

Improving Quality through Nursing



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*B*oth the public and physicians rank nurse understaffing of hospitals as one of the most serious threats to patient safety (Blendon et al. 2002). Two-thirds of hospital bedside nurses concur that there are not enough nurses in their hospitals to provide high-quality care, and close to half score in the high-burnout range on standardized tests. Almost one in four intends to leave his or her job in the hospital within a year (Aiken et al. 2001). Federal estimates suggest that the shortfall of nurses could approach 275,000 by 2010 and 800,000 by 2020 (U.S. DHHS 2002). Until very recently, policymakers and health care leaders have not associated hospital nurse understaffing and burnout with medical errors and adverse patient outcomes, as evidenced by the few references to nursing in the Institute of Medicine's first two major quality reports (Institute of Medicine 2000, 2001). This chapter explicates the link between nursing and quality and discusses the implications for the nation's quality improvement agenda.

The Role of Nurses in Promoting Quality of Care

Nursing is the care of the sick (and those who may become sick) and the maintenance of the environment in which care occurs (Diers 2004). Nurses are responsible for fulfilling those aspects of the medical regimen delegated to them by physicians, such as administering medication, but they are legally and professionally responsible for their own actions when fulfilling delegated tasks. In the case of administering medications, nurses are responsible for ascertaining that the dose is correct for the age of the patient and that the route of administration is proper. Nurses have a professional and legal scope of practice that is complementary to that of physicians and includes assessing and intervening within their areas of expertise, such as skin and wound care, managing pain and providing comfort, and teaching patients and their families how to manage their care after hospital discharge, among myriad other responsibilities. Nurses are also responsible for maintaining a safe and patient-centered care environment. Thus, nurses routinely step in when non-nursing support services are not available or are inadequate to maintain a clean environment. They ensure that patients receive adequate nourishment, enforce infection control practices, and prevent hazards such as

improper disposal of needles and sharps that could transmit blood-borne pathogens to unsuspecting staff and visitors.

Two of nurses' most important functions associated with patient safety, quality of care, and patient outcomes are providing surveillance for early detection of adverse events, complications, and medical errors and mobilizing institutional resources for timely intervention and rescue. A number of factors influence the effectiveness of nurse surveillance, including patient-to-registered-nurse ratios, the education of registered nurses at the bedside, and the numbers of licensed practical nurses and aides relative to registered nurses (often referred to as the skill mix of nursing personnel). Once a nurse detects potentially hazardous clinical signs, the work environment and institutional culture can promote or impede timely and successful resolution of the problem.

Nurses' relationships with physicians are particularly important in ensuring that patients receive the help they need. Since U.S. physicians typically combine office-based medical practice with caring for hospitalized patients, nurses are often physicians' eyes and ears at the hospital bedside. This arrangement works best in organizations that employ enough well-qualified staff, where nurses and physicians have a high degree of mutual respect and trust, and where top administrators facilitate patient-centered services throughout the institution (Aiken, Clarke, and Sloane 2002). Increasingly, nurses, particularly nurse practitioners, have assumed the same important roles in primary care and ambulatory settings.

Patients have high regard for nurses. For many years Gallop polls have reported that nurses top the list of occupations that the public most trusts and respects; indeed, nurses rank considerably higher than physicians, pharmacists, health care executives, and all others who work in health care. Nurses interact with the public in a variety of roles across the life span from birth to death, providing support in labor, consultations on breastfeeding and infant care, well-child care in medical offices and schools, occupational health in the workplace, care for the chronically ill and elderly, and care for the dying and support for their families. Patients and families often seek out nurses to translate information imparted by physicians, perhaps because there is less social distance between nurses and their patients than between doctors and patients. Nurses have been the key advocates for some of the innovations that have made modern health care more humane and patient-centered, such as demedicalizing normal births, liberalizing visiting hours and family participation in hospital care, and providing alternatives to invasive medical interventions at the end of life, such as hospice care. The high regard in which the public holds nurses is a source of personal gratification for them and the basis, along with their close interface with physicians, for their influence and authority in health care.

The Adequacy of Nurse Staffing

The adequacy of nurse staffing in hospitals and other health care settings is a matter of considerable debate, largely because of concerns about costs. Registered nurses constitute the largest group of health professionals in hospitals and

account for a significant share of their operating expenses. Using a conservative total compensation estimate of \$60,000 a year for a registered nurse, hospitals that add 50 nurses a year would have to pay out a total of \$3 million. At present the nation's hospitals employ some 1.2 million nurses. It is generally easier for hospitals to base nurse staffing levels on budgetary resources than to use objective case-mix standards which would require additional financial resources.

An underappreciated aspect of the debate over the adequacy of nurse staffing concerns the impact of understaffing on annual nurse turnover rates, which are estimated to average about 13 percent nationally and over 20 percent at some hospitals. Aiken and associates examined the hypothesis that a minimum level of staffing is required to retain nurses and minimize turnover (Aiken et al. 2002). They found that each patient added to the workload of a hospital bedside nurse was associated with a 23 percent increase in burnout and a 15 percent rise in job dissatisfaction—both precursors to voluntary job resignation. Forty percent of nurses who were dissatisfied and burnt out intended to leave their jobs, compared with only 10 percent who were satisfied and not burnt out.

Assessing Nurse Staffing Adequacy

Two different perspectives dominate perceptions of hospital nurse shortages. One focuses on vacant budgeted positions and the influence of vacancies on costs and revenues. The other—often held by clinical nurses and physicians—evaluates the extent to which existing staff can provide needed services, taking into account the illness burden and intensity of care their patients require. Measuring shortages by vacancy rates has led to the widely held belief that nurse shortages are cyclical and self-correcting in response to changing market conditions (Aiken and Mullinix 1987; Buerhaus et al. 2002). The expectation that nurse shortages will not last long has tempered efforts to address nurses' dissatisfaction and claims that inadequate investment in nursing is undermining quality of care. However, the factors associated with predictions of greater national need for nurses are not cyclical. They include population aging, prevalence of chronic illness, rising per capita use of health services, and greater use of nurse-intensive technologies. These factors have prompted federal workforce planners to forecast a growing gap between nurse supply and demand (U.S. DHHS 2002).

Hospitals have experienced substantial increases in the intensity of services and case-mix complexity and shorter lengths of stay since the advent of prospective payment in 1980. This new payment system reimbursed hospitals based on patient diagnosis rather than length of stay. Since hospitals received the same amount regardless of whether patients with hip replacements remained in the hospital for three days or two weeks, prospective payment drove many hospitals to shorten patient stays. As large numbers of patients were discharged before they fully recuperated from surgery or illnesses, the condition of patients remaining in hospitals became more serious, requiring more intensive services and care.

Before the 1980s, hospitals commonly admitted preoperative patients several days before surgery for tests and evaluation. Nurses used that preoperative time to develop a trusting relationship, prepare patients and their families for what

to expect following surgery, and assess the patient's usual physical and mental state, to be able to evaluate abnormalities and detect complications postoperatively. Today few patients are admitted to the hospital before the day of their scheduled surgery, and nurses see most patients for the first time when they are leaving the recovery room still groggy from anesthesia. They do not know the extent to which a patient can see, hear, or communicate under normal circumstances, or the patient's normal color, breathing patterns, and blood pressure. Patients may have more than one surgical site, multiple monitors, an artificial respirator, and an intravenous line administering powerful drugs that can result in death if the infusion rate is not correct. On average, nurses care for five to six postoperative patients at a time. Every day about a third of nurses' patients arrive directly from the operating room or have been admitted in an acute medical crisis; a third are in the early stages of recovery or stabilization, with many requirements for nursing time; and a third are being discharged, often with complicated home care requirements.

Hospitals have not added enough new registered nurse positions to offset the substantial rise in case-mix complexity. Between 1981 and 1993, the total percentage change in full-time-equivalent nursing personnel—adjusted for patient days and case-mix complexity—declined by more than 7 percent nationally and by over 20 percent in some states, including Massachusetts, New York, and California (Aiken, Sochalski, and Anderson 1996). Pennsylvania hospitals experienced a 21 percent increase in patient acuity between 1991 and 1996, and no change in the number of employed licensed nurses (RNs and LPNs). The result was a 14 percent decrease in the ratio of licensed nurses to case-mix-adjusted patient days of care (Unruh 2002).

Because increases in case-mix complexity and faster admission/discharge cycles have placed a burden on nurses that hospitals have not adequately recognized, about 85 percent of nurses work longer on a daily basis than their scheduled hours. Recent research has documented a substantial increase in the rate of errors associated with nurses working more than twelve consecutive hours, and close to half of hospital staff nurses commonly work longer than twelve hours (Rogers 2004). Presently no policies govern safe working hours for nurses, in contrast to other occupations in which vigilance is a matter of life and death. Lack of understanding by institutional managers and public policymakers of how shortened stays and greater case-mix complexity have adversely affected the work of nurses and the safety of patients—and failure to add enough nurse positions to ensure high-quality care—lie at the heart of the nurse shortage and perceptions that hospitals are unsafe.

Nurse Staffing and Patient Outcomes

Many research studies have now linked nurse staffing and patient outcomes. One of the first such contemporary studies was the national halothane study, which documented a twelve-fold variation in surgical mortality from this form of anesthesia across the nation. The study found nurse staffing among the significant determinants of mortality (Moses and Mosteller 1968). Public availability of Medicare data for U.S. hospitals also generated a series of studies on the factors underlying

variations in mortality; these studies focused primarily on non-nursing correlates such as for-profit versus nonprofit hospital ownership (Shortell and Hughes 1988; Hartz, Krakauer, and Kuhn 1989; Silber et al. 2000). Each study reported in passing that nurse staffing was significantly related to mortality, but no one took much notice of these collective findings until nurse investigators began designing studies to examine the effects of nurse staffing on patient outcomes.

In 1996 the Institute of Medicine published the results of its study on the adequacy of hospital nurse staffing, acknowledging the evidence from health services research suggesting a link between nurse staffing and patient outcomes, but concluding that insufficient evidence existed for recommending safe staffing levels (Institute of Medicine 1996). The IOM's call for funding more research spawned new studies reinforcing the link between nurse staffing and patient outcomes.

In a study of outcomes following common surgical procedures for over 230,000 patients in 168 hospitals, Aiken and colleagues documented a strong association between staff nurse workloads and surgical mortality and failure to rescue patients who had developed complications (Aiken et al. 2002). Hospital staffing ranged from about 4 to 8 patients per nurse; 50 percent of hospitals had a patient-to-nurse ratio of 5 to 1 or lower. After adjusting for over 130 patient and hospital factors, the results suggested that each additional patient in a nurse's workload raised the odds of mortality by 7 percent. Thus the risk of death and failure to rescue patients with complications was nearly 30 percent higher in hospitals where nurses' average workload was 8 patients than in hospitals where nurses cared for 4 patients. The effect was linear, so reducing nurses' workloads from 8 to 7 patients produced the same 7 percent decline in mortality risk as cutting the workload from 5 patients to 4. (The sample included too few hospitals to reliably estimate the effect beyond 8 patients per nurse.)

There is a growing literature of well-designed studies demonstrating a variety of better patient outcomes associated with more favorable staffing of registered nurses (Kovner and Gergen 1998; Blegen, Goode, and Reed 1998; Cho et al. 2003). For example, Needleman and associates documented a significant relationship between nurse staffing and urinary tract infections, pneumonia, shock, hemorrhage in the upper gastrointestinal tract, and length of stay in medical patients, as well as failure to rescue in surgical patients (2002). Person and associates showed that the odds of dying from first-time acute myocardial infarction were significantly lower in hospitals with more favorable nurse-to-patient ratios (2004). Studies have also linked better nurse staffing to lower rates of medication errors and reduced needle-stick injuries to nurses (Blegen, Goode, and Reed 1998; Clarke, Sloane, and Aiken 2002).

Nursing Skill Mix and Patient Outcomes

Nursing skill mix varies substantially, with some hospitals employing predominantly registered nurses (RNs) and others a mix of RNs, licensed practical nurses (LPNs), and aides. The organization of nurses' work and the deployment of non-RNs have changed over time. In the 1960s division of labor within hospital

nursing commonly occurred in a team structure, where RNs provided assessments, medications, and treatments to all patients while directing LPNs and aides who attended to personal hygiene, ambulation, and other routine patient care. As the number of registered nurses employed by hospitals grew, RNs saw the value of maintaining a closer relationship with patients than team nursing allowed and the opportunity to shed the unwanted responsibility for supervising LPNs and aides. Nurses advocated returning the care of all patients to RNs under a model referred to as primary nursing, and hospital managers supported the transition from team to primary nursing. The result was a substantial decline in the employment of LPNs in hospitals nationally and a skill mix in which RNs represented the majority of nursing personnel.

During the hospital restructuring movement to contain costs in the 1990s, many hospitals once again substituted LPNs and aides for RNs (Brannon 1996; Norrish and Rundall 2001). However, research findings consistently support the conclusion that the most important factor in improving patient outcomes is the number of registered nurses. Aiken and associates found no relationship between patient-to-LPN ratios or patient-to-aide ratios and variation in mortality, but they did find a substantial effect of patient-to-RN ratios on surgical mortality and failure to rescue (Aiken et al. 2002). Jarman and associates found the higher the proportion of the least-trained auxiliary nursing personnel in English hospitals, the higher the mortality (1999). The weight of evidence suggests that lesser-trained nursing personnel are not substitutes for RNs in ensuring quality of care and patient safety.

Nurses' Education and Patient Outcomes

Registered nurses in the United States receive their basic education in one of three types of programs, all of which qualify graduates to take the registered nurse licensing examination. These programs include three-year hospital-sponsored diploma programs, two-year associate degree programs in community colleges, and four-year baccalaureate nursing programs in colleges and universities. Freidson described nursing as an incompletely closed profession because of its inability to establish minimum education requirements for entry (1970).

In 2001 hospital diploma programs—which had educated almost all nurses in the 1960s—graduated just 3 percent of new nurses. Associate degree programs replaced diploma programs, accounting for over 60 percent of new entrants to nursing in 2001, while about 36 percent of new nurses were baccalaureate graduates (National Council of State Boards of Nursing 2001). Close to 45 percent of nurses nationally had a baccalaureate or higher degree in 2000, and almost one in four obtained the degree following basic education in a diploma or associate degree program (Spratley et al. 2001). Many other countries, including Canada, Australia, New Zealand, Ireland, Iceland, and Cuba, have eliminated multiple educational pathways into nursing by establishing the baccalaureate as the entry-level degree for new nurses. The United Kingdom has moved nursing education within higher education but has not yet completed the full transition to a baccalaureate degree.

Research is surprisingly scanty on variations in nurses' education across institutions and health care settings and on the impact of nurses' educational levels on clinical practice and patient outcomes. A few studies have suggested that baccalaureate-prepared nurses are more likely to demonstrate professional behaviors important to patient safety, such as problem solving, performance of complex functions, and effective interdisciplinary communication (Hickam et al. 2003; Blegen, Vaughn, and Goode 2001). Nurse executives in teaching hospitals prefer baccalaureate-prepared nurses and aim to have at least 70 percent of their staff nurses trained at the baccalaureate level, while community hospital nurse executives reportedly prefer that 50 percent of nurses have BSNs (Goode et al. 2001). With only about 43 percent of hospital staff nurses holding a baccalaureate degree, not enough are available to meet these targets.

Aiken and colleagues observed that the proportion of hospital staff nurses holding a baccalaureate degree ranged from none to 77 percent across Pennsylvania hospitals, and they designed a study to find out if variation of that magnitude was associated with differences in patient outcomes (2003). The answer was yes. The researchers found that hospitals with a larger proportion of baccalaureate-prepared nurses had significantly lower surgical mortality rates, after adjusting for patient and hospital characteristics (such as size, teaching status, and technology) as well as patient-to-nurse staffing ratios, nurse experience, and whether the patient's surgeon was board certified. Every 10 percent increase in the proportion of nurses holding a baccalaureate degree was associated with a 5 percent decrease in both the likelihood that patients would die within thirty days of admission and the odds of failure to rescue patients with complications.

Moreover, the effects of nurse staffing and education were found to be additive. The best outcomes occurred in hospitals where nurses took care of four or fewer patients each and 60 percent of staff nurses were educated at the baccalaureate level or higher. The worst outcomes occurred in hospitals where nurses cared for eight or more patients each and only 20 percent had baccalaureate degrees. The effect on mortality of a 20 percent rise in the percentage of baccalaureate-prepared nurses was roughly equivalent to adding enough nurses to reduce the mean workload by two patients. Thus, hospitals might be able to stem the growing need for more nurses per one hundred inpatient days by moving to a more highly educated RN workforce.

Nursing faces special challenges in raising educational requirements commensurate with trends in other health professions because of modern hospitals' dependence on large numbers of nurses. Hospital employers seem to prefer training nurses quickly and inexpensively and inculcating interchangeable skills and modest career expectations. However, this scenario clashes with the aspirations of many people attracted to nursing with hopes of upward mobility and opportunities for personally gratifying careers and reasonably remunerated work. The number of applicants to nursing schools who already have college degrees is growing rapidly, and universities have responded with programs as short as one year for college graduates who wish to earn a BSN.

Nurse Practice Environments

Flood and Scott describe hospitals as having dual bureaucratic and professional structures that represent opposing approaches to managing complex tasks (1987). Conventional bureaucracies subdivide work among many participants and control their activities through externally imposed rules and hierarchies. Organizations with professional structures support the efforts of self-regulating individuals who exercise considerable discretion in carrying out their work (Freidson 1970). Hospital nurses are agents of a bureaucracy but hold professional values and seek peer relationships and professional modes of organizing their work. Etzioni described professional-bureaucratic conflict as a major concern for complex health care organizations such as hospitals, suggesting that “the authority of knowledge and the authority of administrative hierarchy are basically incompatible” (1969, viii). Indeed, research on hospital nurse burnout is consistent with this view, showing that organizational conflict far outweighs the psychological and physical stress associated with caring for ill and dying patients (Aiken and Sloane 1997).

Studies have devoted relatively little attention to the impact of organizational context and culture on patient outcomes, focusing instead on the effects of staffing. One of the first studies of nursing to integrate a sociological perspective with outcomes such as mortality examined the performance of magnet hospitals (Aiken, Smith, and Lake 1994). Such hospitals were originally designated in the early 1980s based on their success in attracting and retaining nurses when other local hospitals were experiencing nurse shortages (McClure and Hinshaw 2002). Compared with other institutions, magnet hospitals had higher nurse satisfaction, and their nurses reported more autonomy, greater control over resources required for high-quality care, and better relations with physicians.

As a first step in exploring the effects of organizational features common to magnet hospitals, Aiken and colleagues matched the 39 original magnet hospitals with 195 control hospitals selected from all non-magnet U.S. hospitals. Using a multivariate matched sampling procedure—propensity scoring—that controlled for twelve hospital characteristics including size, teaching status, technology, and proportion of board-certified physicians, the investigators found that magnet hospitals had a 4.5 percent lower Medicare mortality rate than matched hospitals (Aiken, Smith, and Lake 1994). Nurse staffing alone did not explain this outcome: organizational cultures that devolved greater autonomy and control to nurses and promoted good relations between nurses and physicians were also associated with better patient outcomes.

Aiken and colleagues further explored the relationship between nurse practice environments and patient and nurse outcomes in a subsequent study making use of a natural experiment in the organization of care associated with the AIDS epidemic. A multiple-site study was designed that included forty units in twenty hospitals. Ten of these hospitals had dedicated AIDS units and were matched with comparable hospitals without such units. The study included two magnet hospitals without AIDS units for comparison. The investigators found that risk-adjusted AIDS mortality within thirty days of admission was substantially lower and patient satisfaction was significantly higher in dedicated AIDS units and magnet hos-

pitals than in conventionally organized general medical units (Aiken et al. 1999). More favorable nurse staffing and practice environments were among the important explanations for these better patient and nurse outcomes.

Aiken and colleagues have since studied nurse practice environments in a large representative group of hospitals to determine the extent to which features are associated with nurse retention and patient outcomes. That study—which included over seven hundred hospitals in five countries—found that nurses in hospitals in the United States, Canada, the United Kingdom, Germany, and New Zealand face common challenges regarding nurse understaffing and high levels of burnout and job dissatisfaction. Nurses in all these countries also associate deficiencies in quality of care with inadequate staffing and poor nurse work environments (Aiken et al. 2001; Aiken, Clarke, and Sloane 2002). Germany is the only country with substantially lower nurse burnout, which may reflect its significantly longer average length of stay.

Remarkably, given the many differences in culture and nurses' education across countries, at least some hospitals in every country have organizational features similar to those of U.S. magnet hospitals. Nurse and patient outcomes are better in magnet-like hospitals, which devolve greater autonomy and control to nurses and provide a more supportive environment for professional practice. For example, the frequency of patient falls with injuries, medication errors, and hospital-acquired infections is lower in hospitals across the five countries where nurse staffing is more favorable, the administration supports high-quality nursing, nurses have career development opportunities, and physicians and nurses have good relations.

Nursing and Quality Improvement

There is one area of potential discordance between the research evidence documenting better outcomes when hospitals devolve more authority to nurses and ongoing efforts to protect patients from medical errors. Much of the evolving thinking about how to reduce medical errors suggests developing systems that standardize medical decision-making and minimize professional discretion. Do the aims of patient safety systems conflict with evidence that organizations that devolve more authority and autonomy to nurses have better outcomes?

Nurses have long been responsible for many of the safeguards in hospital care, such as counting sponges and instruments in the operating room to ensure that they are not left inside patients, storing dangerous drugs in locked cabinets, having two nurses check the compatibility of blood before transfusion, and notifying physicians when a medication order seems out of the ordinary before administering it. Nurses have been the *de facto* safety system in hospitals for over a hundred years. Indeed, recent studies confirm that nurses find most of the medication errors that are detected in hospitals. However, nurses understand the vulnerabilities of the people-dependent safety provisions on which hospitals rely. Indeed, a common fear of nurses—and one that contributes to their high levels of burnout—is that with their increasingly heavy workloads they will fail to detect

an error committed by someone else or commit an error themselves that will hurt a patient. Hence, more effective safety systems that minimize the opportunity for human error would improve the work environment and mental health for nurses more than for any other hospital workers.

However, minimizing errors is only one strategy for improving quality of care in hospitals. Good nurse-patient relationships are at the heart of safe and effective hospital care. A myriad of situations still require expert clinical judgment, including recognizing early signs that a patient may not be doing well and mobilizing a timely institutional response, and determining when and under what circumstances a patient can be safely discharged. Moreover, in addition to caring for patients, nurses are responsible for maintaining the environment in which care takes place, which requires authority as well as status within an organization. Nurses must have some control over the resources required for meeting patients' needs, such as safe nurse staffing levels, timely responses from physicians, accessible supplies and equipment, and support departments, such as housekeeping, pharmacy, central supply, and blood bank, that run efficiently and effectively around the clock.

The international hospital outcomes study aimed to show that nurse autonomy was consistent with—rather than antithetical to—effective interdisciplinary team functioning. Researchers documented that hospitals in which nurses had greater autonomy and more control over resources were more, not less, likely to have well-developed and effective interdisciplinary teams (Rafferty, Ball, and Aiken 2001). Research by Aiken and associates suggests that hospitals that promote the full exercise of the professional nurse role and devolve authority to nurses in their areas of expertise also create effective interdisciplinary care cultures, patient-centered environments, and better patient outcomes. Such institutions will probably be at the forefront of establishing new and better systems to reduce human error because their professional culture values clinical excellence informed by evidence-based practice.

Both new systems that reduce human error and an organizational context that enables the best performance from each health professional are essential in ensuring safe and effective care for hospitalized patients. The IOM reports on quality, which initially gave little attention to nursing, have now focused explicitly on the need to transform the nurse work environment to keep patients safe. This suggests a merging of two previously separate areas of concern—nurse shortages and patient safety—into a more unified approach to quality that is likely to yield important new initiatives to ameliorate both problems.

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