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Contradicting Fears, California's Nurse-To-Patient Mandate Did Not Reduce The Skill Level Of The Nursing Workforce In Hospitals

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Abstract

When California passed a law in 1999 establishing minimum nurse-to-patient staffing ratios for hospitals, it was feared that hospitals might respond by disproportionately hiring lower-skill licensed vocational nurses. This article examines nurse staffing ratios for California hospitals for the period 1997–2008. It compares staffing levels to those in similar hospitals in the United States. We found that California's mandate did not reduce the nurse workforce skill level as feared. Instead, California hospitals on average followed the trend of hospitals nationally by increasing their nursing skill mix, and they primarily used more highly skilled registered nurses to meet the staffing mandate. In addition, we found that the staffing mandate resulted in roughly an additional half-hour of nursing per adjusted patient day beyond what would have been expected in the absence of the policy. Policy makers in other states can look to California's experience when considering similar approaches to improving patient care.

In 1999 then–California Governor Gray Davis signed Assembly Bill 394 into law,[1] requiring the California Department of Health Services to adopt regulations establishing minimum nurse-to-patient staffing ratios for hospitals.[2] The law came in response to growing concern about patient safety as the complexity of care in hospitals increased and California experienced a severe nurse shortage in the late 1990s.[3] Influence from unions, including the California Nurses Association and the Service Employees International Union, helped propel staffing issues into the political agenda, despite opposition from organizations such as the California Healthcare Association, which represents hospitals.

California's minimum nurse staffing ratios were intended to improve quality of care and patient safety, and to retain nurses in employment in hospitals.[4] Another primary goal of the law was to avoid high patient-to-nurse ratios, especially for registered nurses. These ratios

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have been associated with a number of negative patient outcomes, such as higher surgical mortality and higher complication rates due to errors.[5–7] Higher patient workloads for nurses have also been linked to negative nurse outcomes, such as job dissatisfaction and burnout, that are associated with staff retention problems.[6–8]

The California Department of Health Services spent two years holding hearings and inviting stakeholders to make recommendations regarding which nurse-to-patient ratio minimums should be mandated. In 2002 the department announced the final ratios, which went into effect on January 1, 2004.

The department's regulations specified staffing ratios for different specialties. For example, minimum staffing in general medical and surgical units were set at one licensed nurse for six patients for an eighteen-month phase-in period, and then reduced to one nurse for five patients.[1,2] Hospitals could staff with more nurses per set number of patients than specified, but not fewer.

The law allowed hospitals to be considered in compliance with the mandate if 50 percent of their required nursing staff was licensed vocational nurses, sometimes called licensed practical nurses. Licensed vocational nurses have less training and a more restricted scope of practice than registered nurses, and they are generally paid less. Some hospitals with higher proportions of licensed vocational nurse staffing, referred to as a "lower skill mix," have been shown to have poorer patient health outcomes.[9–11]

The law gave hospitals in markets where registered nurses were in short supply a mechanism to meet the state mandate with a lower skill mix. However, some feared that this could undermine the law's intent to boost patient safety with improved nurse-to-patient ratios.[3,12]

Many other states have staffing regulations that require actions such as collecting data on staffing, public reporting, and limits on over-time. Because they do not directly target staffing levels, these measures are likely to be far less effective than California's approach of mandating specific minimum staffing levels. As the only state with a clear and enforceable minimum nurse-to-patient ratio guiding hospital staffing decisions, California may provide valuable information for policy makers considering the appropriate nurse staffing policy design for other states.

For example, in the legislative session beginning January 2011, the Massachusetts Nurses Association proposed a similar bill that would require the Massachusetts Department of Public Health to limit the number of hospital patients a nurse can care for at one time. Currently under review in the Joint Committee on Public Health, that bill is scheduled for a hearing on September 21, 2011.

Previous studies of California's mandate on staffing and skill mix have either focused on a single point in time[8] or looked exclusively within California.[13–16] Comparing the changes in staffing in California to other states and the nation as a whole is necessary to determine the effect on staffing attributable to the state's law. The purpose of this article is to address this knowledge gap by conducting a longitudinal study with multiple comparison groups of US hospitals to assess the effect of California's nurse staffing law.

Study Data And Methods

DESIGN

The implementation of nurse-to-patient staffing ratios in California created an experiment in which the effect of the mandate could be assessed by comparing the changes before and

after implementation in California with changes in states without a similar policy. Our approach therefore used a longitudinal design with multiple comparison groups for the period 1997–2008.

Our goal was to assess the effect of California's policy on changes in hospital staffing and skill mix. Similar hospitals were selected based on propensity score matching. This technique provides a means of balancing the distribution of observable characteristics in the California and comparison hospitals. It approximates a randomized experiment in that the California hospitals were, except for being in California, similar to the comparison hospitals in observed characteristics such as size and teaching status.

We used two methods to assess the robustness of our findings. First, we compared California hospitals to all hospitals in states other than California. Second, to ensure that hospitals in one large state alone were not disproportionately accounting for the trend seen in the national average, we selected four states from which to compare hospitals to institutions in California: Florida, New York, Pennsylvania, and Texas.

Although California is unique in many ways, we selected states that, like California, had a large number of hospitals and sizable variation in hospital characteristics. In addition to having a large enough sample size, states were selected for geographical diversity, with variation between regions.

California has the most adult, nonfederal, acute care hospitals of any state. The comparison states represented the states with the second through fifth most such hospitals in the country: Texas, New York, Florida, and Pennsylvania, respectively (for additional detail, see the Appendix).[17]

DATA SOURCES AND VARIABLES

We analyzed hospitals' registered nurse staffing, nursing skill mix, and a number of control variables in all adult, nonfederal, acute care hospitals in the United States during the period 1997–2008. The primary data source for hospital characteristics was the American Hospital Association Annual Survey for the years 1997–2008. The universe of hospitals surveyed annually is about 6,000, and the overall response rate averages approximately 85 percent each year.

OUTCOMES

Two dependent variables were constructed to evaluate the effect of California's law: a staffing measure reflecting the ratio of registered nurses to patients, and a skill-mix measure reflecting the mix of registered nurses and licensed vocational nurses.

We measured staffing as the ratio of nursing hours per adjusted patient day. The variable was constructed based on full-time-equivalent registered nurse positions per adjusted patient day and using a standard conversion where one full-time-equivalent position equals nursing hours divided by 1,768, which represents the potential productive hours per year for a full-time-equivalent nurse.[18]

Skill mix–the ratio of registered nurses to total licensed nurse staffing–was evaluated as an outcome to determine whether California hospitals had reduced their skill mix in response to the law.We calculated skill mix as the number of registered nurses divided by total nursing staff (registered nurses and licensed vocational nurses).

COVARIATES

In models testing the specific effects of the mandate, we included multiple controls to account for the variance in staffing and skill mix. Time-varying hospital characteristics–that is, characteristics that were not fixed but could change from one year to the next–were drawn from the 1997–2008 American Hospital Association data. These variables were chosen as controls based on their previous use in staffing research and their potential to affect nurse staffing.[6,19–21]

Variables included number of beds; teaching intensity; occupancy rate; ownership status; Medicare case-mix index; percentage of admissions with Medicare as the primary payer; percentage of admissions with Medicaid as the primary payer; state registered nurse supply; and the Herfindahl-Hirschman Index (a measure of area-level competitiveness based on hospitals' market share in their service areas) as a proxy for market competition (see the Appendix for additional details on covariates).[17]

ANALYTIC APPROACH

We constructed a longitudinal panel data set of hospitals accounting for hospital consolidations and mergers from 1997 to 2008 for analysis. Variables contrasting California hospitals with hospitals from all other states were constructed for comparison over time.

We then used propensity score matching to match California hospitals with comparable hospitals from all other states. Using the baseline year of 2001 (the year prior to the announcement of the ratios faced by hospitals), the propensity score was the probability of an individual hospital's being a California hospital, conditional on observed covariates.

We assessed standard balance diagnostics to find the set of comparison hospitals that provided the best comparison group for the California hospitals. Further details on the matching approach, along with balance diagnostic tables, are in the Appendix.[17] We also compared California hospitals to comparison groups of hospitals, including all US hospitals as well as the individual state hospital populations of the four comparison states.

For all comparisons, we created time-period variables to indicate the three key time intervals: prior to 2002, the period before the final ratios were released; 2002–04, after the announcement but before the California regulations implementing the staffing ratios went into effect; and 2004–08, when the regulations went into effect. We refer to these intervals as the "preannouncement,""announcement," and "implementation" periods, respectively.

We were interested in determining whether there was an announcement effect–that is, if hospitals changed their staffing and skill mix once they knew the ratios they would face. We were also interested in seeing if there was an implementation effect once the ratio mandates were in place.

We evaluated the implementation effect by contrasting the implementation period with the preannouncement period for an overall effect, and also by contrasting it with the announcement period to determine the effect that was over and above any announcement effect.

We used separate hospital-level regression models to estimate the effect of the staffing mandate in California compared to each comparison group. To determine the effect of the mandate on registered nurse staffing and skill mix, we estimated models that included interactions between the variable indicating whether the hospital was a California hospital or not and the three time period variables (preannouncement, announcement, and

implementation). We evaluated the sign, size, and significance of the co-efficients for these interaction terms.

LIMITATIONS

Although our approach controlled for unobserved factors that could have increased staffing or nursing skill mix, some changes might be due to omitted factors or events in local history that are highly correlated with the staffing mandate. These factors could range from other staffing policies to reactions to publicity about quality problems at hospitals.

It is possible that there was systematic inflation in California hospitals' reports of their nurse staffing data following the implementation of the California mandate. However, using different data, other investigators[13–15] have shown trends in nurse staffing in California similar to those we found. This suggests that the pattern we observed was not attributable to bias in the data source.

Our data also did not include unlicensed care personnel, who may have been fired or hired at lower rates as a cost containment strategy–a possible unintended consequence of the mandate. However, there is no evidence in the research literature that having more unlicensed personnel in hospitals with adequate nurse staffing adversely affects patient outcomes.

Finally, our data refer to overall hospital staffing levels and are not specific to the individual specialty ratios mandated by the law. In previous work using primary data at the specialty level, hospitals in California were shown to have significantly higher staffing levels than two comparison states in every specialty area affected by the mandate.[8]

Study Results

Registered nurse staffing–measured as hours per adjusted patient day–was, on average, higher in California hospitals than in matched hospitals in other states in any given year. There was a notable downward trend in staffing in the preannouncement period (1997–2001) in both California hospitals (5.83 hours in 1997 to 5.67 hours in 2001) and matched hospitals from all other states (5.83 hours in 1997 to 5.64 hours in 2001) (Exhibit 1).

Nurse staffing began to increase both in California hospitals and in hospitals in other states after 2002. The rate of increase appears steeper in California (from 5.72 hours in 2002 to 6.03 hours in 2003) than elsewhere (from 5.66 hours in 2002 to 5.74 hours in 2003). There was a notable increase in staffing again for California hospitals in the implementation period (from 6.44 hours in 2004 to 7.11 hours in 2008). Staffing went from 5.75 hours to 6.22 hours in the comparison hospitals for the same period. Additional descriptive details on hospital characteristics are in the Appendix.[17]

Skill mix was higher in California hospitals at the beginning of the study period than it was in the matched set of hospitals in other states (Exhibit 2). From 2002 on, the trend was identical for California hospitals and other hospitals: Skill mix increased at an annual rate of 0.006 in both sets of hospitals.

Differences in the change in staffing from the announcement period to the implementation period between California hospitals and the comparison hospitals were significantly greater ($p < 0.001$) in all cases (Exhibit 3). The change in registered nurses' hours per patient day was twice as great in California hospitals compared to Texas hospitals, and five times that of New York hospitals.

The skill mix in California hospitals did not decrease following implementation of the staffing mandate as feared. In fact, it increased three percentage points (Exhibit 4). This increase was not significantly different from the comparison groups, whose skill mixes also increased (ranging from 1.4 percentage points to 3.2 percentage points). This suggests that the changes in skill mix in California largely matched the trend across the nation.

Our estimates of the effects of the nurse staffing mandate on California hospitals compared to hospitals not subject to a similar policy show little evidence that an announcement effect resulted in higher staffing in California hospitals. In the announcement period, nurses' hours increased by only 0.25 hour in California and by 0.09 hour in matched hospitals (difference = 0.16, $p = 0.09$) (Exhibit 5).

However, there is evidence of an implementation effect on staffing (1.00 hour increase in California versus 0.43 hour in matched hospitals, difference = 0.57, $p < 0.001$) (Exhibit 5). The implementation effect above and beyond the announcement period suggests that the policy resulted in roughly an additional half-hour of nursing per adjusted patient day beyond what would have been expected in the absence of the policy (range 0.43 [compared to all hospitals in Florida]–0.59 [compared to all hospitals in other states]).

There is no evidence supporting an announcement effect of the state's mandate on skill mix (difference in the announcement effect between California and matched hospitals = 0.004, $p = 0.27$). And there is little evidence of an implementation effect of the state's mandate on skill mix (difference in the implementation effect between California and matched hospitals = 0.002, $p = 0.52$). Skill mix was slightly lower (less than 2 percent) as a result of California's mandate compared to Florida and Texas. The skill mix change in California was no different compared to New York, Pennsylvania, and all other states combined.

Discussion

Our findings suggest that registered nurse staffing in California hospitals increased considerably as a consequence of the implementation of the state's nurse staffing mandate. We found no evidence that the policy resulted in lower nursing skill mix, including a higher proportion of licensed vocational nurses. To the contrary, skill mix increased.

California remains the only state to have implemented minimum nurse staffing ratios. However, other policy options to promote appropriate hospital nurse staffing have been implemented in a variety of states. These policies include mandating mechanisms at the hospital level to determine evidence-based staffing levels without mandating the actual levels, requiring public reporting of hospital nurse staffing, and limiting mandatory overtime by nurses.

None of these alternatives to fixed nurse staffing mandates have been rigorously evaluated to determine their effectiveness. Evaluations of these other policy options to match the emerging information on the impact of the California nurse staffing legislation would greatly inform the choices being considered by states and individual hospitals.

Prior to implementation, it was not certain that California's staffing mandate would result in improved staffing. This was particularly true given the unfunded nature of the mandate, competing financial constraints faced by California hospitals, and the nurse shortage. For the fourteen states that, as of March 2011,[22] had some form of nurse staffing legislation proposed or under study, our findings demonstrate that higher nurse-to-patient ratios can be achieved through a policy design featuring a fixed-ratio mandate.

Whether the cost of increased staffing provides adequate returns compared to other quality-improving initiatives remains to be determined. Research following the implementation of California's staffing mandate has shown that the increased staffing in California hospitals was associated with better outcomes, compared to outcomes for patients treated in hospitals in states without a similar law.[8] It has also shown that surgical mortality rates and rates of death among surgical patients with complications, known as "failure to rescue," in hospitals in New Jersey and Pennsylvania would be greatly reduced if those hospitals were to increase their staffing to a level on par with California's mandated level.

A few previous studies of California nurse staffing, primarily encompassing the period before the state's nurse staffing law was implemented, provide evidence that suggests a link between changes in staffing and changes in patient outcomes. David Harless and Barbara Mark found that increases in nurse staffing in California were associated with reductions in overall mortality as well as in surgical failure-to-rescue rates.[23] Julie Sochalski and colleagues similarly found that changes in nurse staffing in California before the mandate was implemented were associated with reductions in acute myocardial infarction mortality and failure to rescue.[14]

The effects were most pronounced for the hospitals with low baseline staffing to begin with. Such hospitals are exactly the institutions of most concern. The California Department of Health Services noted in its Final Statement of Reasons that the implemented ratios were aimed at remediating "the hospitals with the leanest staffing, effectively raising the bar for the standard of acceptable staffing."[4]

The association with patient outcomes is not universal, however. Linda Burnes Bolton and colleagues[15] found no relationship between changes in staffing and falls and pressure ulcers in a benchmarking sample of California hospitals.

If outcomes are shown to be better for patients treated in California hospitals compared to patients treated in hospitals in other states following implementation of the staffing ratios, the issue of cost remains. The expected registered nurse spending per hospital to comply with the mandate was estimated to be between $700,000 and $800,000.[24] Evidence suggests that these costs come, in part, because registered nurse wages in California have risen following the implementation of the state mandate.[25]

The wage growth was partly attributable to the severe nurse shortage that coincided with the implementation of the mandate.[26] California hospitals also faced unique and costly regulatory pressures, including requirements to strengthen the structures of older acute care hospitals to meet contemporary earthquake safety standards.[27]

The costs associated with increasing the number of nurses employed in hospitals may be offset by the costs of avoided poor outcomes and adverse events.[28–32] The potential for offsets and savings may be increased as value-based purchasing programs are implemented in response to the Affordable Care Act of 2010. For example, higher nurse staffing levels have been associated with fewer of the hospital-acquired conditions and infections that the Centers for Medicare and Medicaid Services no longer pays for, unless the complication was present when the patient was first admitted to the hospital.[33–35]

To address labor-supply concerns, policy makers might consider linking a staffing mandate with registered nurse workforce development, training programs, and targeted incentives for working in understaffed institutions. These steps might need to be taken to provide an adequate pipeline of nurses to keep up with the mandate's demands.

For example, when California's nurse staffing mandate was enacted, the California Nurse Workforce Initiative was also implemented to assist in growing the supply of nurses, although its impact was not immediately apparent. Such an approach may need to be considered in other states.

Conclusions

Our findings demonstrate that the nurse-to-patient ratio mandate in California was effective in increasing registered nurse staffing in hospitals. The concerns regarding reduced skill mix have not been realized. California hospitals, on average, followed the trend of hospitals nationally by increasing their skill mix, and they primarily used registered nurses to meet the staffing mandate.

Although multiple strategies could be pursued to increase hospital nurse staffing, California's state-mandated nurse staffing ratios have been shown to be successful in terms of increasing registered nurse staffing. From a policy perspective, this should be useful information to the states currently debating legislation on nurse-to-patient ratios.

A risk inherent in legislation is the possibility that unforeseen and unintended consequences may result. These risks may increase if more choice is provided to ease the implementation process, as in the case of California's provision to allow the nurse mandates to be met in part by the use of less qualified licensed vocational nurses.

Our findings suggest that this option was not widely used in California despite a serious shortage of nurses there when the mandates were implemented. Other research suggests that various strategies, including the increased use of travel nurses–temporary nurses employed by external agencies–were used to maintain the registered nurse skill mix.[8]

Although we were not able in this article to address all of the possible unintended consequences of the legislation, we found none that were likely to affect the quality or safety of care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Higher nurse-to-patient ratios can be achieved through a policy design featuring a fixed-ratio mandate.

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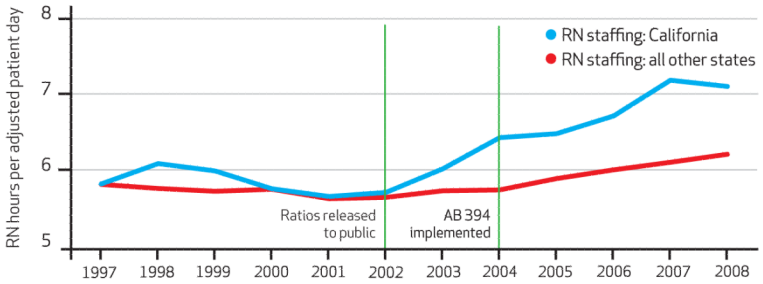

EXHIBIT 1. Registered Nurse (RN) Staffing In California Hospitals Compared To A Matched Set Of Hospitals In Other US States, 1997–2008

SOURCE Authors' analysis of data from American Hospital Association Annual Survey, 1997–2008.

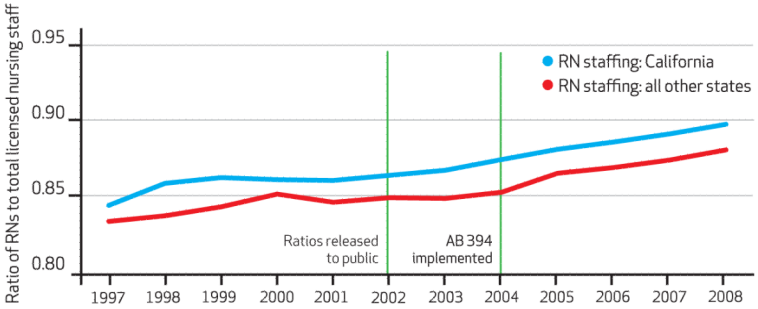

EXHIBIT 2. Nursing Skill Mix In California Hospitals Compared To A Matched Set Of Hospitals In Other US States, 1997–2008

SOURCE Authors' analysis of data from American Hospital Association Annual Survey, 1997–2008. NOTE RN is registered nurse.

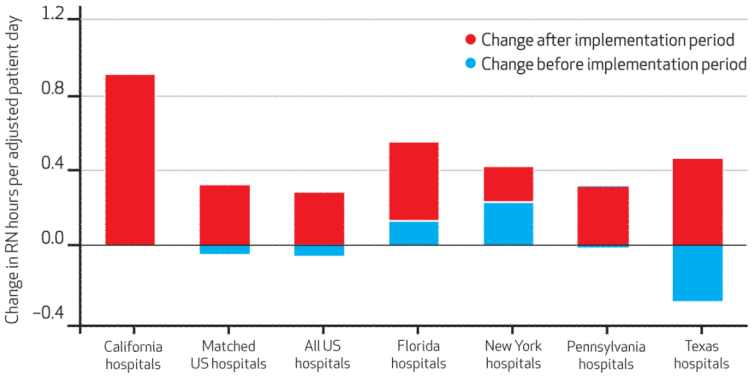

EXHIBIT 3. Changes In Nurse Staffing In California Hospitals And Comparison Groups Before And After Implementation Of California's Staffing Ratios In 2004
SOURCE Authors' analysis. NOTE RN is registered nurse.

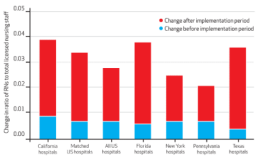

EXHIBIT 4. Changes In Nursing Skill Mix In California Hospitals And Comparison Groups Before And After Implementation Of Staffing Ratios In 2004
SOURCE Authors' analysis. NOTE RN is registered nurse.

EXHIBIT 5

Effect Of California Staffing Mandate On Changes In Nurse Staffing And Skill Mix In California Hospitals, Compared To Matched Hospitals In States Without A Similar Staffing Policy, 1997–2008

	Staffing (RN hours per patient day)		Skill mix (RNs as percent of all nursing staff)	
	Announcement effect	**Implementation effect**	**Announcement effect**	**Implementation effect**
Change in California hospitals	0.25***	1.00****	<1	2
Change in matched hospitals	0.09	0.43****	<1	2
Difference in effect between California hospitals and matched hospitals	0.16	0.57****	0.40	−0.20

SOURCE Authors' analysis. NOTES The announcement effect represents the change in the period 2002–03. The implementation effect is the effect beyond that of the announcement period. Beta coefficients are from separate ordinary least squares fixed-effects regression models estimating the effects of California's staffing mandate on staffing and skill mix using a propensity score–matched comparison group of hospitals in states other than California. Staffing is registered nurse (RN) hours per adjusted patient day. Skill mix is the proportion of registered nurses among all licensed nurses (registered nurses plus licensed vocational nurses). An expanded version of this exhibit, with coefficients and standard errors for differences between California and all comparison groups, appears in the Appendix (see Note 17 in text).

*** $p < 0.01$

**** $p < 0.001$