Medicine report entitled, "Nurse Staffing in Hospitals and Nursing Homes: Is It Adequate?", concluded at that time there was little empirical evidence that staffing and safety were tied to each other and strongly recommended further research.</p> <p>Pushing Forward: In the issue of Kane, RL, Shamliayan, TA, Mueller, C, et al., entitled "The association of registered nurse staffing levels</p>

Citation	Discussion
Pushing Forward.	<p>and patient outcomes: systematic review and meta-analysis”, reviewed 27 reports that dealt with registered nurse to patient staffing ratios and reported associations in a statistical form that allowed direct comparisons. Findings of this meta-analysis support facility-level efforts to base decisions about staffing on data regarding the needs of patients being treated.</p> <p>Researches, taking a variety of approaches, have found that registered nurse staffing levels are often, but not always, connected to outcomes in acute care hospital patients.</p> <p>Even if not mandated by law, institutions should be benchmarking staffing levels as well as quality indicators either empirically demonstrated to be associated with staffing or logically connected to it, to identify clinical areas of their facilities where increases in staffing should be considered.</p> <p>Now that nurse staffing has been shown to be a robust predictor of safety outcomes, it is time for researchers in this field to push thinking about nurse staffing in the broader systems and interdisciplinary context to a higher level.</p>
Coffman, J.M., Seago, J.A. & Spetz, J. (2002). Minimum nurse-to-patient ratios in acute care hospitals in California. <u>Health Affairs</u> , 21(5), 53-64.	<p>The authors offer an economic policy analysis of the implications of mandated minimum nurse-to-patient ratios. They suggest that mandatory minimum staffing ratios have the potential to:</p> <ul style="list-style-type: none"> ▪ cause hospitals to hire more LPNs/LVNs in order to comply with licensed nurse ratios ▪ divert organizational resources away from development of organizational cultures that promote involvement of direct care RNs in organizational decision-making ▪ divert organizational resources away from other factors that impact quality of care ▪ perversely incentivize organizations with richer RN staffing levels to reduce their staffing levels to mandated levels ▪ lead to hospital bed closure ▪ cause some hospitals to reduce spending for support personnel such as unlicensed caregivers, housekeepers, transporters, and others. ▪ discourage innovations in the utilization of other types of health care workers by hospitals ▪ discourage investments in technology and facilities that have the potential to improve health care quality for patients and quality of work life for nurses
DeVandry, S.N. & Cooper, J. (2009). Mandating nurse staffing in Pennsylvania, <u>JOURNAL OF NURSING ADMINISTRATION</u> , 39(11), 470-8.	<p>There is a growing body of evidence supporting an association between RN staffing and patient outcomes; evidence is clinically & statistically significant</p> <p>Fixed nurse-to-patient ratios do not adequately account for patient needs for professional nursing care</p> <p>Fixed nurse-to-patient ratios do not adequately account for variation in nursing skill level</p> <p>The ideal nurse staffing model accounts for the number of nurses at a certain skill level that is required to provide professional nursing care for the number of patients with a certain acuity level.</p> <p>Nurse-to-patient staffing ratios must be evidence-based; at this point there is no solid evidence base for determining an optimal nurse-to-patient ratio.</p>
Gale, S. & Noga, P. (2013). Creating a transparent and dynamic view of staffing as a foundation for improving quality and efficiency. <u>Nursing Administration Quarterly</u> , 37(2), 129-35.	<p>The authors assert that there is abundant information in the nursing and healthcare literature demonstrating that nurse staffing is complex, dependent upon multiple nurse, patient and organizational factors, and cannot be based in standardized nurse-patient ratios across all hospital settings. In fact, the authors state that legislated staffing ratios would “cripple” staffing innovation and our ability to transform nursing care delivery to keep pace with a transformed care delivery system.</p> <p>Described in this paper is the development of a Massachusetts statewide dashboard (called <i>PatientCareLink</i>) that provides data and promotes transparency that can be used to compare existing and future staffing models patient outcomes. Further <i>PatientCareLink</i> is conceptualized as central to Massachusetts being able to plan effectively for nursing workforce development, and to provide work environments for nurses that are safe, supportive, and respectful.</p>
Griffiths, P. (2009).	There is a robust body of evidence demonstrating the association between nursing staffing levels and patient outcomes

Citation	Discussion
Staffing levels and patient outcomes. <u>Nursing Management</u> , 16(9), 22-3.	<p>This body of evidence has been used to support calls for mandated nurse-to-patient ratios</p> <p>Fixed nurse-to-patient ratios are an inflexible approach to improving quality of care and unlikely to optimize resource utilization</p> <p>Additional factors that impact quality of care (e.g. other staff groups, care delivery/care management models) are not accounted for by nurse-to-patient ratios</p> <p>Low RN staffing levels may lead to poor quality of care, but there is insufficient evidence that increasing levels will improve quality of care</p>
Hwang, R.W. & Herndon, J.H. (2007). The business case for patient safety. <u>Clinical Orthopaedics and Related Research</u> , 457, 21-34.	<p>This article reviews financial implications related to patient safety, with special emphasis on issues pertinent to orthopedic surgery patients.</p> <p>The authors discuss strategies to improve patient care and outcomes by addressing adverse drug events, adverse surgical events, and nosocomial infections. In addition to discussing physician staffing, policy issues, and technology-based improvements, they refer to evidence of improved quality of care for patients who receive a higher proportion of care from registered nurses.</p> <p>Recommendations include improvements in the following areas in an effort to decrease adverse events:</p> <ul style="list-style-type: none"> • Education and training • Policy creation and improvement • Event reporting • Technology • Resource allocation (including registered nurse staffing)
Mensik, J.S. (2013). Nursing's role and staffing in accountable care. <u>Nursing Economics</u> , 31(5), 250-3.	<p>The author asserts that the profession of nursing has an essential role in meeting the goals of the Triple Aim: better health, better health care, lower costs. Health care reform initiatives provide a leadership moment for nurses in all setting and all levels of organization to participate in conversations about their desired future of nursing in the era of accountable care.</p> <p>Four important steps for positioning nurses to design and develop the evolving role of the RN are identified:</p> <ul style="list-style-type: none"> • Determine the role of the clinical RN in ACOs • Implement new workforce modeling, deployment, and education based on the new RN role • Communicate the vision in order to facilitate and lead the desired change • Participate in patient, nursing, and organizational outcomes research
Norrish, B.R. & Rundall, T.G. (2001). Hospital restructuring and the work of registered nurses. <u>The Milbank Quarterly</u> , 79(1), 55-79.	<p>This article examines the impact that hospital restructuring has had on the work of Registered Nurses. The authors believe that it is important to explicate this effect because alterations in work roles, workload, and control over work impact the satisfaction of the RN workforce and are key variables through which the effects of restructuring upon patient outcomes are mediated.</p> <p>Impact of restructuring on work roles Return to team nursing with a resultant decrease in the emphasis on the nurse-patient relationship</p> <p>Impact of restructuring on workload Difficult to assess due to:</p> <ul style="list-style-type: none"> • methodological constraints on accurate estimates of patient care staffing requirements • new categories of caregivers in the staff mix • complex dynamics of inpatient unit staffing <ul style="list-style-type: none"> ○ census volatility ○ competency of the nursing staff ○ mandated staffing practices <p>Impact of restructuring on control of nursing work Professional autonomy, participation, and shared decision making are vulnerable when an organization restructures; professional control of the work may be subordinated to the organizational bureaucracy</p>

Citation	Discussion
	<ul style="list-style-type: none"> • restructuring initiatives may “bypass” the governance structure • decreased money budgeted for governance activities • may prompt the organization to move to organization-wide shared governance/shared decision making models <p>The authors conclude that state regulation of nurse staffing ratios may neither enhance patient outcomes nor improve the working conditions of nurses. The complexity of determining the ever fluctuating demand for nursing care makes it very difficult to assure safe and effective clinical care across multiple organizations using a regulatory approach. The authors recommend that 3 strategies be used when initiating hospital restructuring:</p> <ul style="list-style-type: none"> • use effective change management principles • build trust between nursing staff and management • assess the patient impact of planned changes and put the assessment in writing in the form of a Patient Impact Statement
<p>Seago, J.A. (2002). The California experiment: Alternatives for minimum nurse-to-patient ratios. <i>Journal of Nursing Administration, 32</i>(1), 48-58.</p>	<p>The context for this article is California Assembly Bill 394 which established minimum nurse staffing levels for acute care hospitals. The author’s review of the literature is designed to respond to 5 questions:</p> <ul style="list-style-type: none"> • why nurse patient ratios are at the forefront of the California health care agenda • what is expert opinion about mandated staffing ratios • how are states other than California, as well as other institutions, approaching the issue of staffing ratios • what is the relationship between nurse staffing and patient outcomes • what is the relationship between nurse staffing and nursing staff outcomes <p>In terms of nurse staffing and patient outcomes, the author notes the paucity of evidence supporting an “ideal” nurse-patient ratio. The positive association between richer nurse staffing and positive patient outcomes is noted.</p> <p>In terms of nurse staffing and nursing staff outcomes, higher nurse-to-patient ratios are associated with a safer work environment for nurses. There is a relationship between high workload and nurse burnout and reduced job satisfaction. This research base is limited.</p> <p>Conclusions: There is no support in the literature for determining/setting optimal nurse-patient ratios for diverse patient populations.</p>
<p>Welton, J.M. (2011). Nurse staffing and inpatient mortality: Is the question outcomes or nursing value? <i>Medical Care, 49</i>(12), 1045-6.</p>	<p>The author explores limitations of research designed to explicate the relationship between nurse staffing and patient outcomes; e.g. observational studies preclude the establishment of causality, use of convenience samples, aggregation of data to the unit or hospital level, potential bias associated with survey methodologies, etc.</p> <p>Welton asserts that emerging research has the potential to overcome some of these limitations, but states that the real issue is that we might not be asking the right questions when we explore nurse staffing. Nursing care is generally viewed as a commodity buried in the room and board charge, and this can render the nursing contribution to patient outcomes invisible to payers and policy-makers. Welton poses 5 lines of inquiry with the potential to reframe the questions we ask about nurse staffing:</p> <ul style="list-style-type: none"> • derive methodologies to allocate nursing intensity and costs at the patient level and link these data to the quality of patient outcomes • test billing models that align nursing intensity and costs with reimbursement for high value nursing care • build valid benchmarking tools to measure and compare nursing intensity within and across health care settings • investigate the effects of incentives for nurses for best outcomes (pay-for-nursing performance) • Explore alternative models of organizing nursing care to achieve high value (e.g. including nurses in accountable care models)
<p>Weston, M.J., Brewer, K.S. & Peterson, C.A. (2012). ANA principles: The framework for nurse staffing to positively</p>	<p>The authors describe the <i>American Nurses Association Principles for Nurse Staffing, Second Edition</i> and discuss how these principles can assist nurse leaders in dealing with, and responding to, the multiple forces that impact a nurse staffing plan.</p> <p>Key principles affecting staffing decisions are identified:</p> <ul style="list-style-type: none"> • Definition of appropriate nurse staffing

Citation	Discussion
<p>impact outcomes. <u>Nursing Economics</u>, 30(5), 247-52.</p>	<ul style="list-style-type: none"> • Core components of nurse staffing • Principles related to the health care consumer • Principles related to registered nurses and other staff • Principles related to organization and workplace culture • Principles related to the practice environment • Principles related to staffing evaluation <p>The principles are developed to be relevant in all settings where nursing is practiced. The authors call for nurse staffing to be re-conceptualized away from cost and towards the value that nurse staffing brings to patients and organizations.</p>

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Guiding Principles for Achieving Excellence in Nurse Staffing

Position Statement:

As we transition into an era of sweeping health care reform, the focus is shifting from volume to value and to population health. The focus will be increasingly on outcomes; and outcomes are managed at the point of care. Nurses have a critical role to play in a value-based model and can no longer be considered a commodity. Nurses must engage in professional role-based practice and will serve as the coordinators of care in a value-based model. Effective approaches to staffing excellence must include attention to optimization of nursing roles and time for the nurse to engage in value-based activities such as assessing, teaching and evaluating the knowledge and ability of the user of health care services.

Excellence in nurse staffing in any health care setting can only be achieved through a decision making process in which direct care nurses themselves evaluate and respond to the drivers of patient care intensity. This evaluation and response must be made in light of the nursing organization's capacity to provide professional services. In 2008, a national staffing summit was held with leaders of professional organizations, researchers and others with expertise in staffing. The result of the summit was a position paper entitled *Excellence and Evidence in Staffing: Essential Links to Staffing Strategies, Design and Solutions for Healthcare*. This paper highlighted best practices and included numerous references to support the work.

In 2014, in follow up to the work of 2008, a 2nd edition was produced entitled *Excellence and Evidence in Staffing: A Data-Driven Model for Excellence in Staffing (2014 Supplement to Nursing Economic\$)*. This document was created as the organizing framework to lead the development of best practices for nurse staffing across the continuum through research and innovation. It was organized around 5 Core Concepts:

- Core Concept 1: Users and Patients of Health Care
- Core Concept 2: Providers of Health Care
- Core Concept 3: Environment of Care
- Core Concept 4: Delivery of Care
- Core Concept 5: Quality, Safety and Outcomes of Care

The articulation of these core concepts, as a framework for staffing excellence, reflects the importance of moving away from the linear, single variable thinking (e.g. hours of care) that has historically characterized our approaches to nurse staffing. Current evidence requires that we expand our understanding of excellence in staffing to a holistic and systemic approach that encompasses the downstream outcomes and sustainability of staffing decisions.

The Guiding Principles for Achieving Excellence in Nurse Staffing in this document are organized around these 5 Core Concepts.

Guiding Principles:

Core Concept: Users and Patients of Health Care

1. The user/patient must be engaged as a full partner in all aspects of health care delivery. The plan of care is owned by the user and the systems of care delivery must be designed to enable full access to information and participation by the user/patient and family. Processes of care should be designed to achieve this outcome. Rounding, bedside hand-offs, and virtual access to the Health Record are examples.

Core Concept: Providers of Health Care

1. Authority and accountability for all nurse staffing decisions within the organization must rest with the nurse executive who will work in direct collaboration with the clinical direct care professionals. Expertise in nursing is an essential foundation of appropriate staffing decisions.
2. The professional standards, developed by the nationally recognized specialty nursing associations to address appropriate staffing, must be considered in developing staffing plans within organizations.
3. In all settings in which nursing is practiced, the Institute of Medicine goal of achieving 80% BSN preparation by 2020 must be embraced. Efforts should be undertaken to develop consensus around the importance of this goal, identify the barriers to achieving this goal and develop strategies to overcome them. It is noted that, as of June, 2013, all organizations that have achieved, or are aspiring to achieve, Magnet Recognition, are required to have an action plan to enable them to meet the goal of 80% BSN prepared nurses by 2020.
4. Certification in the area of specialty practice should become the standard for nursing practice, as it is in medical practice. All settings in which nursing is practiced should develop strategic goals to achieve this outcome.

Core Concept: Environment of Care

1. Nursing, like all licensed, clinical professions, must respond to a societal mandate to self-regulate. Authentic shared governance structures, which enable the profession to achieve autonomy and fulfill its accountabilities, should be implemented in every setting in which nursing is practiced.
2. Direct care nurses recognize that prerequisites to meaningful voice in determining appropriate staffing include an awareness of the fiscal realities of the current health care

environment, and a willingness to play an active role in ensuring the efficient and effective use of resources through the pursuit of improved approaches to patient care.

3. All organizations across the continuum should be actively working to achieve the principles of Magnet Recognition or Pathways to Excellence Recognition from the American Nurses Credentialing Center (ANCC), as these environments have been associated with the best patient outcomes.

4. Focus, in every practice setting, should be on the development of effective and efficient interprofessional teams, in which members understand the role-based contributions of each other and work together to achieve exceptional clinical outcomes and patient/family experience at the lowest possible cost.

5. Nurses must be actively involved in the physical design of patient care spaces in which they practice. The demand for private spaces for patients, as an essential component of a positive patient care experience, should be offset by decentralized staff spaces, the integration of patient-nurse communication systems and team-based care models.

Core Concept: Delivery of Care

1. An effective system of appropriate staffing strives to match patient care requirements with nursing care resources each shift, each day. Patient care needs must determine the level of staffing. Efforts to compensate for a day of higher than normal care requirements by arbitrarily restricting staffing to less than adequate levels, at some point in the future, are inappropriate.

2. The daily determination of appropriate staffing requires objective information concerning patient care needs, skills of available staff, and budgeted resources, coupled with expert clinical judgment about the specific patient care requirements on any particular day. Appropriate staffing requires mechanisms to increase staffing in response to greater care requirements and to decrease staffing in response to reduced care requirements. Further required is a collaborative approach to managing patient flow, within the organization, when the demand for patient admissions exceeds the available nursing resources.

3. Technology continues to change the health care environment at a rapid pace. It can serve as an enhancement or an impediment to the delivery of effective, efficient care. Nurses must be active participants in the design and integration of technology into the practice setting to ensure that it facilitates the ability to care for patients.

4. The continuous pursuit of evidence-based best practices is an obligation of the profession. Benchmarking with other organizations must be an ongoing endeavor in determining appropriate staffing. To be meaningful, benchmarking must be a comprehensive process that includes the downstream outcomes of staffing decisions, including but not limited to, patient clinical outcomes, patient satisfaction, nurse

engagement and nurse turnover. Comparisons of single variables, such as “hours of care”, without the broader organizational context, are not useful.

Core Concept: Quality, Safety and Outcomes of Care

1. Ongoing evaluation of outcomes is also a necessary element in the achievement of excellence in staffing. At a minimum, this should include collection and analysis of data related to nurse sensitive outcomes such as length of stay, readmission rates, and rates for catheter associated urinary tract infection, pressure injury, post-operative infections, and falls with injury, as examples, and their correlation with other patient care trends. In addition, the impact of quality of work-life on quality of care delivered must be evaluated.

2. National Safety Standards must be adopted in every practice setting, with strategies to protect nurses, as well as patients, from harm. Examples include efforts to prevent needle sticks and to create "no lift" environments to prevent back injuries.

Key Drivers of Intensity of Patient Care Requirements:

1. The acuity, complexity and case mix of the patients, in any care setting, are the primary determinants of patient care requirements.
2. There is a direct relationship between the length of stay in the acute setting and the intensity of care requirements. Therefore, as length of stay decreases, nursing workload increases. In 2002, the Advisory Board attempted to quantify this relationship and identified that for every day the length of stay is decreased, nursing workload is increased by greater than 27% (The Advisory Board, 2002). Since that time, patient length of stay continues to be compressed. Intensity of patient care is increased by admission, discharge and transfer activity.
3. The greater the number of admissions, discharges and transfers in a given day, the greater the intensity. Midnight census, in the acute setting, and linear volume metrics in other settings, do not accurately reflect nursing workload.

Key Drivers of the Capacity of the Nursing Organization to Provide Patient Care:

1. The experience/expertise of the nurse directly influences individual capacity to provide patient care. Generally, the greater the expertise of the nurse, the greater the capacity to manage, both in terms of the number and complexity of patients.
2. The support systems available to nurses in the practice setting directly impact the capacity to provide professional services within the organization. Nurses whose

work is supported by effective housekeeping, pharmacy, food and supply systems, as examples, have a greater capacity to provide professional services than those who are forced to spend time compensating for inadequate support.

3. The effectiveness of the system of care, particularly documentation and other non-direct care requirements, directly impacts the capacity of the nursing organization to provide professional services. Cumbersome systems that pull nurses away from the patient detract from the capacity to provide patient care.

The geography and unit design in which nurses practice influence the capacity to provide professional services. The ability to readily visualize and access patients enhances capacity. The demand for larger and more private patient care spaces (essential to meeting the expectations of today's active consumer,) detracts from the capacity of the nursing organization to provide professional services.

Closing Statement:

This document has been created, and updated to reflect current evidence, by The Wisconsin Organization of Nurse Executives as a service to our patients, in recognition of our obligations and commitment to them, and as a service to our organizations as they struggle with a changing reality. We have created a comprehensive tool to be utilized by nurses, in partnership with their organizations, throughout the state. The accountabilities for decision making and key relevant considerations are clearly described. Our positions reflect the best available evidence of the scientific community.

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