

Economics of Nursing

Linda H. Aiken

University of Pennsylvania, Philadelphia

Pay-for-performance initiatives have renewed interest in payment reform as a vehicle for improving nurse staffing and working conditions in hospitals because of research linking investments in nursing and better patient outcomes. This article addresses the economics of nursing from a broad perspective that considers how both national policies such as hospital prospective payment and managerial decisions within institutions impact the outcomes of nurses and patients. Cost offsets are considered from the perspective of savings in patient care resources that accrue from investments in nursing. Cost offsets are also considered from the perspective of the interactions among different strategies for investing in nursing including the impact of staffing levels on patient outcomes with varying educational levels of nurses and varying quality of practice environments.

Keywords: *nursing work force issues; payment for nursing services; patient safety*

Beginning with the influential report of the Institute of Medicine (IOM; Kohn, Corrigan, & Donaldson, 2000) that concluded that medical error is among the leading causes of death in the United States, there has been increased interest in the potential for promoting quality and safety of health care through provider payment incentives. A less heralded but nevertheless important earlier IOM report *Nursing Staff in Hospitals and Nursing Homes* was a catalyst for increased research on the outcomes of nurse staffing (Wunderlich, Sloan, & Davis, 1996). Consequently, current provider payment initiatives focusing on performance coincide with a substantially stronger research literature documenting an association between investments in nursing and better patient outcomes (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007).

At least one study has empirically shown that the odds of hospitals' achieving quality targets that would trigger payment premiums under pay for performance (P4P) are increased as registered nurse (RN) hours per patient day increase (Landon et al., 2006). Thus a shift to clinical performance-based provider payment could improve the business case for investments in nursing. However, there is skepticism that P4P will be a major driver for institutional change, particularly if the magnitude of payment incentives are only 1% to 2% and significant investments are required to achieve the quality targets.

This article examines nursing economics from a broad perspective that goes beyond new payment proposals and advances an agenda for nursing that involves evidence-based critique of public policies and managerial decision

making that impact on nurses' well-being and the quality of nursing care.

Nurse Shortage

For decades, nurse shortages have served as major obstacles to the introduction and sustainability of nursing innovation. Nurse shortages have been offered as a justification for why improved nurse staffing in hospitals should not be mandated and why policy requirements for nurse staffing in nursing homes should remain impossibly low (Wunderlich et al., 1996). The nurse shortage was advanced by stakeholders in opposition to California's mandated minimum nurse staffing ratio legislation that was subsequently passed and later upheld by the California courts (Gledhill, 2005). Likewise, nurse shortages are widely cited as a reason why the United States cannot standardize entry level educational requirements for RNs at the baccalaureate level, although that would be consistent with trends in a number of countries around the world and also in keeping with research showing improved outcomes for patients (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005; Tourangeau et al., 2007).

Buerhaus, Staiger, and Auerbach (2004) describe the current shortage as beginning in 1998, making it the

Author's Note: The research presented here was supported in part by the Robert Wood Johnson Foundation and the National Institute of Nursing Research (ROI-NR-004513).

longest in modern memory. Although the nurse shortage may have recently eased somewhat (Auerbach, Buerhaus, & Staiger, 2007), no one disputes projections of a substantial long-term nurse shortage if current trends continue without intervention. Yet the nation lacks a considered, national, nurse workforce plan, and tens of thousands of qualified applicants are being turned away from nursing schools because of faculty shortages and capacity limitations. Ponder the likely benefit on quality of care of solving the nurse shortage, which has been left unattended to for so long. No single policy has impacted the nurse shortage more than cost containment policies that emphasize reductions in LOS.

Hospital Cost Containment Initiatives

Payment reforms that focus on producing higher quality care and/or that bring more resources to support nursing care are intriguing opportunities that deserve attention, study, and potential advocacy by nurses. However, there is much evidence that major, long-lasting policy and industry directions and decisions about cost containment in health care have had important but largely unrecognized and/or unacknowledged negative impacts on nurse workforce sufficiency and, possibly, care quality and safety. Enthusiasm for “experimental” payment reforms should not deter us from examining the impact of well-entrenched cost containment policies.

Hospital prospective payment system (PPS) is a case illustration of policy implemented nationally that has been underresearched with respect to its effects on the nurse workforce and patient safety. One of the few analyses of the impact of PPS on nursing was published in the background papers of the 1988 U.S. Department of Health and Human Services Secretary’s Commission on Nursing (Aiken & Hadley, 1988). Aiken and Hadley (1988) observed that in 1984, hospital nurse vacancy rates were at an all-time low of less than 4%, and some hospitals eliminated positions and/or required nurses to reduce their paid hours. But just two years later, nurse vacancy rates in hospitals had more than doubled and hospitals nationwide were reporting a serious shortage of nurses. When the shortage began, graduations from nursing schools were at a historic high at the time: almost 85,000 a year. Inpatient hospital days fell by 51 million annually between 1981 and 1987 as a result of PPS incentives for shorter hospital stays. This scenario—large numbers of new RN graduates and huge reductions in inpatient days—was consistent with nurse surplus rather than shortage, but soon hospitals nationwide were reporting high RN vacancy rates.

The Aiken and Hadley (1988) study documented a major restructuring of labor in hospitals associated with Medicare prospective payment. Between 1982 and 1987, hospitals reduced licensed practical nurse (LPN) employment by more than 67,000 full-time equivalents (FTEs). Between 1979 and 1982, the ratio of RNs to LPNs had been stable at about 3.2 RNs per LPN. Beginning in 1983 with the introduction of PPS, the ratio began to increase substantially until it reached 5 RNs per LPN by 1986. Between 1982 and 1985, hospitals also reduced the number of non-licensed nurse staff by 300,000. In total, there was a workforce reduction in hospitals between 1982 and 1986 of about 367,000 FTEs and a net increased employment of almost 137,000 RNs. Although this trend toward a richer nurse skill mix was viewed favorably by nurses, the incentives in PPS that favored intensive professional nursing care in a shorter period of time created a national nurse shortage that was not attenuated until the advent of managed care in the 1990s, and then only briefly (Aiken, Sochalski, & Anderson, 1996).

The legacy of PPS with its incentives to reduce hospital length of stay (LOS) ever further has been very detrimental for nurses as more complex care is compacted into fewer days. International comparisons suggest a pattern of nurse burnout for Western countries where the highest rates of burnout are generally found among nurses in countries with shorter LOS. Among Western countries, burnout is highest in the United States where LOS is shortest (Aiken et al., 2001). Research suggests that high nurse burnout is a contributing factor to expensive nurse turnover (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002), is associated with patient dissatisfaction (Vahey, Aiken, Sloane, Clarke, & Vargas, 2004), and is a threat to patient safety (Aiken, 2005).

Hospital prospective payment is being introduced into other countries without regard to its apparent effects on nurse shortages and nurse burnout in the United States. Germany will be an interesting case to follow as hospital prospective payment and diagnosis-related groups are implemented. In 1999, Germany had significantly lower nurse burnout and significantly longer average LOS than was in the case in the United States, Canada, the United Kingdom, or New Zealand (Aiken et al., 2001). Based on experience in North America with the impact on nursing of reducing LOS, nurse shortage and increased nurse burnout are predictable outcomes for Germany. Nurses should not let the opportunity pass to learn from the German experience as it could create a powerful argument for rethinking reductions in LOS in the United States and other countries.

In summary, PPS and other initiatives to reduce LOS have had a huge impact on nursing. It is doubtful that

P4P will be as important to nursing as PPS and other incentives to reduce hospital LOS have been. Serious focus on the economics of nursing would include, as a priority, the study of the impact of shortening LOS on nursing care quality and nurse retention in the full range of settings throughout health care; nursing care intensity is increased in every setting when hospital LOS is reduced.

Nursing and Cost Offsets

Nursing is generally considered a “cost” rather than revenue in a hospital context, which makes nursing a constant target for cost reductions. Because institutions are not directly compensated for providing nursing care, unlike physician services, there is little motivation for providing the right “dose” of nursing to meet patients’ varying needs. Some argue that direct reimbursement for nursing in hospitals would have a positive impact on quality of care by better aligning intensity of nursing care with hospital reimbursement levels and thereby reducing incentives to inappropriately ration nursing care (Welton, Fischer, DeGrace, & Zone-Smith, 2006). Indeed, one of the leading nursing research journals recently published a report on a tool for measuring the rationing of nursing care (Schubert, Glass, Clarke, Schaffert-Witvliet, & DeGeest, 2007). Given the general trend in health care payment toward bundling services together for reimbursement, direct reimbursement for nursing may not prove to be feasible, and thus other strategies need to be considered that might achieve the same ends—more appropriate levels of nursing care.

The systematic review and meta-analysis of the association of RN staffing levels and patient outcomes commissioned by the Agency for Health Care Research and Quality concluded that there is substantial evidence that increased RN staffing is associated with better patient outcomes (Kane et al., 2007). This comprehensive review helps refocus attention on the strongest component of a business case for nursing, that is, that more nursing may pay for itself by preventing costly adverse patient outcomes. In the health services research literature, cost offsets refer to spending in one resource category to achieve an equal or greater savings in another. Given the fragmented system of financing of health care in the United States, cost offsets often do not benefit the same entity making the initial investment, thus undermining the incentive. For example, better nurse staffing in nursing homes results in reduced use of hospital emergency room visits and inpatient stays for nursing home patients (Aiken, Mezey, Lynaugh, & Buck, 1985). However, better nurse staffing in nursing homes would cost Medicaid money,

whereas the beneficiary of reduced hospital expenditures would be the Medicare program. In the case of hospital nurse staffing and better patient outcomes, the same financial entity—the hospital—stands to benefit if better nursing prevents the need for costly patient care expenditures.

Aiken and colleagues, in a 20-hospital study of inpatient AIDS care, found that Magnet hospitals achieved better risk-adjusted patient outcomes without higher overall expenditures. Although Magnet hospitals had better nurse staffing than other hospitals in comparison, they also had lower risk-adjusted mortality, used fewer days in the intensive care unit (ICU), had a shorter average LOS, and had lower average ancillary costs for tests and drugs (Aiken, Sloane, Lake, Sochalski, & Weber, 1999). The Kane et al. (2007) meta-analysis estimated that if the association between nurse staffing and improved patient outcomes found in so many studies was causal (something difficult to confirm without unlikely clinical trials), an additional RN per patient day would avoid 7 cases of infected wounds and 4 cases of nosocomial sepsis per 1,000 hospitalized surgical patients, in addition to mortality prevention; in ICUs, an increase by 1 RN-FTE per patient day would avoid 7 cases of hospital-acquired pneumonia, 7 cases of respiratory failure, 6 cases of unplanned extubation, and 2 cases of cardiac arrest per 1,000 patients. Rothberg, Abraham, Lindenauro, and Rose (2005) demonstrated that the cost of saving a life through investments in nurse staffing was in line with the costs of saving a life through commonly accepted medical care practices such as thrombolytic therapy for acute myocardial infarction and routine cervical cancer screening.

Hospitals that have more favorable nurse staffing and work environments have not only better clinical outcomes that should offset the costs of increased staffing but also better nurse retention, another offsetting cost savings (Aiken, Clarke, Sloane, Lake, & Cheney, in press). Reduced nurse turnover produces substantial savings to hospitals when all the costs of replacing nurses are considered, including recruitment, overtime, and use of supplement agency nurses (Jones, 2004, 2005). Higher job dissatisfaction and nurse burnout, both precursors to voluntary turnover, are associated with less favorable nurse staffing and poor work environments (Aiken et al., in press). Presumably one of the reasons why a record number of hospitals have pursued Magnet designation is the evidence that nurse recruitment and retention is better in Magnet hospitals (Aiken, 2002).

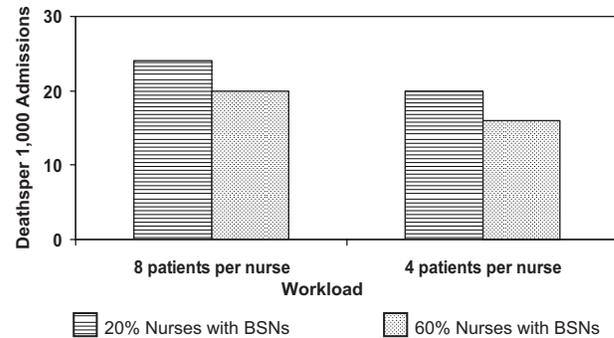
A less studied but vitally important dimension of cost offsets associated with investments in nursing are the interrelationships between types, costs, and outcomes of nursing investments. Hospital care is labor intensive and thus there is long-standing interest in the potential for

substituting less expensive labor for more expensive personnel, specifically substituting less expensive personnel for professional nurses. In the health services research literature there are many studies on nursing skill mix. Most of these suggest that better outcomes are associated with a higher proportion of RNs (Estabrooks et al., 2005; Landon et al., 2006; McCloskey & Diers, 2005; Person, Allison, Keife, Weaver, & Williams, 2004). Needleman and colleagues used a particularly compelling cost offset approach to evaluate the use of LPNs in hospitals. They concluded that contrary to popular opinion, both lives and money could be saved by replacing LPNs in hospitals with RNs (Needleman, Buerhaus, Stewart, Zelevinsky, and Mattke, 2006).

Another strategy for determining nursing cost offsets has been pursued by Aiken and associates to evaluate the relative impact of different types of investments in RNs. They have evaluated sequentially the association of nurse staffing, nurses' education, and the nurse work environment on patient outcomes, considering each individually and collectively. Their research first showed that each additional patient added to the workload of a hospital staff nurse was associated with a 7% increase in both mortality and failure to rescue following common surgical procedures (Aiken, Clarke, Sloane, Sochalski, et al., 2002). The relationship between workload and mortality was also tested in the International Hospital Outcomes Study led by the University of Pennsylvania. The association between staffing and mortality was found to be similar in English hospitals (Rafferty et al. 2007), and a nursing skill mix association was found in Canada (Estabrooks et al., 2005) and in New Zealand (McCloskey & Diers, 2005). Then the Aiken group established that independently of nurse workloads, each 10% increase in the proportion of hospital staff nurses with a baccalaureate or higher degree was associated with a 5% decline in mortality (Aiken et al., 2003). A similar finding was documented in Canada by Estabrooks et al. (2005) and Tourangeau (2007).

A 2003 study by Aiken and colleagues also reported on the joint effects of nurse staffing and education on mortality, revealing an interesting example of an offset that is illustrated in Figure 1. The lowest mortality was found in hospitals where nurses on average cared for 4 patients each and 60% had a baccalaureate degree. The highest mortality was found in hospitals where nurses cared for an average of 8 patients each but only 20% had baccalaureate degrees. The offset is suggested by the two middle categories where the mortality rate is the same, although not the best, in two widely different staffing scenarios. The mortality is the same in hospitals where nurses care for an average of 8 patients each but at least

Figure 1
Deaths per 1,000 General Surgery Patients in Hospitals With Differing Workloads and Percentages of Nurses With Bachelor of Science in Nursing Degrees (BSNs)



Source: Incorporates facts taken from "Educational Levels of Hospital Nurses and Surgical Patient Mortality," by L. H. Aiken, S. P. Clarke, R. B. Cheung, D. M. Sloane, and J. H. Silber, 2003, *Journal of the American Medical Association*, 290(12), pp. 1617-1623.

60% have a baccalaureate degree and hospitals where nurses care for 4 patients each but only 20% or less have a baccalaureate degree.

This finding has been difficult for many staff nurses to envision because of a tendency to think of education as an individual characteristic of a nurse. A hospital staff nurse with a baccalaureate degree usually has difficulty imagining caring effectively for 8 patients. However, the findings reported above consider nurses' education as a characteristic of a hospital; education is measured somewhat like nursing skill mix at the institutional level. It is presumed that management decisions can impact the proportion of nurses in a hospital with baccalaureate education through selective recruitment, retention, and support for existing staff to obtain higher education. Care in an environment where the overall educational levels of nurses is higher may afford patients with advantages that would require more staff to produce in institutions where the nurse workforce is less educated. Although the causal links need further study, the findings raise the potential that a smaller RN workforce might be possible in the future if the overall educational levels were higher.

Currently only 43% of staff nurses have baccalaureate degrees, which means there are not enough nurses for all hospitals to have at least 60% with at least a baccalaureate degree. More than 60% of new nurses now graduate from associate degree programs and relatively small proportions appear to be going on to obtain their bachelor of science in nursing degrees (Bevill, Cleary, Lacey,

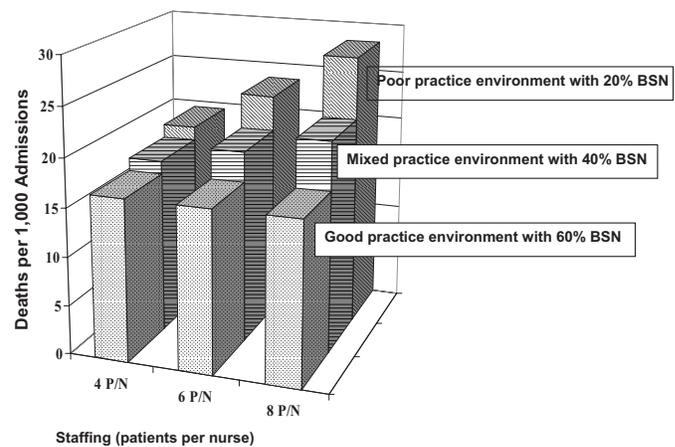
& Nooney, 2007). If subsequent research confirms the findings of an offset of higher nurse education on hospital nurse staffing requirements, efforts to rebalance the educational mix of the nurse workforce could potentially have a significant impact on the outcomes and cost of the hospital workforce.

A similar kind of offset can be hypothesized about the nurse work environment and nurse staffing requirements. The literature is replete with examples of operational failures in the hospital work environment that undermine the efficiency and safety of nursing care (Page, 2004; Tucker & Spears, 2006). Recent research at the University of Pennsylvania shows that the nurse practice environment has a significant effect on patient mortality and failure to rescue, independently of nurse staffing and nurse education (Aiken et al., in press; Friese, Lake, Aiken, Silber, & Sochalski, 2008). The approach by Aiken's group, like other investigators, has been to test additive models examining the level of incremental improvement in patient outcomes that can be achieved by additional investments in nursing. Results of this body of literature suggest that investments in improved nurse staffing, nurse education, and work environments all contribute individually and collectively to improved patient outcomes. Further exploration of these findings suggests that there might be an interaction between the effects of nurses' work environments and nurse staffing on patient mortality as illustrated in Figure 2.

The results presented in Figure 2 are exploratory and require further study. They use data from the 1999 Pennsylvania hospital study (Aiken, Clarke, Sloane, Sochalski, et al., 2002) and models that hypothesize an interaction effect of staffing and the practice environment. We find in this exploratory work that mortality rates after common surgical procedures are the same in hospitals with a range of nurse staffing levels between 4 patients per nurse to 8 patients per nurse as long as the quality of the practice environment is in the best category. In contrast, there are wide differences in mortality by different nurse staffing ratios in hospitals with poor nurse practice environments. Nurse education in models tested here is assumed, for illustrative purposes, to have an additive effect.

The point of showing these exploratory findings (which will be followed up in larger studies) is to illustrate that there is some beginning empirical evidence that there are offsets between various forms of investments in nursing. Some types of investments are likely to result in better value than others. We need the science base not only to make the case that investments in nursing yield better outcomes for patients and cost savings to institutions but also to guide decisions about the relative value of different kinds of investments in nursing.

Figure 2
Interaction Between Hospital Nurse Staffing and Work Environment on Surgical Mortality: Exploratory Findings



Source: Authors' calculations from the 1999 Pennsylvania data reported in "Hospital Nurse Staffing and Patient Mortality, Nurse Burnout and Job Dissatisfaction," by L. H. Aiken, S. P. Clarke, D. M. Sloane, J. Sochalski, and J. Silber, 2002, *Journal of the American Medical Association*, 288(16), pp. 1987-1993.

Concluding Thoughts

Hospital charges increased an astounding \$59 billion in the United States in just one year between 2004 and 2005 (Modern Health care, 2007), and operating margins were favorable for a substantial share of hospitals. But the public is concerned about patient safety, and the recruitment and retention of a qualified nurse workforce remains a problem. The burnout scores for bedside nurses in U.S. hospitals are among the highest recorded in research about human services workers. Despite the shortage, nurses spend considerable time on tasks that do not require their special knowledge and expertise, while needed nursing care is left undone. The majority of nurses report that management fails to listen and respond to problems they identify in care at the bedside (Aiken et al., 2001). That nurses in countries with differently organized health care and different provider financial incentives report remarkably similar problems in hospital care suggests that modest payment reforms may be weak instruments to bring about enduring improvements in quality and to retain a qualified nurse workforce (Aiken, Clarke, & Sloane, 2002).

Fundamental organization and culture changes seem required for the modern hospital to adapt to changing population health priorities, advances in science and technology and their accompanying patient safety hazards,

the growing bureaucracy of health care that challenges the legitimacy of professional judgment, and finite resources. Financial incentives are not the only vehicles to bring about change. Political advocacy is one route to change, as represented by California's mandated hospital nurse staffing ratio legislation and Pennsylvania's health reform plan that builds on access to advanced practice nurses (Aiken, 2007). Professional opinion and standard setting is another force for change, as illustrated by hundreds of hospitals seeking Magnet designation before a business case has been fully articulated.

Research produces knowledge to inform professional opinion, political advocacy, and managerial decision making. However, funding for health care workforce research is scarce (Cooper, 2004), which makes it difficult to attract top scientists to the field and to maintain their interest over time so that knowledge in support of better decision making can be accumulated and applied. Thus, nursing should place a high priority on increasing the number of nurse researchers with the knowledge and skill to conduct rigorous studies on the impact of public policies on nursing.

In market economies, financial incentives are important in shaping health care. Further development of the subfield of nursing economics could provide a stronger scientific basis for influencing policy decisions that impact the nurse workforce and the quality of nursing care. But it is instructive that countries with centrally controlled health care systems have shortcomings in their hospitals that are similar to those in countries with market economies, and even in market economies there are examples of influential noneconomic drivers of policy and cultural changes in health care. Nursing would be best positioned to influence the future shape of health care if it combines its quest for holistic and patient-centered care with science-based advocacy and evidence-based skepticism about any kind of reform that does not fundamentally change the organization and culture of health care.

References

- Aiken, L. H. (2002). Superior outcomes for Magnet hospitals: The evidence base. In M. L. McClure and A. S. Hinshaw (Eds.), *Magnet hospitals revisited: Attraction and retention of professional nurses* (pp. 61-81). Washington, DC: American Nurses Publishing.
- Aiken, L. H. (2005, July-August). Nursing: The unfinished patient safety agenda. *AHRQ WebM&M*. Retrieved April 11, 2008, from <http://www.webmm.ahrq.gov/perspective.aspx?perspectiveID=7>
- Aiken, L. H. (2007, September 5). Workforce policy solutions to health care reform. *Health Affairs, Blog*. Retrieved on April 11, 2008, from <http://healthaffairs.org/blog/2007/09/>
- Aiken, L. H., Clarke, S. P., Cheung, R. B., Sloane, D. M., & Silber, J. H. (2003). Educational levels of hospital nurses and surgical patient mortality. *Journal of the American Medical Association, 290*(12), 1617-1623.
- Aiken, L. H., Clarke, S. P., & Sloane, D. M. (2002). Hospital staffing, organizational support, and quality of care: Cross-national findings. *International Journal for Quality in Health Care, 14*(1), 5-13.
- Aiken, L. H., Clarke, S. P., & Sloane, D. M., Lake, E. T., & Cheney, T. (in press). Effects of hospital care environment on patient mortality and nurse outcomes. *Journal of Nursing Administration*.
- Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J. A., Busse, R., Clarke, H., et al. (2001). Nurses' reports of hospital quality of care and working conditions in five countries. *Health Affairs, 20*(3), 43-53.
- Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., & Silber, J. H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *Journal of the American Medical Association, 288*(16), 1987-1993.
- Aiken, L. H., & Hadley, J. (1988). Factors affecting the hospital employment of registered nurses. *The Secretary's Commission on Nursing final report* (Vol. 2). Washington, DC: U.S. Department of Health and Human Services.
- Aiken, L. H., Mezey, M. D., Lynaugh, J. E., & Buck, Jr., C. R. (1985). Teaching nursing homes: Prospects for improving long-term care. *Journal of the American Geriatrics Society, 33*(3), 196-201.
- Aiken, L. H., Sloane, D. M., Lake, E. T., Sochalski, J., & Weber, A. L. (1999). Organization and outcomes of inpatient AIDS care. *Medical Care, 37*(8), 760-772.
- Aiken, L. H., Sochalski, J. A., & Anderson, G. F. (1996). Downsizing the hospital workforce. *Health Affairs, 15*(4), 88-92.
- Auerbach, D. L., Buerhaus, P. I., & Staiger, D. O. (2007). Better late than never: Workforce supply implications of later entry into nursing. *Health Affairs, 26*(1), 178-185.
- Bevill, J. M., Cleary, B. L., Lacey, L. M., & Nooney, J. G. (2007). Educational mobility of RNs in North Carolina: Who will teach tomorrow's nurses? *American Journal of Nursing, 107*(5), 60-70.
- Buerhaus, P. I., Staiger, D. O., & Auerbach, D. I. (2004, November 17). New signs of a strengthening U.S. nurse labor market? *Health Affairs, Web Exclusive, 526-533*. Available from <http://content.healthaffairs.org/contents-by-date.0.shtml>
- Cooper, R. A. (2004). Scarce physicians encounter scarce foundations: A call for action. *Health Affairs, 23*(6), 243-249.
- Estabrooks, C. A., Midodzi, W. K., Cummings, G. C., Ricker, K. L., & Giovannetti, P. (2005, March-April). The impact of hospital nursing characteristics on 30-day mortality. *Nursing Research, 54*(2), 74-84.
- Friese, C. R., Lake, E. T., Aiken, L. H., Silber, J. H., & Sochalski, J. A. (2008, January 31). Hospital nurse practice environments and outcomes for surgical oncology patients. *Health Services Research* (OnlineEarly article: doi:10.1111/j.1475-6773.2007.00825.x). Available from <http://www.blackwell-synergy.com/toc/hesr/0/0>
- Gledhill, L. (2005, March 4). Governor loses to nurses in ruling: He illegally blocked law that set staffing ratios, judge says. *San Francisco Chronicle*, p. A1.
- Jones, C. B. (2004). The costs of nurse turnover: Part 1: An economic perspective. *Journal of Nursing Administration, 34*(12), 562-570.
- Jones, C. B. (2005). The costs of nurse turnover: Part 2: Application of the Nursing Turnover Cost Calculation Methodology. *Journal of Nursing Administration, 35*(1), 41-49.
- Kane, R. L., Shamliyan, T. A., Mueller, C., Duval, S., & Wilt, T. J. (2007). The association of registered nurse staffing levels and patient outcomes: Systematic review and meta-analysis. *Medical Care, 45*(12), 1195-1204.

- Kohn, L. T., Corrigan, J. M. and Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Washington, DC: National Academy Press.
- Landon, B. E., Normand, S. L., Lessler, A., O'Malley, A. J., Schmaltz, S., Loeb, J. M., et al. (2006). Quality of care for the treatment of acute medical conditions in US hospitals. *Archives of Internal Medicine*, 166(22), 2511-2517.
- McCloskey, B. A., & Diers, D. K. (2005). Effects of New Zealand's health reengineering on nursing and patient outcomes. *Medical Care*, 35(11), 1140-1146.
- Modern Health care. (2007, December 12). Modern Health care Alert: Hospital charges jumped more than 7% in 2005. Message posted to Modern Health care Alerts electronic mailing list, archived at <http://modernhealthcare.com/apps/pbcs.dll/article?AID=/20071212/FREE/312120028>
- Needleman, J., Buerhaus, P. I., Stewart, M., Zelevinsky, K., & Mattke, S. (2006). Nurse staffing in hospitals: Is there a business case for quality? *Health Affairs*, 25(1), 204-211.
- Page, A. (2004). *Keeping patients safe: Transforming the work environment of nurses*. Washington, DC: National Academies Press.
- Person, S. D., Allison, J. J., Keife, C. I., Weaver, M. T., & Williams, O. D. (2004). Nurse staffing and mortality for Medicare patients with acute myocardial infarction. *Medical Care*, 42, 4-12.
- Rafferty, A. M., Clarke, S. P., Coles, J., Ball, J., James, P., McKee, M., et al. (2007). Outcomes of variation in hospital nurse staffing in English hospitals: Cross-sectional analysis of survey data and discharge records. *International Journal of Nursing Studies*, 44, 175-182.
- Rothberg, M. B., Abraham, I., Lindenaur, P. K., & Rose, D. N. (2005). Improving nurse-to-patient staffing ratios as a cost-effective safety intervention. *Medical Care*, 43(8), 785-791.
- Schubert, M., Glass, T. R., Clarke, S. P., Schaffert-Witvliet, B., & DaGeest, S. (2007). Validation of the Basel Extent of Rationing Nursing Care Instrument. *Nursing Research*, 56(6), 416-424.
- Tourangeau, A. E., Doran, D. M., Hall, L. M., Pallas, L. O., Pringle, D., Tu, J. V., et al. (2007). Impact of hospital nursing care on 30-day mortality for acute medical patients. *Journal of Advanced Nursing*, 57(1), 32-44.
- Tucker, A. L., & Spear, S. J. (2006). Operational failures and interruptions in hospital nursing. *Health Services Research*, 41(3, Part 1), 643-662.
- Vahey, D. C., Aiken, L. H., Sloane, D. M., Clarke, S. P., & Vargas, D. (2004). Nurse burnout and patient satisfaction. *Medical Care*, 42(2 Suppl.), II-57-II-66.
- Welton, J. M., Fischer, M. H., DeGrace, S., & Zone-Smith L. (2006). Hospital nursing costs, billing, and reimbursement. *Nursing Economics*, 24(5), 239-245.
- Wunderlich, G. S., Sloan, F. A., & Davis, C. K. (1996). *Nursing staff in hospitals and nursing homes: Is it adequate?* Washington, DC: National Academy Press.

Linda H. Aiken, PhD, RN, FAAN, is the Claire M. Fagin Professor of Nursing, a professor of sociology, and director of the Center for Health Outcomes and Policy Research at the University of Pennsylvania.

