



# RESEARCH IN ACTION



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## Hospital Nurse Staffing and Quality of Care

Hospitals with low nurse staffing levels tend to have higher rates of poor patient outcomes such as pneumonia, shock, cardiac arrest, and urinary tract infections, according to research funded by the Agency for Healthcare Research and Quality (AHRQ) and others. Yet increasing staffing levels is not an easy task. Major factors contributing to lower staffing levels include the needs of today's higher acuity patients for more care and a nationwide gap between the number of available positions and the number of registered nurses (RNs) qualified and willing to fill them. This is evident from an average vacancy rate of 13 percent.

This report summarizes the findings of AHRQ-funded and other research on the relationship of nurse staffing levels to adverse patient outcomes. This valuable information can be used by decisionmakers to make more informed choices in terms of adjusting nurse staffing levels and increasing nurse recruitment while optimizing quality of care and improving nurse satisfaction.

### Background

Periods of high vacancy rates for RNs in hospitals have come and gone, but the current shortage is different. According to a 2002 report by the workforce commission of the American Hospital Association, the nursing shortage "reflects fundamental changes in population demographics, career expectations, work attitudes and worker dissatisfaction."<sup>1</sup> In fact, the present situation may well

continue over the next two decades. A Federal Government study predicts that hospital nursing vacancies will reach 800,000, or 29 percent, by 2020.<sup>2</sup> The number of nurses is expected to grow by only 6 percent by 2020, while demand for nursing care is expected to grow by 40 percent.

The most recent research shows a jump of 100,000 RNs, or 9 percent, in the hospital RN workforce between 2001 and 2002 because of increased demand, higher pay, and a weakening economy. However, since almost all of the

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Author: Mark W. Stanton, M.A.

Managing Editor: Margaret Rutherford

Design and Production: Frances Eisel

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increase came from RNs over age 50 who returned to the workforce and a greater influx of foreign-born RNs, this does not alter the structural features in the long term: the aging of the nurse population and the increasing unwillingness of young women to consider nursing as a profession.<sup>3</sup>

Today's difficulties are further complicated by other changes in hospital care, such as new medical technologies and a declining average length of stay, that have led to increases in the amount of care required by patients while they are in the hospital. New medical technologies allow many less seriously ill patients who previously would have received inpatient surgical care to receive care in outpatient settings. Also, patients who in the past would have continued the early stages of their recovery in the hospital, today are discharged to skilled nursing facilities or to home. During the period 1980-2000, the average length of an inpatient hospital stay fell from 7.5 days to 4.9 days.<sup>4</sup> An important consequence of these changes is that hospitals have a higher overall concentration of sick people who need more care.

Various groups, including the American Hospital Association, the Joint Commission on the Accreditation of Healthcare Organizations, and the Institute of Medicine (IOM), have expressed their concerns about the evolving nursing crisis. The IOM issued a report in 1996 that recognized the importance of determining the appropriate nurse-patient ratios and distribution of skills for ensuring that patients receive quality health care.<sup>5</sup> Its report highlighted the fact that research on the relationship between

the level of staffing by nurses in hospitals and patients' outcomes has been inconclusive. The IOM's analysis of staffing and quality of care in hospitals concluded by calling for "a systematic effort ... at the national level to collect and analyze current and relevant data and develop a research and evaluation agenda so that informed policy development, implementation and evaluation are undertaken in a timely manner." To begin to meet that need, AHRQ-funded research and other research have pursued a number of different paths.

## Hospital nurse staffing and nursing-sensitive outcomes

Hospital nurse staffing is a matter of major concern because of the effects it can have on patient safety and quality of care. Nursing-sensitive outcomes are one indicator of quality of care and may be defined as "variable patient or family caregiver state, condition, or perception responsive to nursing intervention."<sup>6</sup> Some adverse patient outcomes potentially sensitive to nursing care are urinary tract infections (UTIs), pneumonia, shock, upper gastrointestinal bleeding, longer hospital stays, failure to rescue, and 30-day mortality.<sup>a</sup> Most research has focused on adverse rather than positive patient outcomes for the simple reason that adverse outcomes are much more likely to be documented in the medical record.

<sup>a</sup> "Failure to rescue" is defined as the death of a patient with a life-threatening complication for which early identification by nurses and medical and nursing interventions can influence the risk of death.

### The nurse workforce and nurse staffing levels

The **nurse workforce** consists of licensed nurses—registered nurses (RNs) and licensed practical nurses (LPNs)—and nurses' aides (NAs). Both RNs and LPNs are licensed by the State in which they are employed. RNs assess patient needs, develop patient care plans, and administer medications and treatments; LPNs carry out specified nursing duties under the direction of RNs. Nurses' aides typically carry out nonspecialized duties and personal care activities. RNs, LPNs, and nurses' aides all provide direct patient care.

RNs have obtained their education through three different routes: 3-year diploma programs, 2-year associate degree programs, and 4-year baccalaureate degree programs. Almost a third of all RNs have a baccalaureate degree, and 7.6 percent of hospital nurses have advanced practice credentials (either a master's or doctoral degree). LPNs receive 12-18-month training programs that emphasize technical nursing tasks. Nurses' aides are not licensed but many acquire certified nurse aide or nursing assistant (CNA) status after proving they have certain skills related to the requirements of particular positions.

**Nurse staffing** is measured in one of two basic ways:

- Nursing hours per patient per day.
- The nurse to patient ratio.

"Nursing hours" may refer to RNs only; to RNs and LPNs; or to RNs, LPNs, and nurses' aides.

A broad array of research on this topic has found an association between lower nurse staffing levels and higher rates of some adverse patient outcomes. A new evidence report entitled *The Effect of Health Care Working Conditions on Patient Safety*, produced by an AHRQ-funded Evidence-based Practice Center (EPC), reviewed 26 studies on the relationship between nurse staffing levels and measures of patient safety.<sup>b</sup> Most of the studies examined nurse staffing levels and adverse occurrences in the hospital setting, including in-hospital deaths and nonfatal adverse outcomes such as nosocomial infections, pressure ulcers, or falls. The EPC's researchers found that lower nurse-to-patient ratios were associated with higher rates of nonfatal adverse outcomes.<sup>7</sup> This was true at both the hospital level and the nursing unit level. With regard to in-hospital deaths, however, the evidence does not consistently show that lower nurse staffing levels are associated with higher mortality.

### Lower staffing levels are linked to higher adverse outcome rates

The EPC report included five studies funded by AHRQ that examined the relationship between adverse patient outcomes and hospital nurse staffing. All five studies found at least some association between lower nurse staffing levels and one or more types of adverse patient outcomes.

How often do such adverse “nursing-sensitive” patient outcomes occur in hospital care? Different studies report varying adverse event rates, which vary by the type of patient (medical or surgical) as well as other factors. For example, UTIs occur in from 1.9 percent to 6.3 percent of surgical patients and pneumonia in 1.2 percent to 2.6 percent of surgical patients.<sup>8-10</sup>

<sup>b</sup> In order to improve the quality and delivery of health care services, AHRQ has sponsored a series of evidence reports that are based on rigorous, comprehensive reviews of relevant scientific literature. These reports are developed and written by outside research and academic organizations designated as Evidence-based Practice Centers (EPCs). The reports' emphasis is on explicit and detailed documentation of methods, rationale, and assumptions. The goal of these reports is to provide the scientific foundation that public and private organizations can use to develop their own clinical practice guidelines, quality measures, review criteria, and other tools to improve the quality and delivery of health care services

<sup>c</sup> This study measured RN staffing as hours per day and as the RN proportion of nursing hours. Hospitals with higher hours of RN staffing (75th percentile) had an average of 9.1 hours of inpatient RN nursing per patient day, while those with lower RN staffing (25th percentile) had an average 6.4 hours of inpatient RN nursing per patient day. Hospitals with a higher proportion of RN staffing (75th percentile) had an average of 75 percent of inpatient nursing hours provided by RNs, while those with lower RN staffing (25th percentile) had an average of 62 percent of nursing hours provided by RNs.

The largest of these studies on nurse staffing (jointly funded by AHRQ, the Health Resources and Services Administration, the Centers for Medicare & Medicaid Services, and the National Institute of Nursing Research) examined the records of 5 million medical patients and 1.1 million surgical patients who had been treated at 799 hospitals during 1993.<sup>6,8</sup> Among the study's principal findings:

- In hospitals with high RN staffing, medical patients had lower rates of five adverse patient outcomes (UTIs, pneumonia, shock, upper gastrointestinal bleeding, and longer hospital stay) than patients in hospitals with low RN staffing.<sup>c</sup>
- Major surgery patients in hospitals with high RN staffing had lower rates of two patient outcomes (UTIs and failure to rescue).
- Higher rates of RN staffing were associated with a 3- to 12-percent reduction in adverse outcomes, depending on the outcome.
- Higher staffing at all levels of nursing was associated with a 2- to 25-percent reduction in adverse outcomes, depending on the outcome.

Table 1 illustrates some of the major findings. For example, the researchers found that medical patients in hospitals with high RN staffing were 4-12 percent less likely to develop UTIs than medical patients in the comparison group.

**Table 1. Percent reduction in rates of outcomes among medical patients in hospitals with high nurse staffing (75th percentile) compared to the rates in hospitals with low nurse staffing (25th percentile)**

Outcome in medical patients	Amount by which rates are lower for:	
	High RN staffing	High staffing, all levels (RNs, LPNs, aides)
Urinary tract infection	4-12%	4-25%
Upper gastrointestinal bleeding	5-7%	3-17%
Hospital-acquired pneumonia	6-8%	6-17%
Shock or cardiac arrest	6-10%	7-13%

**Note:** Difference is expressed as a range of values (e.g., 4-12 percent) because several statistical models were used in evaluating the relationship between nurse staffing levels and each adverse event.

**Source:** Needleman J, Buerhaus P, Mattke S, et al. Nurse-staffing levels and patient outcomes in hospitals. Final report for Health Resources and Services Administration. Contract No. 230-99-0021. 2001. Harvard School of Public Health, Boston, MA.



Medical patients in hospitals with high levels of total nurse staffing (RNs, LPNs, and aides) were 4-25 percent less likely to develop UTIs than patients in the comparison group.

A similar analysis was performed for the smaller group of surgical patients (Table 2). Surgical patients in hospitals with high RN staffing had a 5-6 percent lower rate of UTIs and a 4-6 percent lower rate of failure to rescue than surgical patients in the comparison group.<sup>d</sup>

**Table 2. Percent reduction in rates of outcomes among surgical patients in hospitals with high nurse staffing (75th percentile) compared to the rates in hospitals with low nurse staffing (25th percentile)**

Outcome in surgical patients	Amount by which rates are lower for:	
	High RN staffing	High staffing, all levels (RNs, LPNs, aides)
Urinary tract infection	5-6%	3-14%
Failure to rescue	4-6%	2-12%
Hospital-acquired pneumonia	11%	19%

**Note:** Difference is expressed as a range of values (e.g., 2-12 percent) because several statistical models were used in evaluating the relationship between nurse staffing levels and each adverse event.

**Source:** Needleman J, Buerhaus P, Matke S, et al. Nurse-staffing levels and patient outcomes in hospitals. Final report for Health Resources and Services Administration. Contract No. 230-99-0021. 2001. Harvard School of Public Health, Boston, MA.

A second study, funded jointly by AHRQ and the National Science Foundation, examined licensed nurse staffing (RNs and LPNs) and adverse outcomes among both medical and surgical patients in Pennsylvania acute-care hospitals.<sup>11</sup> It found a lower incidence of nearly all adverse outcomes it studied in hospitals with more licensed nurses. For example, a 10-percent increase in the number of licensed nurses is estimated to decrease lung collapse by 1.5 percent, pressure ulcers by 2 percent, falls by 3 percent, and UTIs by less than 1 percent. Also, with a 10-percent higher proportion of licensed nurses, there was a 2-percent lower incidence of pressure ulcers.<sup>e,11</sup>

## Pneumonia rates are especially sensitive to staffing levels

Three AHRQ-funded studies found a significant correlation between lower nurse staffing levels and higher rates of pneumonia.

- The first study found that adding half an hour of RN staffing per patient day could reduce pneumonia in surgical patients by over 4 percent.<sup>12</sup> This study covered 589 hospitals in 10 States during 1993.
- A second study by the same researchers also found that fewer RN hours per patient day were significantly correlated with a higher incidence of pneumonia.<sup>13</sup> The study examined administrative data on post-surgical patients in 11 States during 1990-96.
- A study of nurse staffing levels and adverse outcomes in California found that an increase of 1 hour worked by RNs per patient day was associated with an 8.9-percent decrease in the odds of a surgical patient's contracting pneumonia.<sup>8</sup>
- This study also found that a 10-percent increase in RN proportion was associated with a 9.5-percent decrease in the odds of pneumonia.

The researchers in the California study believe that the strong relationship between RN staffing and pneumonia can be attributed to the heavy responsibility RNs have for respiratory care in surgical patients. This study examined the effects of nurse staffing on adverse outcomes in 232 acute care hospitals from 1996 to 1999.<sup>f</sup> Unlike many earlier studies, the California study included only adverse outcomes that were not present at admission.<sup>7</sup>

<sup>d</sup> Surgical patients overall had lower rates of adverse outcomes than medical patients, perhaps because they are healthier. Also, the smaller number of surgical patients in the study may have made it more difficult to detect associations.

<sup>e</sup> Nurse staffing was measured in two ways: (1) the ratio of licensed nurses (RNs + LPNs) to the patient load (with and without adjustments for patient acuity) and (2) the proportion of licensed nurses to the total nursing staff (RNs, LPNs, NAs). The adverse outcomes selected for study were "either caused by or not prevented by medical management" based on criteria used by the Harvard Medical Practice Study.

<sup>f</sup> Nurse staffing was measured in three ways: all hours (the total number of productive hours worked by all nursing personnel per patient day), RN hours (the total number of productive hours worked by registered nurses per patient day), and RN proportion (RN hours divided by all hours).

## Mortality may be associated with staffing levels

Although studies overall are not consistent in demonstrating that higher nursing workload is associated with higher patient mortality, two recent AHRQ-funded studies have found that 30-day mortality and an increase in the likelihood of failure to rescue are higher when nurse staffing levels are lower.

- The first study found that each additional surgical patient per nurse was associated with a 7-percent higher likelihood of dying within 30 days of admission and a 7-percent higher likelihood of failure to rescue. In the 168 hospitals with a mean patient-to-nurse ratio ranging from 4:1 to 8:1, 4,535 of 232,342 patients died within 30 days of being admitted. If the patient-nurse ratio had been as low as 4:1 in the 168 hospitals, then possibly only 4,000 patients might have died, and had the ratio been as high as 8:1, more than 5,000 might have died.<sup>14</sup>
- A second study found that 30-day mortality rates among AIDS patients were lower where there was both a higher nurse-patient ratio and an AIDS specialty physician service. For example, the study found that an increase of 0.25 nurse per patient day would produce a 20-percent decrease in 30-day mortality.<sup>15</sup>

Nurse staffing may be measured by educational level as well as by the number and proportion of RNs in the nursing staff. A third AHRQ-funded study found that a 10-percent increase in the proportion of nurses holding a bachelor's degree was associated with a 5-percent decrease in both the likelihood of surgical patients dying within 30 days of admission and the odds of failure to rescue.<sup>16</sup>

## Nurse workload and job dissatisfaction

The studies discussed above have documented the connection between lower levels of nurse staffing and higher rates of adverse events. Complementing those studies are a number of other studies addressing the growing nurse workload and rising rates of burnout and job dissatisfaction. One study, jointly funded by AHRQ and the National Science Foundation, examined the relationship between nurse staffing and hospital patient acuity (the average severity of illness of the inpatient population) in Pennsylvania hospitals.<sup>11</sup> Acuity determines how much care a patient needs: the higher the acuity, the more care is required. This study found:

- A 21-percent increase in hospital patient acuity between 1991 and 1996.

- No net change in the number of employed licensed nurses.
- A total decrease of 14.2 percent in the ratio of licensed nursing staff to acuity-adjusted patient days of care because of the increase in patient acuity.<sup>g</sup>

In addition, the skill mix of the nursing staff shifted as hospitals increased the number of nurses' aides. As a result, RNs acquired more supervisory responsibilities that took them away from the bedside at a time when their patients needed more bedside nursing care.<sup>h</sup>

Concerns arising from increased patient acuity and the assumption of additional supervisory responsibilities appear to be directly related to job dissatisfaction expressed by nurses in various opinion surveys. For example, a 1999 AHRQ-funded study surveyed 13,471 nurses in Pennsylvania. Among the principal findings:

- Among those surveyed, 40 percent were dissatisfied with their jobs. This is much higher than the 10-15 percent levels of dissatisfaction registered by other professionals and by workers in general in the United States.
- Only 35.7 percent of the nurses surveyed described the quality of care on their unit as excellent.
- A large proportion of nurses, 44.8 percent, said that there had been deterioration in the quality of care in their hospital during the past year.
- Of the nurses surveyed, 83 percent reported that there had been an increase in the number of patients assigned to them during the previous year.
- Only 34.4 percent of nurses believed that there are enough RNs to provide high-quality care.

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<sup>g</sup> "Patient days of care" are equal to the total yearly number of patients in the hospital multiplied by the number of days they spent in the hospital. "Adjusted" patient days of care take into account the outpatient care provided by the hospital because staffing data do not distinguish between in- and outpatient staff. Acuity-adjusted patient days of care, in addition to accounting for outpatient care, adjust for each patient's illness by assigning it a MediQual severity score. This score indicates the presence or absence of a major or minor morbidity as measured by MedisGroups-defined methodology.

<sup>h</sup> An AHRQ-funded study of 570 hospitals in 13 States found a slight increase in the RN hours per adjusted patient day, from 5.84 in 1990 to 6.56 in 1996. However, the researchers were uncertain about the significance of this change since limitations in the database did not allow them to differentiate between direct-care RNs and RNs working in indirect or administrative capacities. Also, the study did not measure changes in hospital acuity.

- Only 33.4 percent believed that there are enough staff to get the work done.

In addition to increased patient acuity, nurse perceptions of inadequate staffing levels are probably related to their being expected to perform non-nursing tasks such as delivering and retrieving food trays; housekeeping duties; transporting patients; and ordering, coordinating, or performing ancillary services.<sup>17,18</sup>

## Cost impacts of adverse events

While inadequate staffing levels place heavy burdens on the nursing staff and adverse events are painful for patients, there is also a considerable financial cost to be considered. An AHRQ-funded study found that all adverse events studied (pneumonia, pressure ulcer, UTI, wound infection, patient fall/injury, sepsis, and adverse drug event) were associated with increased costs. For example, the cost of care for patients who developed pneumonia while in the hospital rose by 84 percent. Treating pneumonia raised total treatment costs by \$22,390-\$28,505, while the length of stay increased 5.1-5.4 days and the probability of death rose 4.67-5.5 percent.<sup>8</sup> Pressure ulcers, another category of adverse patient event sensitive to nursing care, are estimated to cost \$8.5 billion per year.<sup>19</sup>

## Strategies for improvement

Many stakeholders within the health care system, especially Federal and State governments, hospitals and hospital organizations, nurse associations, foundations, and accreditation organizations, are aware of the lack of qualified nursing staff and related problems and are actively seeking solutions. On the Federal level, in 2002, Congress passed the Nurse Reinvestment Act, which has put into effect various measures to improve the recruitment and retention of nurses. The Act establishes a National Nurse Service Corps to give scholarships and loans to nursing students if they are willing to serve in hospitals with critical shortages of nurses for a 2-year period. It also sets up a loan forgiveness program for nurses receiving advanced degrees who will teach at nursing schools. In addition, it offers nurses continuing education, geriatric training, and “career ladder” programs for job advancement, as well as internship and mentor programs.

### AHRQ-Funded Research on Nurse Staffing and Quality of Care

**Nurse Staffing and Quality of Care.** Grant No. HS09958. Harvard University. (Cofunded by Health Resources and Services Administration, Centers for Medicare & Medicaid Services, National Institute of Nursing Research). This project examined the relationship between the amount of care provided by hospital nurses and patient outcomes.

**Nurse Staffing and Quality of Hospital Patient Care.** Grant No. HS09991. University of Central Florida. This project examined changes in licensed nurse staffing in Pennsylvania hospitals from 1991 to 1997 and assessed the relationship of licensed nurse staff to patient adverse events.

**Outcomes of Hospital Dedicated AIDS Units.** Grant No. HS08603. University of Pennsylvania. This project compared differences in AIDS patients’ 30-day mortality and satisfaction with care in dedicated AIDS units, magnet hospitals, and scattered-bed units in hospitals with and without dedicated AIDS units.

State governments have also gotten involved. For example, the State of California has legislated minimum nurse staffing ratios and a number of other States are considering similar legislation. However, one analysis suggests that such measures may generate opportunity costs that are not easily measured and that may outweigh their benefits.<sup>i,20</sup> For example, hospitals may cut spending for other personnel, such as unlicensed caregivers, housekeepers, and other support staff. The amount of non-nursing work performed by RNs in inpatient units could increase, and investments in medical technology and facilities to improve the quality of care could be deferred.

Hospitals that increase their nurse staffing ratios either across all units or within individual units have reason to be concerned about the impact of such steps on their finances. However, a new study finds that increased staffing of RNs does not significantly decrease a hospital’s profit, even though it boosts the hospital’s operating costs. A 1-percent increase in RN full-time equivalents increased operating expenses by about 0.25 percent but resulted in no statistically significant effect on profit margins. In

<sup>i</sup> Opportunity cost includes not only the money spent in buying something, but also the economic benefits forgone because that particular thing was bought and thus something else can no longer be bought.



contrast, higher levels of non-nurse staffing caused higher operating expenses as well as lower profits.<sup>21</sup>

The National Quality Forum, a private, not-for-profit group of public and private health care organizations created to develop and implement a national strategy for health care quality measurement and reporting, has been actively developing national voluntary consensus standards for nursing-sensitive performance measurement. Such measures can help to evaluate the extent to which the lack of qualified nursing staff is affecting the quality of health care. They can also help to identify opportunities to improve nursing performance.<sup>22</sup>

In a recent report on strategies to address the evolving nursing crisis, the Joint Commission on the Accreditation of Healthcare Organizations proposed bolstering the nursing educational infrastructure through team training in nursing education, enhancing support of nursing orientation, in-service and continuing education in hospitals, and creating nursing career ladders based on educational level and experience. It also supports adopting the characteristics of “magnet hospitals,” such as setting staffing levels based on nurse competency and skill mix relative to patient mix and acuity.<sup>1</sup> In addition, it proposes establishing financial incentives for health care organizations to invest in nursing services.<sup>23</sup>

In its latest report on patient safety, issued in draft form in November 2003, the Institute of Medicine identified workforce deployment patterns in the typical work environment of nurses as contributing to many serious threats to patient safety. Among various measures it called for was the involvement of the direct-care nursing staff in determining and evaluating the approaches used to determine appropriate unit staffing levels for each shift.<sup>24</sup>

## The patient safety initiative and hospital nurse staffing

Hospital nurse staffing has an important relationship to patient safety and quality of care. Under a broad initiative focusing on patient safety issues, AHRQ has funded a group of projects on understanding the impact of working

<sup>j</sup> Magnet hospitals must meet stringent quantitative and qualitative standards that define the highest quality of nursing practice and patient care.

<sup>k</sup> For more information about this program, see <http://www.ahrq.gov/qual/newgrants/working.htm>.

conditions on patient safety.<sup>k</sup> Seven projects (\$2.5 million) related to hospital nurse staffing are included in this category. Researchers are examining the critical issues of how staffing, fatigue, stress, sleep deprivation, organizational culture, shift work, and other factors can lead to errors. These issues—which have been studied extensively in aviation, manufacturing, and other industries—have not been closely studied in health care settings.

Thus far, under this initiative, three studies have been completed. One study examined the effects of nurse staffing on adverse outcomes, morbidity, mortality, and medical costs.<sup>8</sup> A second study developed an evidence report with an objective of identifying and summarizing evidence from the scientific literature on the effects of health care working conditions on patient safety. In addition to workforce staffing, it discussed workflow design, personal and social working conditions, the physical environment, and organizational factors.<sup>7</sup> A third study of the work environment for nurses and patient safety identified key aspects of the work environment for nurses—including extended hours and workload—that likely have an impact on patient safety, and identified potential improvements in health care working conditions that could result in enhanced patient safety.<sup>24</sup>

Other ongoing studies include:

- An examination of the impact of unit-level nurse workload on patient safety. This project is assessing the relationship between medical errors and daily changes in the working conditions in hospitals—including nurse staffing ratios, workload, and skill mix. Results are expected in early 2004.
- A study of hospital nurses’ working conditions and patient outcomes. This project is examining the relationship between the occurrence of adverse patient outcomes and nursing care delivery models, job strain, risk of injury, and hospitals’ use of overtime and contract nurses.
- A study of the impact of nurses’ working conditions on medication safety. The aim of this study is to describe how nurses’ working conditions, workload (e.g., shift length and patient assignment), actions taken (e.g., adherence to standards and actions that prevent adverse drug effects), and organizational variables affecting nurses are related to the safety and quality of the care they provide. The working conditions under study include physical environment, safety climate, automation, and staffing levels.

- A study of the relation of hospital workload to patient safety. This study is examining the association between hospital activity/workload and rates of adverse drug events to assess whether the workload should be limited or the processes during times of high workload pressure should be reengineered to improve patient safety. Investigators are also developing new methods for identifying adverse events using electronic medical records.

## Conclusion

The largest of the studies discussed here found significant associations between lower levels of nurse staffing and higher rates of pneumonia, upper gastrointestinal bleeding, shock/cardiac arrest, urinary tract infections, and failure to rescue.<sup>6,7</sup> Other studies found associations between lower staffing levels and pneumonia, lung collapse, falls, pressure ulcers, thrombosis after major surgery, pulmonary compromise after surgery, longer hospital stays, and 30-day mortality. However, researchers stress that, at present, such “nursing-sensitive” adverse outcomes should be viewed more as indicators or sentinel outcomes than as measures of the full impact of nurse staffing on patient outcomes.

Research findings indicating what minimal nurse staffing ratios should be either within the hospital or within its various subunits are not available. Researchers believe that more accurate and consistent measures of acuity and quality and more complete data on staffing for all types of nursing personnel are needed to explain the complex relationship between nurse staffing and the quality of care.<sup>13</sup> The findings thus far can have a positive impact if used to educate and inform interested parties on how quality of care is changing and how it is linked to the contributions of nurses.

Some hospitals may choose to increase nurse staffing levels. According to the authors of one study: “The implications of doing nothing to improve nurse staffing in low staffed hospitals are that a large number of patients will suffer avoidable adverse outcomes and patients will continue to incur higher costs than are necessary.”<sup>19</sup> Finally, policymakers may want to monitor developments in nurse staffing issues closely in order to determine if additional legislative changes are needed to increase nursing supply and reduce adverse patient outcomes.

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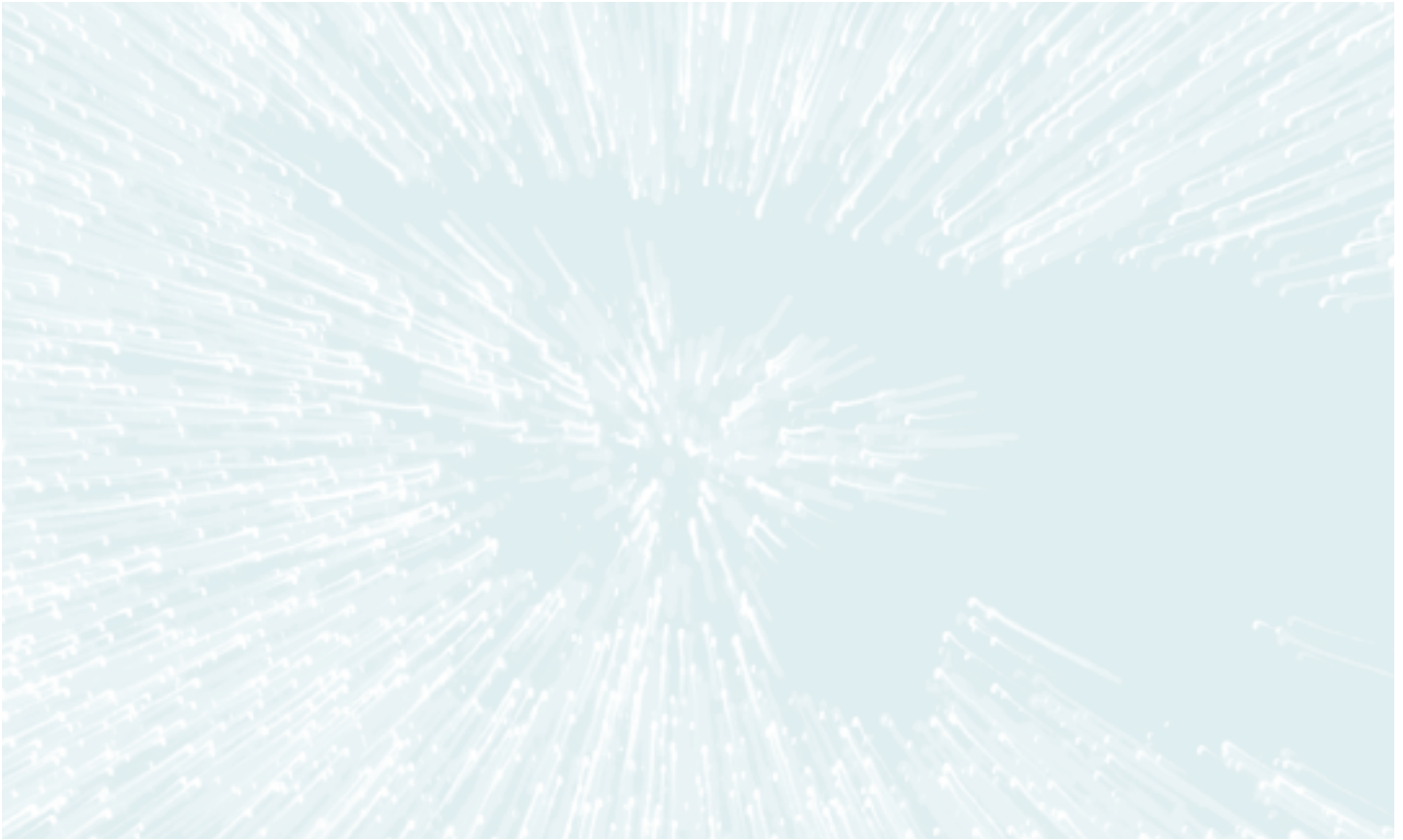
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