

Nurse Staffing

and PATIENT, NURSE, and FINANCIAL OUTCOMES

A literature review examines the impact of staffing levels and offers recommendations.

OVERVIEW: Because there's no scientific evidence to support specific nurse-patient ratios, and in order to assess the impact of hospital nurse staffing levels on given patient, nurse, and financial outcomes, the author conducted a literature review. The evidence shows that adequate staffing and balanced workloads are central to achieving good outcomes, and the author offers recommendations for ensuring appropriate nurse staffing and for further research.

"There is a substantial amount of good research (evidence) on the relationship between nurse staffing and patient outcomes that seems to be ignored," wrote Janet Storch in an editorial in the May 2005 *Nursing Ethics*.¹ If this is so, why hasn't more attention been paid to that research, and to nurses themselves, who continue to declare that their workplaces are understaffed and their workloads too heavy?

The 2006 report *Nurse Staffing and Quality of Patient Care* by the Agency for Healthcare Research and Quality (AHRQ) described what nurses already know: inadequate nurse staffing and heavy workloads threaten care quality and patient safety.² It reported strong evidence linking inadequate staffing with adverse events such as nosocomial infections, shock, and failure to rescue. Better staffing was linked to lower death rates and shorter hospitalizations. An earlier report by the Institute of Medicine, *Keeping Patients Safe: Transforming the Work Environment of Nurses*, reached similar conclusions.³ And patients aren't the only beneficiaries. Some evidence links adequate nurse staffing or balanced workload (or both) to improvements in nurses' health and job satisfaction,^{4,5} and one study found that hospitals showed improved financial performance.⁶

To assess the impact of hospital nurse staffing levels on patient, nurse, and financial outcomes, I conducted a literature review. The findings underscore the importance of hospitals acknowledging the effect nurse staffing has on patient safety, staff satisfaction, and institutions' financial performance.

TERMS AND A CONCEPTUAL MODEL

Definitions. One difficulty in evaluating the research on nurse staffing is that researchers have taken somewhat different approaches. In general, a facility's *nurse staffing ratio* refers to the number of nurses or nursing hours per number of patients or patient-days, or vice versa. Sometimes nurse staffing is discussed in terms of *skill mix* (varying levels of education

or experience); this too can be expressed as a ratio (for example, the number of RNs to the number of all nurses on staff).

But what's adequate? It's difficult to generalize because nurse-patient ratios depend on factors that can vary, including characteristics of the patient, nurse, and work environment. A nurse-patient ratio that's sufficient on one unit might not be on another. And there's no scientific evidence to support *specific* nurse-patient ratios. Where minimum nurse-patient ratios have been legislated, as in California, they reflect political compromises among hospitals, insurers, nurses, and the public, rather than hard science.^{7,8}

Another consideration is the *nursing workload*, which can be defined as the amount and intensity (in terms of the effort required) of work a nurse performs within a given period. Because so many variables can affect workload—including number and acuity of patients cared for, unit design, resources available, and skill mix⁹—developing a reliable assessment method has proven difficult. Some hospitals use commercially available workload-measurement systems, which differ in the variables they measure,¹⁰ aren't evidence based,¹¹ and don't adequately reflect workload.¹² For example, some systems approximate workload by patient acuity but fail to take into account other factors. Recent efforts to develop a noncommercial, standardized system have brought about measures referred to as “nursing intensity”¹³ and “nurse dose,”¹⁴ in which a number of factors are considered together. Subjective measures such as the stress felt might also be used.¹⁵ But there's no evidence-based, standardized workload-assessment system.

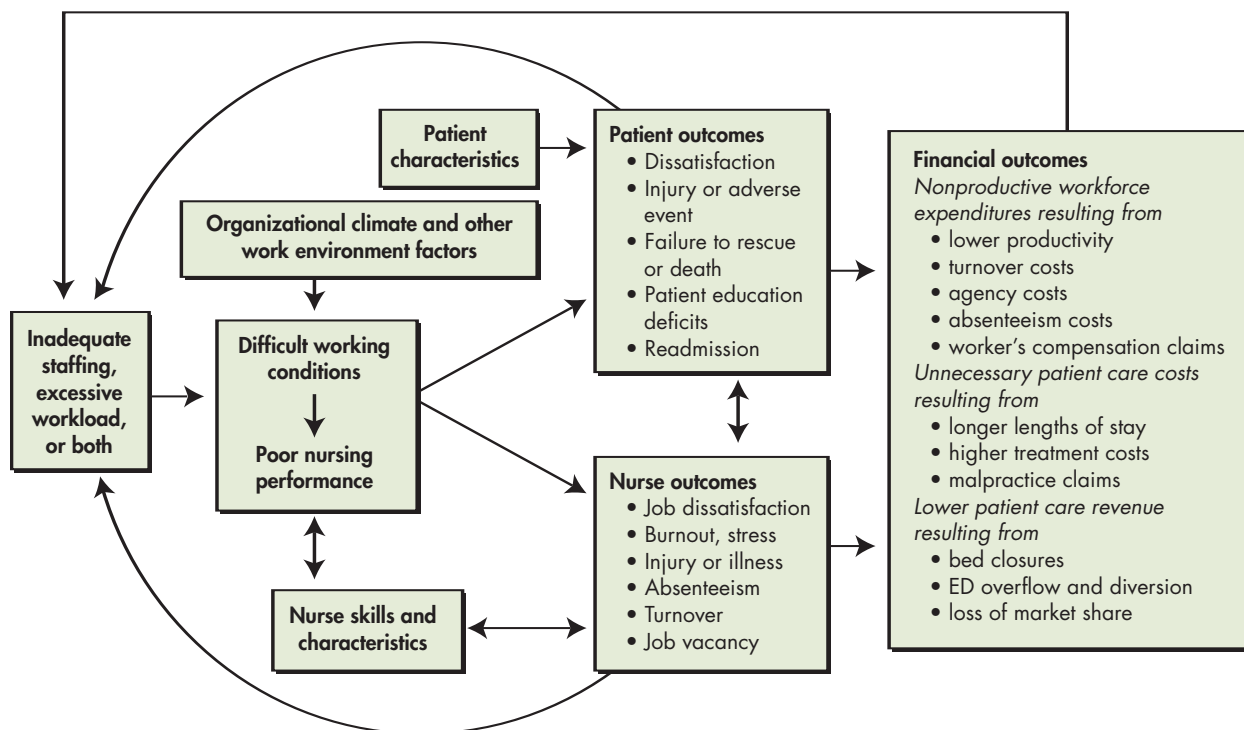


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Without scientific methods for assessing the adequacy of nurse staffing levels, researchers must use relative or subjective methods. For example, researchers might consider a hospital's nurse staffing ratios in relation either to previous ratios at that hospital or to those at other hospitals and look for associated outcomes. Or they might survey nurses about a facility's staffing levels, their job satisfaction, and the quality of care. Although such subjective research methods are limited, the findings still have merit.

A conceptual model. Figure 1, page 64, illustrates the relationships among inadequate staffing

Figure 1. Conceptual Model of Patient, Nurse, and Financial Outcomes Associated with Inadequate Nurse Staffing



or excessive workloads (or both) and various undesirable outcomes. As the figure shows, inadequate staffing and excessive workload contribute to a difficult work environment—such as tight time constraints, inadequate supervision of support staff, inadequate communication, and a generally chaotic or stressful work environment—factors that can result in poor job performance (medication errors, for example) and employee distress.¹⁶

So it can be seen that staffing and workload are part of a complex matrix of factors that contribute to the patient, nurse, and financial outcomes listed in the figure. The resulting adverse effects for patients include higher incidences of pneumonia, postoperative infections, pressure ulcers, urinary tract infections (UTIs), and failure to rescue.^{2, 17} Among nurses, they include job dissatisfaction, burnout, and injury and illness, as well as high job turnover.¹⁸⁻²¹ And dissatisfaction, burnout, and poorer health have been associated with higher “intent to quit” levels and turnover rates.²²

Nurse outcomes can affect patient outcomes, and vice versa. For example, nurses become dissatisfied with their work when unable to give good care,^{23, 24} which can in turn reduce patient satisfaction.²⁵ And poor nurse and patient outcomes contribute to higher costs as a result of low productivity, high turnover, and workers’ compensation claims, as well as longer hospitalizations and expensive treatments.⁶ A hospital can lose revenue by losing market share, which might result from bed closures²⁶ or ED overflow and diversion.

It can be a vicious cycle: inadequate staffing leads to reduced job performance and diminished patient and nurse satisfaction; the resulting burnout and high turnover rates worsen staffing levels.

LITERATURE REVIEW: METHODS

Along with an assistant, I performed a comprehensive literature review using five databases covering articles published from 1980 through 2006: *Academic Search Premier*, the *Cumulative Index to Nursing and Allied Health Literature (CINAHL)*, *EconLit*, *Health Source: Nursing/Academic Edition*, and *Medline*. We conducted the initial search for all outcomes related to nurse staffing by using 16 search terms, including “nurse staffing,” “nurse skill mix,” “nurse hours,” and “nurse to patient days of care.” In the search for patient outcomes related to nurse staffing, we combined staffing terms (using the Boolean operator “AND”) with “patient outcomes,” “adverse event,” and “quality,” as well as 17 specific adverse-event terms such as “cardiac arrest” and “postoperative infections.” In the search for nurse outcomes related to nurse staffing, the staffing terms were combined (using the Boolean operator “AND”) with 15 additional terms including “absenteeism,” “burnout,” “job dissatisfaction,” and “turnover.” And in the search for financial outcomes related to nurse staffing, staffing terms were combined (using the Boolean operator “AND”) with terms including “costs,” “length of stay,” and “productivity.” For the complete list of search terms, see Literature Review Search Terms, available online

at <http://links.lww.com/A355>. Tables 1, 2, and 3 (available online at <http://links.lww.com/A356>) show the results of the literature search with regard to patient, nurse, and financial outcomes, respectively.

We selected original U.S. or international research studies for review, excluding dissertations, opinion pieces, editorials, and reports in the mainstream media. A total of 117 studies met the criteria. I excluded literature reviews from the tables but included their conclusions in the discussion in this article.

IMPACT OF HOSPITAL NURSE STAFFING ON PATIENT OUTCOMES

More than 45 U.S. studies have explored the relationship between hospital nurse staffing and patient outcomes; at least 20 more have been conducted in other countries. This discussion focuses primarily on 21 studies conducted since 2002. I decided on this focus because of the large number of studies on nurse staffing and patient outcomes, because methodologies have improved over time, and because 2002 was a watershed year. These 21 studies and their results are listed online in Table 1.

That year two large studies appeared, one by Aiken and colleagues in *JAMA* and another by Needleman and colleagues in the *New England Journal of Medicine*. The Aiken group examined data from 168 Pennsylvania hospitals; the mean patient–nurse ratio varied from 4 to 1 to 8 to 1.¹⁸ They found that each additional patient in the average nurse’s workload produced a 7% increase in the likelihood of failure to rescue (death from serious complications). The Needleman group examined data from 799 hospitals in 11 states; the mean number of hours of nursing care per patient-day was 11.4 (7.8 hours provided by RNs, 1.2 hours by LPNs, and 2.4 hours by nurses’ aides).²⁷ In medical patients, a higher proportion of hours of care per patient-day (HPPD) by RNs and a higher number of hours of RN care were each associated with shorter hospitalizations and a lower rate of UTI and upper-gastrointestinal bleeding. A higher proportion of RN HPPD was also associated with lower rates of pneumonia, shock or cardiac arrest, and failure to rescue. Among surgical patients, fewer UTIs were found when the proportion of RN HPPD was higher, and fewer UTIs and failures to rescue occurred when the total number of RN hours was higher.

Findings from other 2002 studies included the following: there were lower rates of pneumonia in hospitals with higher RN staffing levels (measured in RN HPPD)²⁸; fewer postoperative complications occurred in ICUs with higher RN–patient ratios²⁹; fewer deaths occurred within 30 days of admission when the skill mix included a higher proportion of RNs³⁰; and on better-staffed specialty units were found lower incidences of falls and medication errors

and less restraints use (although this study counted secretaries among nursing staff personnel).³¹

In a 2003 study, I determined that hospitals with more licensed nurses had lower incidences of atelectasis, pressure ulcers, falls, and UTIs; those with higher proportions of licensed nurses had lower rates of pressure ulcers and pneumonia.³² Cho and colleagues found a lower risk of pneumonia associated with an increase in either the proportion of RNs or RN HPPD,³³ and Aiken and colleagues found fewer deaths and failures to rescue in surgical patients when a higher proportion of nurses had bachelor’s degrees or higher.³⁴

I found several more studies between 2004 and 2006: more falls occurred on units with fewer nursing HPPD and a lower proportion of RNs³⁵; a higher RN–patient ratio was linked to a lower risk of falling³⁶; and four studies reported lower death rates on units or in hospitals with higher RN-staffing levels, variously measured as RNs per 1,000 inpatient days,³⁷ more RNs per average daily patient census,³⁸ and higher RN–patient ratios.^{39, 40} One Canadian study determined that in hospitals with a higher proportion of RNs, fewer medication errors and wound infections occurred.⁴¹ Another found that having a higher proportion either of RNs or of nurses with bachelor’s degrees was associated with lower 30-day mortality rates, while greater use of temporary staff was associated with more deaths.⁴² And a longitudinal study determined that greater patient satisfaction was associated with more total nurse HPPD and with more RNs in the mix.⁴³

Significance. One way to evaluate these results is simply to count the number of times that a statistically significant relationship in the “correct” direction (one that supports the researchers’ hypothesis) is found between staffing and a specific patient outcome. Researchers look at statistical significance because it ensures that a given result is due to the intervention and not to chance. Accordingly, of the 21 studies conducted between 2002 and 2006,

- only three found no significant relationship between nurse staffing and patient outcomes.⁴⁴⁻⁴⁶
- 15 looked at more than one staffing variable and more than one patient outcome, increasing the likelihood that at least one significant relationship between a staffing variable and a patient outcome would be found, as was the case.
- 13 also found at least one insignificant or counterintuitive relationship between a staffing variable and a patient outcome.
- for each of the 17 patient outcomes we considered, at least one study reported finding no significant association with nurse staffing levels.

But just looking at statistical significance isn’t enough. A stronger assessment method is needed, one that grades findings based not only on their statistical significance but also on their clinical importance

(“effect size”) and on study methodology. Assessing methodology is important because the choices made regarding outcome measures, analytical model, and statistical analysis all have bearing on the results.² Clinical significance matters because while a study may detect statistical significance for a given relationship, its clinical impact might be negligible.

More than 45 U.S. studies have explored the relationship between hospital nurse staffing and patient outcomes.

Literature reviews and metaanalyses. In 2004 Lang and colleagues conducted a systematic review of 43 studies, performed between 1981 and 2003, on the effects of nurse staffing on patient, nurse, and hospital outcomes.⁴⁷ The authors had several criticisms of these studies: positive outcomes (other than patient satisfaction) and postdischarge effects weren't included; “[m]ethodological and analytical problems were abundant”; and the severity of adverse events such as pressure ulcers often wasn't reported. The hypothesis that better nurse staffing improves patient outcomes was upheld when applied to failure to rescue and death rates, but was neither supported nor unsupported when rates of pneumonia and UTI were considered and was unsupported when applied to rates of pressure ulcers, falls, and nosocomial infections, among others.

Although the Lang review has merit, it also has weaknesses. Its chief strength is that the authors looked at both the statistical and clinical significance of findings, and assigned grades to each. (Statistical significance was based on *P* values; clinical significance was determined by the degree to which a finding was associated with a “substantial change” in outcome.) But because their grading criteria weren't more explicit, the validity of their decisions can't be judged. Moreover, other than sample and effect size, they didn't take into account study methodology.

Subsequent reviews by Haberfelde and colleagues and by Lankshear and colleagues have examined studies conducted from 1998 to 2003 and from 1990 to 2003, respectively.^{48, 49} The former concluded that the evidence of a link between nurse staffing and patient outcomes was mixed; the latter concluded that there is growing evidence that better nurse staffing is associated with better patient out-

comes. But Haberfelde's group acknowledged that their review was an “annotated bibliography,” involving neither qualitative nor quantitative analyses, while the Lankshear group based its conclusions on statistical significance alone. Lake and Cheung looked at both research design and findings in reviewing studies conducted from 1998 to 2005 on falls and pressure ulcers, asking whether these outcomes were sensitive to nurse staffing levels.⁵⁰ They concluded that although “substantial differences in research methods” might account for mixed findings, the evidence appeared weak.

While the AHRQ's 2006 metaanalysis of observational studies conducted from 1990 to 2006 showed a link between higher nurse staffing and fewer patient deaths and other positive outcomes, it also noted that the relationship isn't necessarily causal.² This study quantitatively assessed effect size and several methodological aspects. But the only statistical aspect assessed was whether confounding factors were controlled; other aspects (such as study design) are also likely to affect results.

Taken together, these reviews show that studies examining the relationship between nurse staffing and patient outcomes have yielded inconsistent results: there's variable evidence to support a link between specific staffing measures and specific patient outcomes. But they also show that weak results don't necessarily mean there's no relationship but rather may reflect varying methods or insufficient data.

Over the years analytic methods have improved; specific characteristics of study variables and the complexities of relationships that might result are being taken into account, and unit-level and longitudinal approaches are helping to establish more precise causal connections. But the available data are not necessarily more reliable. Nurse staffing data, such as those derived from the American Hospital Association Annual Survey of Hospitals, might combine information on nurses in different settings or fail to provide information on all nursing staff.^{51, 52} Adverse events data often come from discharge information available through the Healthcare Cost and Utilization Project database provided by the AHRQ or from individual states and are collected for financial purposes and may not reflect the entire picture of adverse events.⁵³

Thus, despite an abundance of research, more is needed. Suggested improvements include using more reliable unit-level data and studying how changes in staffing levels affect outcomes over time.

IMPACT OF HOSPITAL NURSE STAFFING ON NURSE OUTCOMES

Several studies have examined the effects of nurse staffing levels on nurses, and workload or “work pressure” has frequently been among the factors examined. These studies and their results, which

are remarkably consistent in terms of specific outcomes, are listed online in Table 2.

Six studies found that emotional exhaustion, job dissatisfaction, or both were associated with lower nurse staffing levels, greater workloads, higher “work pressure” or stress levels, or a combination of these (definitions of terms differed somewhat).⁵⁴⁻⁵⁹ One study determined that high workloads were related to lower job satisfaction.⁶⁰ Another found that inadequate staffing and insufficient time to complete tasks were linked to lower job satisfaction and that adequate staffing and sufficient time were associated with increased job satisfaction, although the effects weren’t as great.⁶¹

A 1999 qualitative study found that the greatest of several contributors to nurses’ job satisfaction was providing good care; another major factor was having a “challenging but manageable” workload.²³ Dissatisfaction resulted from several factors: “feeling overloaded, factors that interfere with patient care, coworkers who do not provide good care, and situations that feel unfair.” Most studies of nurse satisfaction have relied solely on surveys, but in 2002 Aiken and colleagues matched survey responses to archived hospital staffing data, demonstrating links among burnout, job dissatisfaction, and low nurse-patient ratios.¹⁸

Nurses’ physical health has been studied too. In 2002 low staffing ratios and heavy workloads were found to correlate with a significantly higher probability of a needlestick.^{19, 20} And in 2003 RNs who found their jobs to be moderately or highly physically demanding were significantly more likely to report neck, shoulder, and back injuries.⁶² A 2006 Danish survey found that an imbalance between effort and reward was associated with nurses’ reports of poor health.⁶³ And in 1994 Dutch researchers found a link between work pressure and nurses’ physical and psychological complaints.⁵⁷

In a 2004 survey of nurses’ working conditions, one of the most frequently cited themes derived from nurses’ written comments was excessive work demands; these were linked to several factors, including long hours and low staffing.⁶⁴ Many respondents felt that low staffing ratios compromised the quality of care; nurses who felt this way were also highly likely to report that they had quit or were planning to quit a job. A 2002 study of nurses at 10 Canadian hospitals—five with high rates of worker’s compensation claims in nurses and five with low rates—identified workload as the top factor contributing to musculoskeletal injuries and stress.⁶⁵ Factors differentiating high-claim-rate hospitals from low-claim-rate hospitals included work environment and staffing. Nurses said that improvements in work environment, benefits, and staffing would lower rates of injury and stress.

Only two studies have examined nurse staffing levels’ direct impact on job retention. In a Swedish

study of why nurses quit their jobs, nurses named dissatisfaction with salary as the main factor and also reported psychological stress and stressful work as reasons, citing high work tempo, work-related exhaustion, and a lower quality of patient care (their perception) as factors.²¹ And in a survey of 84 nurses who had left their jobs during a nine-month period in a Midwestern health system, Strachota and colleagues found that more than half left because they had had to work “long shifts, overtime, weekends, nights, and holidays,” and more than a third of them “were unhappy with staffing levels.”²⁴ Other findings are relevant to this discussion: low nurse staffing levels⁶¹ and heavy workloads^{61, 66} have been linked to decreased job satisfaction; job satisfaction and dissatisfaction have been linked, respectively, to staying at and quitting (or intending to quit) a job.^{22, 67-69}

Not all studies have demonstrated significant relationships between nurse staffing or workload and nurse outcomes. Kovner and colleagues found no association between workload and job satisfaction.⁷⁰ Lanza and colleagues found none between RN staffing ratios and incidence of physical assaults by patients.⁷¹ Hayhurst and colleagues found no statistically significant relationship between work-related pressure and intent to leave a job.⁷² Such unexpected findings might be the result of measurement or design differences. Metaanalysis of this literature might be useful in guiding future research.

Literature reviews. Three of four reviews on nurse staffing and nurse outcomes summarized the research in ways that correspond to the findings reported here. In 1994 Duquette and colleagues stated that the evidence showed a correlation between heavy workloads and burnout but not between more time spent with patients and burnout.⁴ More recently, McNeely named high work demands as one of three elements of stressful work but commented on the limitations of research in this area: definitions of workload vary; the aspects of nursing that contribute to ill health “remain under-identified”; some studies fail to consider both physical and psychological demands; and some don’t consider the effects of home stressors.⁷³ Way and MacNeil reported that “job demand” is associated with dissatisfaction and ill health; the pacing, timing, amount, and variety of work are factors.⁵ Lang and colleagues concluded that there is some evidence of an association between low staffing levels and the likelihood of burnout or needlestick injury but not job satisfaction, incidence of assaults by patients, or absenteeism.⁴⁷ But these reviewers reviewed only eight studies, and they didn’t take into account the merits of and flaws in methodologies.

Research on nurses’ emotional and physical health and level of job commitment should continue. Both quantitative and qualitative analyses of the evidence should be conducted.

IMPACT OF HOSPITAL NURSE STAFFING ON FINANCIAL OUTCOMES

Relatively few studies have investigated the relationship between nurse staffing levels and hospitals' financial outcomes. Though results are inconclusive, researchers have used four approaches to explore a possible link:

1. studying RN–patient staffing ratios and RN–non-RN skill mix in relation to costs
2. studying nurse staffing levels in relation to lengths of hospital stay and, therefore, costs
3. exploring how changes to nurse staffing levels affect the rate of adverse events and, therefore, cost savings
4. examining costs in relation to turnover rate, which may be related to staffing levels

Efforts to improve care, recruit and retain nurses, and enhance financial performance must address nurse staffing and workload.

These studies and their results are presented online in Table 3.

In taking the first approach, several older studies yielded mixed results. One study found that increasing the proportion of RNs in the skill mix reduced nursing labor costs,⁷⁴ while two others determined that an RN-rich skill mix raised them.^{75, 76} None of these studies weighed the personnel costs of having more RNs in the mix against the cost savings of fewer adverse events. But a subsequent study that looked at both personnel and operating costs concluded that an RN-rich skill mix was cost neutral.⁷⁷ In 2005 Titler and colleagues found that RN staffing either above or below the unit's average increased costs.⁷⁸ In 2007 another group led by Titler demonstrated that higher RN staffing levels reduced costs, while below-average RN staffing increased costs.⁷⁹ (The later study doesn't address the difference in findings.)

In studies taking the second approach, a shorter length of stay was associated with more RN hours,^{80, 81} lighter workloads,⁸² and higher nurse–patient ratios.⁸³ With hospitals charging by the day, facilities don't fully reap immediate savings from shorter hospitalizations, but per diem charges do allow a facility to

gain more-competitive contracts with insurers and increase patient volume.

Taking the third approach, Dimick and colleagues examined the effects of nurse staffing levels on complications and associated costs for patients after hepatectomy.⁸⁴ Patients at hospitals with ICU nurse–patient ratios of 1 to 3 or higher had more complications and 14% higher costs (\$1,248 per patient) than those at hospitals with lower ICU nurse–patient ratios. Cho and colleagues found that increasing RN HPPD by one hour or raising the proportion of RNs in the skill mix by 10% lowered patients' risk of pneumonia by 8.9% or 9.5%, respectively, and led to significantly shorter hospitalizations and lowered costs.³³ Unexpectedly, increased nursing HPPD were also associated with a higher probability of pressure ulcers; the authors attributed this to possible “incomplete risk adjustment that would omit important risk factors” or increased monitoring, which would result in greater detection.

Recent studies have compared the cost increases from increased staffing with the cost savings from fewer complications. McCue and colleagues studied the costs of added staffing and its effect on profits, finding that although increasing the number of full-time RNs significantly raised operating expenses, it didn't significantly affect operating profits.⁸⁵ The researchers commented, “These results call into question the idea that a route to greater profitability is through cuts in RN staffing.” Rothberg and colleagues studied the cost-effectiveness (in dollars per life saved) of various patient–nurse ratios; reducing the number of patients per nurse lowered death rates and increased savings, although the cost of saving one life rose in progressively higher increments as the patient–nurse ratio fell.⁴⁰ Improving staffing ratios was found to be a “reasonably priced” and often cheaper intervention than, for example, thrombolytic therapy for acute myocardial infarction. Needleman and colleagues found that increasing the proportion of RNs in the skill mix, without changing nursing HPPD, was the least costly of several staffing improvement strategies and would result in a small average net benefit.⁶

It's also important to consider the link between nurse staffing levels and retention, because nursing turnover is expensive. In 2005 Jones estimated that it would cost between \$62,100 and \$67,100 (in 2002 dollars) to replace an RN.²⁶ According to my estimate of the average nurse salaries in 2002, based on the findings of the 2004 National Sample Study of Registered Nurses,⁸⁶ these figures represent 120% and 130%, respectively, of the 2002 average RN salary.²⁶ Turnover costs include those related to vacancy, reduced productivity, orientation and training, and termination. Others have reached similar conclusions, although the reported estimated costs associated with turnover vary somewhat.^{24, 87}

Literature review. Lang and colleagues determined that although there was no evidence of a positive relationship between a hospital's nurse staffing ratio or skill mix and financial outcomes, there was a statistically significant, inverse relationship between nurse staffing and length of hospitalization.⁴⁷ They didn't review studies that examined how changes to nurse staffing levels affected the incidence of adverse events and therefore costs, nor did they consider studies examining the relationship of nurse staffing levels to turnover rates. Several more studies, completed since that review, have been included here.^{6, 24, 26, 33, 40, 78, 79, 85, 88} Their findings indicate that adequate staffing may save hospitals money, but more research is needed.

RECOMMENDATIONS

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. Indeed, nurses' workloads should be a prime consideration. If a proposed change would improve care and also reduce excessive (or maintain acceptable) workloads, it should be implemented. If not, it shouldn't be.

When efforts at improving patient safety or care quality also increase nursing workload, the results can be other than intended. For example, an emphasis on better monitoring and documentation techniques has resulted in many changes in procedures, creating a new problem for nurses—what one study has called “complexity compression”⁸⁹—leaving nurses more distracted, in greater stress, and with less time for patient care. And certain facility changes, such as remodeling or changes aimed at increasing profits by raising patient volume or reducing lengths of stay, often intensify the nurses' workloads and compromise care unless balanced by changes made to address those issues. For example, if a hospital offers a greater number of private rooms, it might need to hire more nurses and build more nurses' stations to ensure adequate monitoring.

Such improvements may be expensive, but they might be less expensive than other alternatives. Winters and colleagues have argued, for example, that the widespread use of rapid response teams, for which the evidence is equivocal, might be exposing institutions to “financial and reputational risks.”⁹⁰ They said that if other options already well supported by evidence—such as increased nurse staffing—were pursued first, the complications these teams treat might be prevented. A similar argument might be made using the results of the study by Rothberg and colleagues, which found that 1-to-4

and 1-to-5 RN-patient ratios were more cost-effective than thrombolytics in reducing deaths after myocardial infarction.⁴⁰

Every intervention that affects outcomes should be examined, as should how the various outcomes affect one another. Such evaluations will be complicated by the interactions among interventions. It may be necessary to introduce one change at a time in order to isolate its impact on specific outcomes. As more interventions are added, multivariate analysis will be required. Multiinstitutional studies will probably require the use of administrative data sets supplemented by observational or survey data.

One area for future research is determining how technologic changes affect workload. Commercial systems that measure patient acuity or workload may offer a starting point. But these systems use a variety of definitions for and measures of staffing and workload, and most focus on patient contributors, not work-environment contributors; thus research results using their data may be inconsistent and inconclusive. Nursing needs an evidence-based, standardized measure of workload in which the effects of all known contributing factors are assessed. ▼

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