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Hospital Nurse Staffing, Education, and Patient Mortality

Editor's Note: A serious shortage of hospital nurses in the U.S., evident in the past decade, is expected to continue and worsen in the next 15 years. Increasingly, the public and the health professions are acknowledging that nurse understaffing represents a serious threat to patient safety in U.S. hospitals. Although anecdotal evidence has linked patient deaths to inadequate nurse staffing, the numbers and kinds of nurses needed for patient safety is unknown. This Issue Brief highlights two studies that clarify the impact of nurse staffing levels on surgical patient outcomes, and examine the effect of nurses' experience and educational level on patient mortality in the 30 days after a surgical admission.

Hospital nurse shortage spawns concerns about nurse workload, education, and experience

Hospital nurses are the surveillance system for early detection of complications and problems in care. As the registered nurse shortage continues, with burdensome nurse workloads, high turnover, and many unfilled hospital positions, concern is growing about the ability of nurses to fill this role effectively. But little consensus exists on how many patients a nurse should care for on each shift. On medical and surgical units, recommended ratios have ranged broadly, from 3 to 10 patients for each nurse.

- In 1999, California became the first state to pass comprehensive legislation mandating patient-to-nurse ratios for its hospitals. As of 2004, this ratio was 1 licensed nurse for every 6 medical and surgical patients, moving to 1 to 5 in 2005. A dozen other states are considering similar legislation.
- Beyond staffing levels, other characteristics are likely to affect nurses' ability to provide quality patient care. For example, registered nurses may have 2, 3, 4, or more years of nurse education. Conventional wisdom suggests that nurses' experience is more important than their educational level, but the independent effects of education, experience and staffing levels are unknown.

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- Registered nurses in the U.S. generally receive their basic education from one of three types of programs: associate degree nursing programs in community colleges, 3-year diploma programs in hospitals, and baccalaureate nursing programs in colleges and universities. In 1950, 92% of new RNs graduated from hospital diploma programs, whereas by 2001, only 3% graduated from hospital diploma programs, 61% graduated from associate degree programs, and 36% graduated from baccalaureate programs. Little is known about the benefits, if any, of the substantial growth in the numbers of nurses with bachelor's degrees.

Studies of Pennsylvania hospitals investigate the effect of hospital nurse staffing and education on patient care

Aiken and colleagues linked information from nurse surveys, hospital administrative sources, and hospital discharge summaries to examine whether hospital nurse staffing and educational level are associated with differences in the outcomes of surgical patients.

- The investigators used data from 168 non-federal general hospitals in Pennsylvania, surveys of 10,184 nurses, and information from 232,342 general, orthopedic, and vascular surgery patients discharged between April 1, 1998 and November 30, 1999.
- Patient outcomes included 30-day mortality rates and failure-to-rescue rates (deaths among patients who experienced complications).
- Studies determined whether nurse staffing (measured as average patient-to-nurse ratio per shift) and nurse educational level (highest credential in nursing) were associated with mortality and failure to rescue, after adjusting for more than 100 risk factors.
- Of the patient studied, 53,813 (23.2%) experienced a major complication not present on admission, and 4,535 (2%) died within 30 days of admission. The death rate among patients with complications was 8.4%.

Higher nurse workloads linked to increased mortality among surgical patients

Among the surgical patients studied, there was a pronounced association between nurse staffing and both overall mortality and mortality after complications.

- Hospital nurse staffing ranged from about 4 to 8 patients per nurse; 50% of hospitals had a patient-to-nurse ratio of 5:1 or lower.
 - After adjusting for many hospital and patient factors, nurse staffing was associated with significant increases in 30-day mortality and failure to rescue. The results suggest that every additional patient in a nurse's workload increased the odds of patient mortality by 7%.
 - The investigators estimate that the risk of death was 14% higher in hospitals where nurses' average workload was 6 patients or more, and 31% higher in hospitals with workloads of 8 patients or more, compared to hospitals where nurses cared for 4 or fewer patients.
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- A direct comparison of staffing hospitals uniformly at 8 vs. 4 patients per nurse yielded estimates of 5 excess deaths per 1000 patients, and 18 excess deaths per 1000 patients with complications.

Nurses' educational level linked to mortality and failure to rescue

Having found an association between nurse staffing and patient outcomes, the investigators analyzed whether other nurse characteristics, such as years of experience or educational level, are associated with mortality rates.

- Across all hospitals, nurses had an average of 14 years of experience and an average workload on their last shift of 5.7 patients. Overall, 39.6% of nurses held a bachelor's degree or higher, but this figure ranged from 0% to 70% across hospitals.
- Nurses' educational level was strongly associated with mortality. The authors estimate that odds of 30-day mortality and failure to rescue would be 19% lower in hospitals where 60% of the nurses had bachelor's or higher degrees than in hospitals where only 20% of nurses did.
- A full analysis of nurse staffing levels, experience, and educational levels showed that staffing and education had independent and additive associations with patient mortality. After controlling for all these factors, nurses' experience was not associated with mortality or failure to rescue.
- These studies suggest a strong association between nurse education and reduced hospital mortality. This finding is consistent with the view that nurse education improves patient outcomes, but it is also consistent with the view that baccalaureate programs attract, rather than create, better nurses.
- The investigators estimate that if these associations are causal, the effect of a 20% increase in the percentage of nurses with bachelor's degrees in the workforce would be roughly equivalent to a reduction in average nurse workload of 2 patients, and that patient outcomes would be substantially better if both workloads were lighter and the workforce were composed of higher percentages of baccalaureate-prepared nurses.

POLICY IMPLICATIONS

These studies document that surgical patients have significantly better outcomes in hospitals with lower patient-to-nurse ratios and with more highly educated nurses at the bedside.

- The results imply that, all else being equal, substantial decreases in mortality rates could result from increasing registered nurse staffing. While the results do not directly indicate how many nurses are needed to care for patients, or the optimal ratio of patients per nurse, they do suggest that the focus on reducing nurse workloads is a credible approach to improving patient care.

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POLICY IMPLICATIONS

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- Substantial barriers exist to increasing the proportion of hospital nurses with bachelor's degrees. Only 43% of all hospital staff nurses nationally in 2000 were prepared at the baccalaureate level or higher. Enrollments in baccalaureate nursing programs declined almost 10% from 1995 to 2000, although the past few years have seen an upturn. One important source of baccalaureate-prepared nurses is the return of diploma- and associate degree-prepared nurses to colleges and universities. Employer investment in further education for nurses should be encouraged to improve nurse retention. Further education may also yield substantial improvements in patient care.
- In the current nurse shortage, public policy discussion has centered on how to increase the supply of registered nurses. The recently enacted Nurse Reinvestment Act provides federal scholarships and loans to increase the number of individuals entering nursing. In addition to this support, greater emphasis should be placed in national nurse workforce planning on policies to alter the educational composition of the future nurse workforce toward a greater proportion with baccalaureate or higher education.

This Issue Brief is based on the following articles: L.H. Aiken, S.P. Clarke, R.B. Cheung, D.M. Sloane, J.H. Silber. Educational Levels of Hospital Nurses and Surgical Patient Mortality. Journal of the American Medical Association, Sept. 24, 2003, vol. 290, pp. 1617-1623; and L.H. Aiken, S.P. Clarke, D.M. Sloane, J. Sochalski, J.H. Silber. Hospital Nurse Staffing and Patient Mortality, Nurse Burnout, and Job Dissatisfaction. Journal of the American Medical Association, Oct. 23/30, 2002, vol. 288, pp. 1987-1993.

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