

Nurse Staffing Ratios: Trends and Policy Implications for Hospitalists and the Safety Net

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BACKGROUND: Mandated minimum nurse-to-patient staffing ratio legislation was passed in California in 1999 and implemented January 1, 2004. Nurse staffing legislation is being considered in at least 25 other states.

OBJECTIVES: The objectives of this study were: (1) to evaluate nurse staffing trends in California from 1993 to 2004, (2) to identify types of hospitals below minimum staffing ratios and staffing changes in 2004, the first year post-implementation; and (3) to discuss possible implications of nurse staffing on hospitalists and their hospital-based initiatives.

DESIGN, SETTING, PATIENTS: We analyzed data from the medical-surgical units of all short-term acute-care general hospitals in California from 1993 to 2004. The annual hospital staffing ratio is composed of the combined hours of registered nurses and licensed vocational nurses and total number of patient days on medical-surgical units.

RESULTS: Nurse staffing ratios were relatively unchanged from 1993 to 1999 and then increased significantly from 1999 to 2004, with the largest increase in 2004, the year the nurse staffing ratio was implemented. Types of hospitals more likely to be below minimum ratios had a high Medicaid/uninsured patient population and were government owned, nonteaching, urban, and in more competitive markets. Most hospitals below ratios were considered part of the health care "safety net."

CONCLUSIONS: Nurse staffing legislation may increase nurse staffing. However, mandated nurse staffing ratios without mechanisms to help achieve ratios may force hospitals, especially safety-net hospitals, to make tradeoffs in other services or investments with unintended negative consequences for patients. Nurse staffing likely influences the outcomes of hospitalist-led quality initiatives, but these effects need to be explored further. *Journal of Hospital Medicine* 2008;3:193-199.

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Many studies have reported associations between higher nurse-to-patient ratios and decreased mortality and complications. These studies coupled with increasing concern about patient safety, nursing shortages, and nurse burnout have spurred many state legislatures to discuss mandating minimum nurse staffing ratios.¹⁻⁵ The California legislature passed law AB394 in 1999, mandating minimum nurse staffing ratios in order to improve patient safety and the nurse work environment. The original implementation date, January 1, 2001, was delayed to allow the California Department of Health Services more time to develop minimum nurse ratios for each unit type.^{6,7} California implemented a ratio of at least 1 licensed nurse (RN+LVN) for every 6 patients on general adult medical-surgical floors on January 1, 2004. This was subsequently increased, on January 1, 2005, to at

least 1 licensed nurse for every 5 patients, a ratio that was upheld by the California Supreme Court on March 14, 2005.⁸

Additional laws regarding nurse staffing are being considered in at least 25 states.⁹ States have taken 3 main approaches to legislation: mandating nurse staffing ratios for each hospital unit type, requiring hospitals to establish and report nurse staffing plans that typically include ratios, or a combination of mandated ratios and staffing plans.¹⁰ This type of legislation would have a major impact on hospitalists, nurses, other health care personnel, hospital administrators, and patients. However, little is known about trends in nurse staffing, how staffing levels vary among hospitals overall, in different markets, and by ownership type and location, and consequently how implementing nurse staffing ratios will affect different types of hospitals, including those that make up the "safety net."¹¹

California nurse staffing data are better than many other sources because the state provides nurse staffing hours by unit types in hospitals as opposed to aggregate numbers of nurse hours across an entire hospital or medical center.¹² California is also at the forefront of mandated minimum nurse staffing legislation, as it is the only state to have enacted nurse staffing ratio legislation. Examining nurse staffing trends and hospital types currently under mandated or proposed nurse staffing ratios is integral to informing the debate on nurse staffing legislation and its effect on hospitalists. We hypothesized that nurse staffing would increase in California after the legislation was passed in 1999 but that safety-net hospitals such as those that are urban, government owned, and serving a high percentage of Medicaid and uninsured patients would be more likely to be below minimum ratios.¹³

MATERIALS AND METHODS

We used hospital financial panel data for 1993 through 2004, the most recent year with complete data, from California's Office of Statewide Health Planning and Development (OSHPD). We included only short-term acute-care general hospitals and excluded other hospital types such as long-term care, children's, and psychiatric hospitals. We investigated staffing of adult general medical-surgical units and not of other types of units such as intensive care units. The numerator of the staffing variables for each hospital was the combined medical-surgical productive hours for registered nurses (RNs) and licensed vocational nurses (LVNs), as

California allows up to 50% of staffing hours to be LVN hours. Staffing hours of the adult general medical-surgical units of each hospital are reported on an annual basis. The denominator was total patient days on the acute adult medical-surgical units of each hospital in a given year. We calculated the number of patients per one nurse by dividing 24 by the nurse hours per patient day (eg, 4.0 nurse hours per patient day is equivalent to a nurse-to-patient ratio of 1:6). We did not adjust staffing ratios by the hospital case mix or other factors because the ratio legislation did not take these factors into account.

We further evaluated staffing ratios in 2003 and 2004 based on 5 hospital characteristics: hospital ownership, market competitiveness, teaching status, urban versus rural location, and safety-net hospitals, using 2 common definitions for the latter. The Institute of Medicine report defines safety-net providers as those with a substantial share of their patient mix from uninsured and Medicaid populations.¹³ Safety-net hospitals have been more specifically defined as short-term general hospitals whose percentage of Medicaid and uninsured patients is greater than 1 standard deviation above the mean.¹⁴ Using this definition, hospitals in California where more than 36% of patients had Medicaid or no insurance in 2004 would be considered safety-net hospitals. A more comprehensive definition of the hospital safety net that has been used includes urban nonprofit and government hospitals and hospitals with a high percentage of Medicaid/uninsured patients.^{10,11,15} We analyzed nurse staffing ratios using both these definitions. Hospital ownership was designated as for profit, nonprofit, or government owned. Hospital competitiveness was measured using the Hirschman-Herfindahl Index (HHI), or the sum of squared market shares, a standard approach to defining hospital market competition. Market boundaries were defined as those zip codes from which each hospital draws most of its patients.¹⁶ We then dichotomized hospitals into a high- or low-competition category based on the approximate median HHI cut point of 0.34. Teaching status was based on intern/resident-to-bed ratio (ie, 0 = nonteaching, 0.01-0.25 = minor teaching, and >0.25 = major teaching). Location was defined by county location as either urban or nonurban medical service area.

We then analyzed the percentage of hospitals in 2003 and 2004 below the mandated minimum ratios of (1) at least 1 licensed nurse (RN+LVN) per 6 patients effective in 2004, (2) the ratio of 1

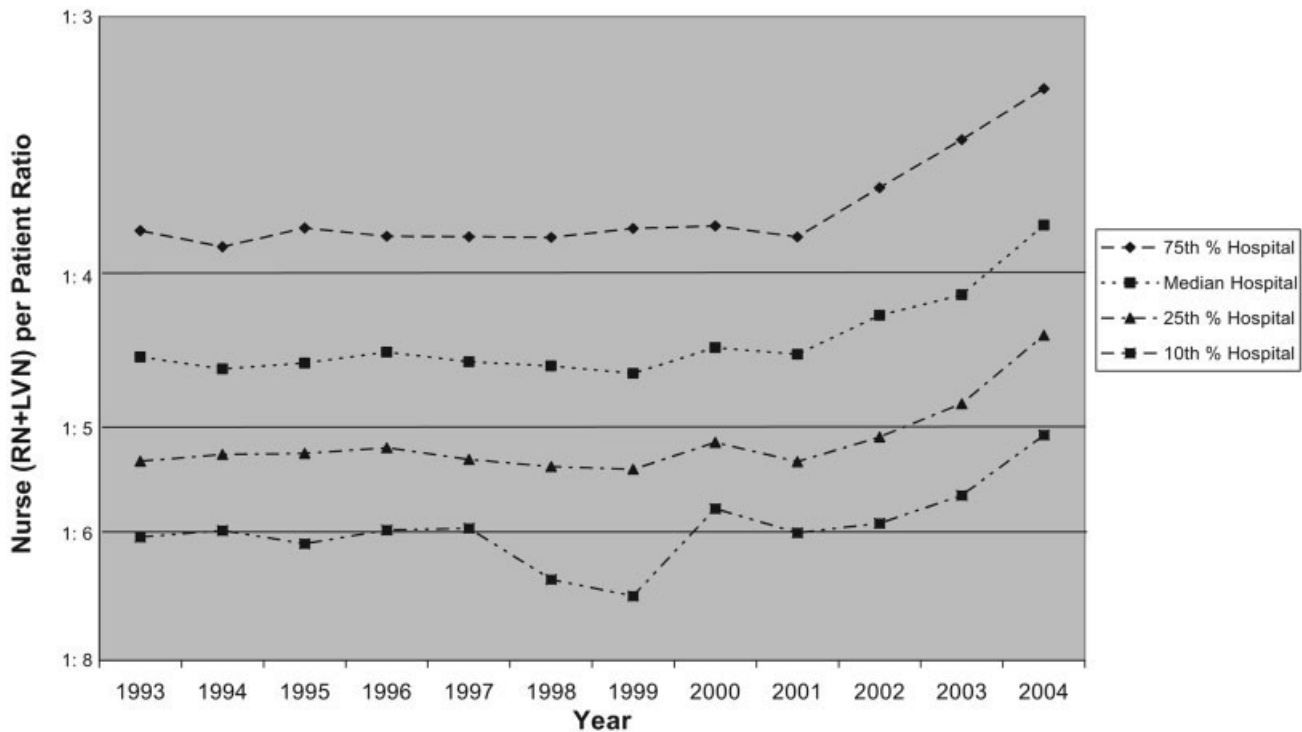


FIGURE 1. Hospital nurse staffing ratio trends 1993-2004.¹ No significant trend in median hospital nurse to patient ratio 1993-99; chi square test for trend for median hospital nurse staffing ratio 1999-2004 ($p < .001$).

(RN+LVN) nurse per 5 patients to be implemented in 2005, (3) the ratio of at least 1 registered nurse (RN only) per 5 patients, and (4) at least 1 nurse (RN+LVN) per 4 patients, as these ratios are under consideration in other states.^{9,17} Finally, we examined the trend in nurse staffing ratios from 2003, the pre-implementation year, to 2004, the post-implementation year. Data analysis was performed using STATA SE 9.1 (College Station, TX).

RESULTS

Nurse Staffing Trends

The trend in nurse staffing ratios based on licensed nurses (RN + LVN) from 1993 to 2004 is shown in Figure 1, with lines representing the 10th, 25th, 50th (median), and 75th percentiles of hospital nurse staffing ratios. The nurse staffing ratios were essentially flat from 1993 to 1999 without any significant trend. After nurse staffing legislation was passed in 1999, median nurse-to-patient ratio rose, with the largest increase from 2003 to the implementation year for staffing ratios, 2004. From 2003 to 2004, the median hospital staffing ratio increased from fewer than 1 nurse per 4 patients to a ratio of more than

1 nurse per 4 patients. The first year that fewer than 25% of hospitals were below the minimum of at least 1 nurse per 5 patients was 2003.

Trends in Nurse Staffing Mix

The legislation in California and the proposed legislation in some other states allow hospitals to meet mandated ratios with both RNs and LVNs or LPNs, that is, with “licensed nursing staff.” Specifically, California allows up to 50% of nurse staffing ratios to be met by LVN hours. Therefore, we analyzed the overall trend in percentage of nurse staffing hours attributable to LVNs. In 1993, LVNs accounted for 27% of nurse staffing hours. Because of a steady decrease in the proportion of LVNs staffing relative to RNs staffing, LVNs accounted for only 13% of the nurse staffing hours by 2004.

Hospitals Below Implemented and Proposed Ratios

The first column of Table 1 shows the percentage of hospitals of each type in 2003 and 2004 below the mandated ratio of at least 1 licensed nurse (RN+LVN) per 6 patients, which went into effect January 1, 2004. The next column represents the

TABLE 1
Hospitals Below Minimum Nurse Per Patient Ratios in 2003 and the Implementation Year, 2004

	<1 Nurse per 6 patients (RN+LVN)*		<1 Nurse per 5 patients (RN+LVN)*		<1 Nurse per 5 patients (RN only)*		<1 Nurse per 4 patients (RN+LVN)*	
	2003 (%)	2004 (%)	2003 (%)	2004 (%)	2003 (%)	2004 (%)	2003 (%)	2004 (%)
All hospitals (2003, n = 342; 2004, n = 332) [†]	5.0%	2.4%	19.6%	11.4% [§]	39.8	29.5% [§]	53.2%	40.4% [§]
Hospital ownership [†]								
—For-profit (2003, n = 87; 2004, n = 82)	2.3%	1.2%	25.3%	9.8% [§]	54.0 [‡]	32.9% [§]	63.2%	40.2% [§]
—Nonprofit (2003, n = 234; 2004, n = 231)	5.6%	3.0%	16.7%	11.3%	34.6 [‡]	28.1%	49.6%	40.7%
—Government (2003, n = 21; 2004, n = 19)	9.5%	0%	28.6%	21.1%	38.1 [‡]	31.6%	52.4%	36.8%
More competitive versus less competitive markets [†]								
—More competitive (2003, n = 168; 2004, n = 163)	6.0%	2.6%	25.0% [‡]	11.7% [§]	46.4 [‡]	33.8% [§]	59.3% [‡]	42.2% [§]
—Less competitive (2003, n = 174; 2004, n = 169)	4.0%	2.2%	14.4% [‡]	11.2%	33.3 [‡]	25.8%	48.3% [‡]	38.8%
Teaching status [†]								
—No teaching (2003 n = 250; 2004 n = 251)	5.6%	2.4%	20.4%	12.0% [§]	42.0%	30.7% [§]	56.0%	41.0% [§]
—Minor teaching (2003 n = 72; 2004 n = 60)	2.8%	3.3%	18.1%	10.0%	36.5%	28.3%	48.6%	41.7%
—Major teaching (2003 n = 20; 2004 n = 21)	5.0%	0%	15.0%	9.5%	20.0%	19.0%	35.0%	28.6%
Urban versus nonurban [†]								
—Urban (2003 n = 306; 2004 n = 294)	4.9%	2.4%	20.9%	11.9% [§]	41.2%	30.6% [§]	55.6% [‡]	42.5% ^{‡§}
—Nonurban (2003 n = 36; 2004 n = 38)	5.6%	2.6%	8.3%	7.9%	27.8%	21.1%	33.3% [‡]	23.7% [‡]
High versus low Medicaid/uninsured patient population [†]								
—High [‡] (≥36%; 2003, n = 65; 2004, n = 60)	6.2%	5.0%	30.8% [‡]	21.7% [‡]	50.8% [‡]	43.3% [‡]	64.6% [‡]	48.7% [§]
—Low [‡] (<36%; 2003, n = 276; 2004, n = 270)	4.7%	1.9%	17.0% [‡]	9.3% ^{‡§}	37.3% [‡]	26.7% ^{‡§}	50.7% [‡]	39.3% [§]

*Based on nurse hours (RN+LVN or RN only) per patient day (eg, <1 RN+LVN per 6 patients, equivalent to <4.0 RN+LVN hours per patient day), as described in the Materials and Methods section.

[†]Only includes short-term general hospitals with reported nurse staffing ratios.

[‡]Significantly different between hospital types in that year (ie, 2003 or 2004) based on chi-square test at $P < .05$ level.

[§]Significantly different change from 2003 to 2004 in that hospital type (eg, nonprofit hospitals) based on chi-square test for trend at $P < .05$ level.

[†] Percentage of hospitals below nurse-per-patients staffing ratio in each category (eg, 2 of 87, or 2.3%, of for-profit hospitals with <1 nurse per 6 patients in 2003).

[‡]Cutoff based on mean + 1 standard deviation (1 hospital in 2003 and 2 hospitals in 2004 without percentage of Medicaid reported).

hospitals below the ratio of at least 1 licensed nurse per 5 patients, which was implemented in 2005. The final 2 columns represent ratios that have been considered in other states of at least 1 RN per 5 patients and at least 1 licensed nurse per 4 patients.^{9,17} In 2004, only 2.4% of hospitals were below a minimum ratio of at least 1 nurse (RN+LVN) per 6 patients, but 11.4% were below 1:5, 29.5% were below 1 RN per 5 patients, and 40.4% were below at least 1 nurse (RN+LVN) per 4 patients. This demonstrates the substantial increase in the proportion of hospitals that are below minimum ratios as the number of nurses or required training level of nurses is increased.

Nurse Staffing Ratio Changes in First Year of Implementation of Legislation

From 2003 to 2004, there was a decrease in the percentage of hospitals below all the ratios. The absolute decrease was least in the actual mandated ratio in 2004 of at least 1 nurse per 6 patients (5.0%

of hospitals below the ratio in 2003 versus 2.4% of hospitals in 2004), and the decrease was greatest in the highest ratio of at least 1 nurse per 4 patients (53.2% versus 40.4%). Although there was a decrease in the percentage of hospitals of all types below the minimum ratios from 2003 to 2004, some hospital types had larger reductions in hospitals below ratios than others. The types of hospitals with the most significant decreases in the percentage below minimum ratios were for-profit hospitals, hospitals in more competitive markets, non-teaching hospitals, urban hospitals, and non-safety-net hospitals with a low percentage of Medicaid/uninsured patients.

Types of Hospitals Below Minimum Ratios

One of the most important considerations is the type of hospital in 2004 below the minimum ratio of at least 1 nurse (RN+LVN) per 5 patients implemented January 1, 2005. The hospital types with the

highest percentage of hospitals below the 1:5 ratio were those with a high proportion of Medicaid/uninsured (21.7%), government owned (21.1%), nonteaching (12.0%), urban (11.9%), and in more competitive markets (11.7%). Of note, hospitals with a high proportion of Medicaid/uninsured patients were significantly more likely than hospitals with a low proportion of Medicaid patients to be below minimum ratios. These safety net hospitals also failed to achieve the significant decrease in percentage of hospitals below minimum ratios from 2003 to 2004 that hospitals with a low Medicaid population achieved. There were a total of 38 of 332 hospitals (11.4%) whose ratios were below the minimum of at least 1 nurse (RN+LVN) per 5 patients in 2004 (Table 1). Using the broader definition of hospital safety net, which includes urban nonprofit and government hospitals in addition to those hospitals with a high percentage of Medicaid/uninsured patients, the vast majority of hospitals (84%)—32 of 38—below the minimum ratio of 1:5 in 2004 were part of the hospital safety net.

DISCUSSION

These data demonstrate that nurse staffing ratios in California were relatively stable from 1993 to 1999. In 1999, law AB 394 with its focus on nurse staffing levels passed, and subsequently, from 1999 to 2004, nurse staffing levels increased significantly, with the largest increase in 2004, the year of implementation. Although multiple factors could account for this trend, a likely cause for the statewide increase in nurse staffing was the anticipation and then implementation of legislation to achieve minimum ratios.

This study had several limitations. The OSHPD data capture nurse staffing on an annual basis, but the California legislation mandated minimum nurse staffing ratios be kept at all times; these data do not capture how often a given hospital was below the minimum ratio on a monthly or shift-by-shift basis. These data may overreport nurse staffing hours if they include hours not spent in direct patient care, or they could misrepresent nurse staffing ratios because of poor reporting.

Certain hospitals are more likely to be below mandated ratios. These hospitals are often government owned, in urban areas, and serve a high percentage of Medicaid/uninsured patients. Hospitals with these characteristics are typically considered part of the safety net. These are the hospitals that

serve our nation's most vulnerable populations and are likely to struggle disproportionately to meet minimum mandated ratios. As evidence of these precarious finances, 67% of hospitals defined as safety-net hospitals based on a high percentage of Medicaid/uninsured patients in 2004 had a negative operating margin versus 40% of hospitals not considered to be safety-net hospitals ($P < .001$).¹⁸ The question remains how hospitals will meet minimum nurse staffing ratios given these tenuous operating margins, as some of the approaches might result in restricted access, reduced services, reduced expenditures on new equipment or technology, or other decisions that might adversely affect quality. These potential tradeoffs will directly affect hospitalists, nurses, and other health care personnel working in hospitals. Because legislation generally does not provide funds or mechanisms to help hospitals meet proposed staffing ratios and there is a national nursing shortage, hospitals may struggle to meet minimum ratios. Cross-sectional studies have demonstrated a potential link between increased nurse staffing and better patient outcomes,¹⁻⁵ but if a financially constrained hospital makes tradeoffs by restricting access to care and services or by diverting funds from other beneficial uses, on balance, mandated nurse staffing ratios may not be beneficial to patients. The potential for unintended but serious negative consequences exists if hospitals in the safety net are mandated to meet minimum nurse staffing ratios without adequate resources.

At all types of hospitals, hospitalists are increasingly becoming responsible for quality improvement programs and outcomes measurement. However, the outcomes of these programs may be strongly influenced by nurse staffing. For example, cross-sectional studies have demonstrated that increased nurse staffing was associated with decreased mortality, length of stay, failure to rescue from complications, catheter-associated bloodstream infections, catheter-associated urinary tract infections, gastrointestinal bleeding, ventilator-acquired pneumonia, and shock or cardiac arrest.^{1,4,19} These types of quality and patient safety outcomes are likely to be the focus of many hospitalist-led quality improvement programs and may even be linked to hospitalist compensation. Therefore, hospitals and their hospitalists must take into account the effect that inadequate nurse staffing could have on their patient outcomes while balancing the investment in nurse staffing with other quality im-

provement investments. An interaction between nurse staffing level and hospitalist staffing may exist, but we are unaware of any published studies investigating this interaction. The nurse burnout documented to be associated with inadequate nurse staffing certainly could affect hospitalists if it increases nurse turnover or inhibits effective communication.¹ Additional research is needed to better delineate the effects of nurse staffing, particularly in regard to hospitalists and hospital-based quality and safety initiatives.

Finally, these data highlight the need for policymakers and hospital administrators to consider whether the aim is to establish a minimal floor or an “optimal” ratio. California first opted for what many would consider a minimal floor of at least 1 nurse per 6 patients, as only 5% of hospitals were below this ratio in 2003. California then increased the ratio to a 1:5 nurse-to-patient ratio, which affected a larger percentage of hospitals, presumably because of a belief that this higher ratio would lead to better outcomes. In addition, some states such as Massachusetts have considered a minimum ratio of 1:4.¹⁷ A ratio of 1:4 would require a significant proportion of hospitals to hire more nurses if staffing levels are similar to California. Only a few studies have estimated the cost effectiveness of staffing changes. Based on cross-sectional data, Needleman et al. estimated that it would cost \$8.5 billion nationally to raise all hospitals to the 75th percentile of RN and overall nurse staffing but that this would prevent 70,000 adverse patient outcomes (eg, hospital-acquired pneumonia). Rothberg et al. estimated that the incremental cost per life saved as a hospital moved from 1 nurse per 8 patients to 1 nurse per 5 patients was \$48,100. However, these estimates based on cross-sectional data fail to inform the debate on “optimal” nurse staffing ratios. The effect on patient outcomes when hospitals move from 1:6 to 1:5 or 1:4 nurse staffing levels needs to be determined in a longitudinal study. Thus, legislators and hospitals have little to guide them in establishing optimal nurse staffing ratios, and consideration of specific mandated minimum ratios would benefit greatly from comparative information on the cost and quality tradeoffs.

Hospitals, policy makers, health care providers, and researchers are struggling to improve the health care delivered in our hospitals; fortunately, there has been an increased focus on the importance of nurses who deliver medical care on the

front lines and are responsible for many aspects of quality. Mandating minimum nurse staffing ratios may seem like an “easy fix” of the problem; however, we must consider how these ratios can be met, the potential difficulty for hospitals to meet these ratios in the fraying safety net²⁰, and possible unintended negative consequences. Without a mechanism for hospitals to meet ratios, simply mandating a minimum ratio will not necessarily improve care. Hospitalists should be leaders in better understanding the effects of nurse staffing on patient outcomes and quality initiatives in hospitals.

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