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# EVIDENCE ON HOSPITAL STAFFING & OUTCOMES:

## IMPLICATIONS FOR WASHINGTON

Fitzhugh Mullan  
Institute for Health  
Workforce Equity

THE GEORGE WASHINGTON UNIVERSITY

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## EXECUTIVE SUMMARY

In the early 2000s, the first studies emerged showing the negative effects on patient mortality of low registered nurse (RN) staffing levels in hospitals. Since that time, state legislators in Washington state and around the country have grappled with the question of how best to ensure public safety and protect the workforce when hospitals do not adequately staff.

This report summarizes the research demonstrating that nurse and nurse assistive personnel staffing levels are associated with patient safety and staff wellbeing ([Section 3](#)). The next section reviews evidence on the effect of nurse staffing laws on staffing levels ([Section 4](#)). It then presents Washington-specific data analysis derived from two national studies in which the author participated that locate Washington in this national debate ([Section 4.2](#)). Lastly, it examines research on the outcomes of California's staffing law ([Section 4.3](#)) and summarizes a major prospective experimental study that assesses outcomes of a nurse staffing mandate law in Queensland, Australia ([Section 4.4](#)).

There are hundreds of studies on the outcomes of nurse staffing in the United States, and dozens more in other countries. **Studies have shown that nurse staffing levels are significantly associated with the following:**

- patient mortality and failure to rescue, using many different data sources and analytic approaches ([Section 3.1](#));
- adverse patient events, including: hospital acquired pneumonia, unplanned extubation, respiratory failure and cardiac arrest in ICUs, decubitus ulcers, falls, urinary tract and surgical site infection, as well as longer restraint application duration, more medication errors, and longer times to diagnosis in the emergency room ([Section 3.2](#));
- longer lengths of stay, higher rates of 30-day patient readmission and lower patient satisfaction ([Section 3.3](#)); and
- nurse burnout, job satisfaction, and occupational harms, specifically needle stick injuries ([Section 3.5](#));
- cost savings in health services that surpass the expense of additional nurses ([Section 1](#), [Section 4.4](#)).

The literature also suggests nurse staffing levels interact with other elements in the nurse practice environment, and that the effect of nurse staffing on patient outcomes tends to be largest in hospitals with poor work environments, and in hospital units with the sickest patients ([Section 3.5](#)).

There is less research on nursing assistive personnel and quality of care, but at least three important studies suggest that higher support staff levels are associated with reduced patient mortality and better patient satisfaction ([Section 3.4](#)).

Fourteen states have responded to this evidence with legislation ([Section 4.1](#)). Three general approaches have been used: (1) directly mandating nurse to patient levels, (2) requiring staffing committees that include bedside nurses (in the hopes that their perspectives will be considered by hospital administrators), and (3) public reporting of staffing levels, (in the hopes that consumers will “vote with their feet” and put market pressure on hospitals). Just one state,

California, mandated minimum nurse to patient staffing ratios for all hospital units. The other thirteen, including Washington, have tried the two “softer” types of laws. In 2008, the Washington State Legislature enacted a required staffing committee law, and in 2017, enhanced the legislation by adding a public reporting requirement and additional enforcement and complaint mechanisms ([Section 4.2](#)).

The first national level study to assess these three legal approaches used a “difference in difference” design to compare staffing changes in states utilizing one of the three approaches to states with no law of any kind, during the period 2003 to 2018 ([Section 4.1](#)). The study concluded that **only the mandate has had any significant effect on nurse and nurse-support staffing levels.**

Data on Washington extracted from this study showed that, while hospital RN hours per patient day increased by 55% in California during those years, the increase in Washington was just 6%. In 2018, California had reached an average of 9.02 RN hours per adjusted patient day, while in Washington it was 6.8 ([Section 4.2](#)).

Another study looking at staffing levels needed to improve patient satisfaction showed the important role that RNs and nursing assistive personnel play ([Section 3.4](#)). Using the same data set and approach as the national study, the Washington-specific analysis conducted for this report suggested that, depending on the patient satisfaction subscale, between 5% and 13% of Washington hospital observations would need to increase RN staffing to see any marginal benefit in patient satisfaction ([Section 4.2](#)). Only 2-5% (depending on the subscale) of hospital observations in Washington have reached this peak level. For nursing assistant (NA) personnel, these patterns are even more dramatic. Between 33% and 75% of hospital observations had NA staffing levels so low that their contribution to patient satisfaction was below zero. Just 2-6% of hospital observations had NA staffing levels high enough to reach the peak marginal contribution.

The California law has been studied by scores of researchers ([Section 4.3](#)). Results show not only that nurse staffing increased, and that skill mix (RNs as percent of all nursing staff) did not suffer. One major study comparing California to two other states found improvements in some areas of quality of care. A longitudinal survey showed increases in nurse job satisfaction since the law's implementation in 2004. Two very early studies using a convenience sample found no improvements, and three later studies with more rigorous difference in difference designs found mixed results.

Internationally, there has also been considerable research and policy action on nurse staffing levels ([Section 4.4](#)). Ireland, Wales, Scotland and two states in Australia have implemented mandates. The case of Queensland, Australia was recently evaluated using the first ever prospective experimental design. They found significant improvements in patient safety in the intervention hospitals, when compared to control hospitals. The authors also concluded that savings as a result of avoidable health services surpassed the costs of increased staffing.

**This summary of available research suggests that Washington could do more to ensure safe staffing in its hospitals.** It is important for policymakers to understand this varied and robust evidence as they consider whether to make Washington the second state in the nation to mandate safe staffing.

## 1. INTRODUCTION

In the early 2000s, the first studies emerged showing the negative effects on patient mortality of low registered nurse (RN) staffing levels in hospitals. Since that time, state legislators in Washington state and around the country have grappled with the question of how best to ensure public safety and protect the workforce when hospitals do not adequately staff.

This report summarizes the research suggesting, first, that **there are minimum thresholds of nurse and nurse assistive personnel staffing levels necessary to ensure patient safety and staff wellbeing**, and second, that **staffing levels can be modified through regulation and policy**. It then presents Washington-specific data analysis derived from two national studies, in which the author participated, that locate Washington in this national debate. The report then examines research on the outcomes of California's staffing law and summarizes a major prospective study on an important international experience in staffing regulation in Queensland, Australia.

## 2. BACKGROUND

The problem of unsafe staffing is once again in stark relief as the COVID-19 pandemic enters its third year, and hospitals around the country face a vicious cycle of low nurse staffing, nurse burnout and resignations, worsening nurse shortages, moral injury and burnout among those remaining. Indeed, the massive hemorrhaging of nurses has meant some states, including Washington, have had to mobilize the National Guard to help (Olympian 2022), and others have had to use taxpayer dollars (in the form of COVID relief funding) to subsidize hospitals' use of travel nurses (Burkhalter, 2021; R. T. Garrett, 2021; Gooch, 2021). **Travel nurses are extremely expensive and the growing reliance on them has not only harmed hospitals financially, but it has also contributed to low morale among the incumbent nurses and further incentivized their resignations** (Eschner, 2021).

This is not the first time this nurse shortage has occurred. In the early 2000s, a similar phenomenon took place across the nation. In the 1990s cycle, managed care's pressure on hospitals to cut costs led to thousands of nurses being laid off. This, in turn, led to fewer young people interested in going into the profession. Finally, in the early 2000s, the nations faced a national shortage of nurses, and concerns about unsafe staffing levels led to strikes and burnout among exhausted nurses (Nevidjon & Erickson, 2001).

The shortage led to a surge in the international recruitment of nurses. While many nurses came from the Philippines (which had intentionally overproduced nurses to encourage migration), some also came from African and Caribbean nations that could ill afford to lose them (P. Pittman et al., 2007; P. Pittman et al., 2010). Moreover, these nurses recruited in low-income countries were obligated to sign contracts at minimum prevailing wages and high breach fees that locked them into jobs for two to four years. This dynamic interrupted what would likely have been an opportunity for the domestic labor market to find equilibrium though improved wages and

working conditions for U.S. nurses (P. Pittman et al., 2012; P. Pittman & Pulver, 2020). Not surprisingly, in 2022 we are now seeing an increased demand for international nurses again (Elhi, 2022).

Among nurse leaders, even those in hospital executive roles, there is general agreement that a major driver of the under investment in nurses and assistive personnel staffing in hospitals is the fee for service billing system that still dominates in the United States (P. Pittman et al., 2021). Unlike physicians and advanced practice clinicians, nurses and support staff cannot bill for their services, making them cost drivers, rather than revenue generators, from the hospital administrator's perspective. Because many hospital administrators are rewarded for short term cost reductions, **cutting nurses and support staff has been one of the fastest ways to cut costs.** Indeed, we saw this during the early months of the COVID-19 pandemic. When hospital revenue fell due to the postponement of elective procedures, thousands of nurses and support staff were furloughed or laid off (Fadel et al., 2020). These layoffs were occurring even as hospitals received billions of dollars in emergency funds from the federal government (Silver-Genberg et al., 2020).

Hospital executives' perspective on nurse labor costs stands in contrast to the work of health economists who have estimated the value to society of each additional nurse hired (Dall et al., 2009). Dall and colleagues calculated **annual medical savings per additional RN include \$7,400 from preventing nursing sensitive adverse events (e.g., ulcers, falls and hospital acquired infections), \$38,100 for hospital-related savings and \$2,500 for professional services savings related to reduced length of stay resulting from the prevention of adverse patient events. They add to this the estimated productivity benefits of patients per additional RN, resulting from better patient care, at \$10,300 for reduced patient mortality, and \$1,800 from faster recovery.**

While hospitals often call for flexibility in staffing and say that nurses should make staffing level decisions, as Schlack and her nursing colleagues point out in a recent "blueprint" to address moral injury and burnout in nursing, it is usually the central budget office, not nurse managers, that makes decisions to constrain hiring or to reduce staff (Schack et al., 2022).

This report synthesizes the robust evidence that has emerged over time that hospital nurse and ancillary staffing levels are significantly associated with patient and nurse outcomes. It then reviews the effectiveness of different types of laws used by states to date, and more closely examines research on Washington, California and Queensland, Australia's laws.



### 3. PATIENT AND NURSE OUTCOMES

This section examines the effect of nurse staffing on three types of patient outcomes: (1) mortality and failure to rescue, (2) adverse patient events and length of stay, and (3) other quality measures, specifically readmission and patient satisfaction. In subsection 4, we review evidence that examines the relationship of nursing assistive (support) staff levels and quality outcomes. Lastly, in subsection 5, we examine the research on nurse staffing levels on nurse outcomes, such as satisfaction and burnout.

The literature on nurse staffing outcomes is vast. A PubMed search of nurse staffing and patient outcomes in the United States since 2000 produced 1898 references, 722 of which were studies in the United States. 206 of these were classified as reviews, and 72 were systematic reviews. Some of the more prominent reviews on the effects of nurse staffing on patient outcomes over the last 15 years are used in this report (Butler et al., 2011; C. Garrett, 2008; Kane et al., 2007; McGahan et al., 2012; Rae et al., 2021; Shekelle, 2013; Shin et al., 2018, 2019; Wynendaele et al., 2019).

Studies of nurse staffing are observational, as randomized designs are not possible. Designs have been primarily cross-sectional (comparing cohorts of hospitals at one point in time), although a few have also been longitudinal. Data sources on nurse staffing were either administrative or survey-based. The most commonly used nurse level control variables were gender, experience, nursing specialty, age, and education. Hospital characteristics generally accounted for were size of hospital, teaching status, technology and location. Many studies adjusted for patient characteristics as well, including case mix, and a few studies examined skill mix of nursing as well [RN, licensed practical nurses (LPNs) and nursing assistive personnel (NAP)].

The main independent variable (staffing) has been measured in two basic ways. The first examines the number of patients for whom each nurse was responsible during their last shift. It is most often self-reported in surveys. The second approach measures staff hours per patient day (HPPD), as the ratio of “productive hours worked” to “patient census days.” Some studies have calculated HPPD and then approximated patient to nurse ratios by dividing by the 24 hours in patient day (Min & Scott, 2016; Spetz et al., 2008).

**The summary conclusion of these reviews has been that there are scores of studies that show a significant relationship between low nurse staffing levels and both poor patient and nurse outcomes.** There are about four U.S. studies that found this relationship for some outcomes, but no statistically significant relationships for one or more of the outcomes being examined. The size of the effect of nurse staffing levels on outcomes appears to vary by hospital units (larger effect with higher acuity patients), and by type of hospitals (for example, by nurse work environment).



### **3.1 Mortality and Failure-to-Rescue**

Two landmark studies, using different data and methods were published in 2002, establishing what has now become a robust field of research examining nurse staffing levels and patient outcomes. Using administrative data and controlling for patient acuity at 799 hospitals in 11 states, Needleman and colleagues showed that **fewer RN hours of care per day were associated with a higher “failure to rescue” rate** (i.e., death from pneumonia, shock or cardiac arrest, upper gastrointestinal bleeding, sepsis, or deep venous thrombosis) (Needleman et al., 2002). In the same year, Aiken et al. found **higher mortality among all patients when RN staffing was lower** (Aiken, Clarke, Sloane, et al., 2002). Her team used a cross-sectional analysis of nurse surveys, adjusting for patient and hospital characteristics, and found **each additional patient per nurse was associated with a 7% increase in the likelihood of 30-day mortality among all patients.**

A 2007 meta-analysis of twenty-eight studies by Kane and colleagues concluded that **increased RN staffing was associated with lower hospital related mortality in intensive care units (ICUs)** with an odds ratio (OR), 0.91; in surgical units (OR 0.84); and in medical units (OR 0.94) per additional full-time employee (FTE) per patient day (Kane et al., 2007).

Rae and colleagues conducted an international review in 2021 which focused specifically on intensive care units. They also found strong evidence that **higher critical care nurse staffing levels are associated with reduced rates of mortality** (Rae et al., 2021). In particular, two recent studies by Blegen and colleagues (2011) and Checkley and colleagues (2014) confirmed the significance of the association (Blegen et al., 2011; Checkley et al., 2014).

Needleman and colleagues enhanced their methodology in a more recent study examining the association of nurse staffing with patient outcomes (Needleman et al., 2020). While most prior studies compared high- to low-staffed hospitals, which could lead to unobserved differences between these groups, this study included an analysis at the unit level (as opposed to the whole facility), as well as variations in staffing at the shift level, and included both nursing support staffing and patient turnover as control variables. The authors found shifts with low RN staffing were associated with 2.3% increased mortality, although if this low count was restricted to the second to fifth days of the admission, it rose to 9.1%.

Aiken and colleagues also advanced the field with a 2011 study that examined the impact of increased nurse staffing on different types of hospitals based on their work environment (Aiken et al., 2011). They found decreasing workloads by 1 patient per nurse, reduced deaths and failure-to-rescue on average, but that these **effects also differed depending on nurse work environment.** In hospitals with average environments, deaths and failures were reduced by 4%, while in hospitals with the best environments they fell by 9% and 10%, respectively.

There is also some evidence of a **differential effect of low nurse staffing by the race of the patients served.** Carthon and colleagues found that for 30-day mortality rates and failure to

rescue rate, Black patients experienced slightly higher odds of death with each additional patient per nurse when compared to white patients (Carthon et al., 2012).

### **3.2 Adverse Patient Events and Length of Stay**

Kane and colleagues' 2007 meta-analysis of 28 of the most rigorously designed studies also assessed the effects of nurse staffing on adverse patient outcomes, and the related variables of length of stay (Kane et al., 2007). They found **an increase of 1 RN per patient day was associated with a decreased odds ratio of hospital acquired pneumonia, unplanned extubation, respiratory failure, and cardiac arrest in ICUs.**

Shin and colleagues conducted a review of 19 published studies that examined hospital acquired conditions as of 2018, 11 of which were in the United States (Shin et al., 2019). Overall, they found that the measures of staffing levels mattered. Total hours of nursing care per patient day and FTE RNs + LPNs/1,000 patient days was the measure found to be significantly related to hospital-acquired conditions. The less specific measure of RN hours per patient day alone did not reveal a significant relationship with hospital-acquired conditions. Among the U.S. studies in this review, two studies found **low staffing increased decubitus ulcers** (Blegen et al., 2011; Unruh, 2003) and three studies found **staffing associated with falls** (Dunton et al., 2004; Everhart et al., 2014; Staggs et al., 2012).

Additional landmark studies included Cimotti and colleagues' 2012 study showing **urinary tract infection and surgical site infection to be significantly associated with nurse staffing levels** (Cimiotti et al., 2012). Whitman and colleagues' 2019 study found total staff member work hours to be significantly related to falls in cardiac intermediate care units and **medication errors in the cardiac ICU and non-cardiac intermediate care units** (Whitman et al., 2002). They also found **restraint application duration rate was significantly inversely related to staff hours** worked in medical-surgical units.

Rae and colleague's 2021 systematic review specific to intensive care units also found a significant relationship between higher nursing staff levels and lower nosocomial infection (Rae et al., 2021). Four U.S. based studies were particularly important in demonstrating this relationship (Amaravadi et al., 2000; Blegen et al., 2011; Dorsey et al., 2000; Stone et al., 2007).

In summary, the evidence suggests that while the size of the effect of staffing on adverse patient events may vary by type of hospital units, **overall, lower staffing levels were associated with higher rates of hospital acquired infections and adverse patient events.**

### **3.3 Other Quality Outcomes**

Of particular interest are quality measures for which the Center for Medicare and Medicaid Services (CMS) either penalizes or rewards hospitals. If increased staffing improves these outcomes, the additional revenue could arguably cover all or part for the additional labor costs.

These include length of stay (LOS), 30-day readmissions, patient satisfaction, and time to diagnosis in emergency departments.

LOS has long been used as a measure of quality and was the impetus for Medicare's payment shift to payment for Diagnosis Related Groups (DRGs) in the 1980s. CMS sets payment rates prospectively for inpatient stays based on the patient's diagnosis, procedures, and severity of illness (CMS 2015), thereby reducing the incentives for longer stays. In Kane and colleagues' meta-analysis of 28 studies, they found **higher nurse staffing was associated with 24% shorter LOS in ICUs and 31% shorter LOS among surgical patients** (Kane et al., 2007).

Since implementation of the Hospital Readmissions Reduction Program in 2012, Medicare reduces payments to hospitals with an excess of readmissions within 30-days of being discharged for acute myocardial infarction, chronic obstructive pulmonary disease, heart failure, pneumonia, coronary artery, bypass graft surgery, or elective primary total hip arthroplasty and/or total knee arthroplasty (*Hospital Readmissions Reduction Program (HRRP)*, 2021). This penalty has made 30-day readmissions an important patient outcome to track, since penalties could, in theory, encourage hospitals to increase nurse and nurse assistive personnel staffing levels.

There is now evidence that **hospitals with higher nurse staffing were less likely to be penalized for 30-day readmission**. McHugh and colleagues found that highly-staffed hospitals had 25% lower odds of being penalized compared to otherwise similar hospitals with lower staffing (McHugh et al., 2013). The authors suggest that this may be because nurses caring for fewer patients have more time for direct patient care and patient and family education.

These results have been reproduced in a variety of types of hospitals and with different clinical conditions. For example, Lasater and McHugh found that, adjusting for patient and hospital characteristics, patients that had received major joint replacement had 8% higher odds of 30-day readmission and 12% higher odds of 10-day readmission for each additional patient per nurse (Lasater & Mchugh, 2016).

Similar results were found by Guliano and colleagues who studied heart failure in the top US adult cardiology and heart surgery hospitals (Giuliano et al., 2016). They found hospitals with a lower nurse staffing index had a significantly higher excess readmission rate.

Staffing levels have also been linked to readmissions among the pediatric population. Tubbs-Cooley and colleagues found that children treated in hospitals with pediatric staffing ratios of 1 to 4 or less were significantly less likely to be readmitted within 15–30 days (Tubbs-Cooley et al., 2013).

Another quality-of-care measure that has gained visibility as a result of Medicare reimbursement policies is **patient satisfaction**. The results from Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) are publicly available on the Hospital Compare website (*Hospital Compare*, 2021). As of 2016, HCAHPS scores were included in the Centers for Medicare

& Medicaid Services (CMS) Value-Based Payment Modifiers, which increase payments to hospitals based on a variety of quality-of-care scores.

There is a growing body of evidence showing that **higher nurse staffing improves patient satisfaction**, as measured by HCAHPS scores. Jha and colleagues found that hospitals in the bottom quartile, in terms of nurses to patient-days, had lower scores on the question “would definitely recommend” the hospital, compared with those in the top quartile (63.5% vs. 70.2%) (Jha et al., 2008).

Hockenberry and Becker also found positive associations between nurse staffing and HCAHPS in California (Hockenberry & Becker, 2016).

Martsof and colleagues found positive associations between nurse staffing and HCAHPS in three states—California, Maryland, and Nevada from 2009 to 2011 (Martsof et al., 2016). In their cross-sectional model, they found a significant effect on all seven subcategories, but in a more rigorous design that used hospital fixed effect longitudinal analyses, significance was limited to three of the seven: adequate discharge information, adequate communication about medications, and recommend the hospital to others.

A third quality measure that has been studied is **time to diagnosis** in Emergency Departments, which is also now included in CMS’ Pay-for-Performance Program. Shindul-Rothschild and colleagues found “**time to a diagnostic evaluation**” **more than doubled from 30 minutes to 61 minutes, when they compared one RN to 11.32 patients, to one RN to 14.8** or more over the course of 24 hours (Shindul-Rothschild et al., 2017). Delay in evaluation time has been associated with an increased risk of death and significant delays in receiving pain medication (Gabayan 2015).

### **3.4 Nursing Support Staff**

While most of the research on staffing levels has focused on RNs, and in some cases RNs as a percent of total nurse staffing (skill mix), few studies have examined the independent effect of nurse assistive personnel on patient outcomes.

In an important study, Needleman and colleagues showed **an increase in mortality when there was low nursing support staffing**, with an estimated hazard ratio similar to shifts with low RNs (Needleman et al., 2020). In addition, they found an interaction effect when both RNs and nursing support staff was low that was even higher. The authors propose two important mechanisms for this finding. First, nursing support staff contribute to nurses’ work by identifying patients who need attention. Second, when nurse support staffing is lacking, their work must be done by nurses, thereby reducing the nurses’ ability to complete their own work.

Delhy and colleagues showed in their study that nurse assistive personnel staffing levels had a significant effect on patient satisfaction (Delhy et al., 2021). Using a production function

approach, we found that patient satisfaction scores (HCAHPS) generally improve with increases in both RN and NA hours per patient day. However, the gap in staffing between the national average current levels and the marginal impact levels needed to have any effect on patient satisfaction scores was greater for nursing assistive personnel than for RNs. In other words, when actual staffing is compared with the levels needed to significantly improve patient satisfaction scores, nursing assistive personnel appear to be the more under-employed labor input. We suggest that given the low cost of labor associated with NA employment, it is surprising that hospitals do not employ more assistive personnel.

### **3.5 Nurse Workforce Outcomes**

#### **Burnout and Job Satisfaction**

Reports on rates of nurse burnout prior to the 2020 COVID pandemic have historically been about 35% (Cimiotti et al., 2012). The effects of burnout on nurses' health, as well as on their retention rates has made these figures a point of ongoing concern. **In a study of nurses who reported leaving their job in 2017, 31.5% reported burnout as a reason, and of those, 60.9% cited inadequate staffing as the cause** (Shah et al., 2021).

Numerous studies have found that each additional patient per nurse increased the odds of nurses' job dissatisfaction (Aiken, Clarke, & Sloane, 2002; Aiken et al., 2008, 2010; Hairr et al., 2014; McHugh & Ma, 2014). These studies suggest that each additional patient increased the odds of burnout from 1.07 to 1.15. Aiken and colleagues in their landmark 2002 study found that nurses in hospitals with 8:1 patient to nurse ratio were 1.75 times as likely as nurses with 4:1 ratio to be dissatisfied with their jobs. One study did not find nurse staffing to be associated with improved nurse job satisfaction, although they found an association with a range of other work environment factors (Kutney-Lee et al 2013).

The importance of reducing burnout is not limited to the impact on nurse retention, it also contributes to the patient level outcomes documented above. Cimiotti and colleagues in their study of hospital infections also showed that **hospitals in which burnout was reduced by 30% had a total of 6,239 fewer infections, for an annual cost saving of up to \$68 million** (Cimiotti et al., 2012).

The impacts of the COVID pandemic on nurse staffing are as yet undocumented. But an August 2021 survey conducted by the American Association of Critical-Care Nurses reported 66% of ICU nurses were considering leaving their jobs, and 92% believe the pandemic has depleted nurses at their hospitals, and because of this, their careers will be shorter than they planned (*Hear Us Out Campaign Reports Nurses' COVID-19 Reality*, 2021).

#### **Other Occupational Harms**

In addition to psycho-social harms, nurse staffing has also been associated with other occupational harms. A seminal study on needle stick injuries was conducted by Clarke and

colleagues. Among 960 nurses across 40 units in 20 hospitals, nurses from **units with low staffing and poor organizational climates were twice as likely as nurses on well-staffed and better-organized units to report risk factors, needlestick injuries, and near misses** (Clarke et al., 2002).

Studies on nurse staffing levels and COVID infection rates are an important area for future research. As of April 2021, over 3,600 healthcare workers had died of the disease according to the Lost on the Frontlines project. The highest proportion of these workers were nurses (35%), followed by health care support workers (20%).

## 4. STAFFING LAWS

### 4.1 *Types of Laws*

In response to this overwhelming evidence on the relationship of nurse staffing to patient and nurse outcomes, states are grappling with their options in terms of legal approaches to ensure safe staffing.

Across the country, three approaches have been used to regulate staffing in hospitals to date: (1) directly mandating nurse to patient levels, (2) requiring staffing committees that include bedside nurses (in the hopes that their perspectives will be considered by administrators), and (3) public reporting of staffing levels, (in the hopes that consumers will “vote with their feet” and put market pressure on hospitals to staff up).

Just one state, California (in 2002), (*CA Health & Safety Code*) mandated minimum nurse to patient staffing ratios for all hospital units, although waivers may be granted to rural general acute hospitals. In 2014, Massachusetts passed a law to mandate nurse levels, but only in intensive care units.

Thirteen other states, including Washington, have tried variations on the other two approaches. Oregon was the first state to attempt the staffing committee approach in 2001. In 2008, the Washington State Legislature enacted a similar law, RCW 70.41.420 (*Healthcare in Washington*, n.d.). In the years 2008-2009, Ohio, Connecticut, Illinois and Texas followed suit with almost identical laws.

In 2004, New Jersey became the first state to legislate public reporting of the ratio of patients to registered nurses, licensed practical nurses, and certified nurse aides. Rhode Island, Vermont, Illinois and New York followed suit in the subsequent years with similar policies. In 2017, Washington also amended its legislation to add public reporting to the staffing committee requirement, which went into effect in 2019 and expired June 2021 (*Healthcare in Washington*, n.d.).

In the first national study to compare these three legal approaches, Han and colleagues used a difference in difference approach (DID) to compare changes in staffing in states utilizing one of the three approaches to states with no law of any kind, during the period 2003 to 2018 (Han et al., 2021). Washington's 2008 staffing committee law was considered, but the 2017 public reporting was not included because implementation began in 2019.

**The study found that only the mandated minimum staffing law had a significant effect on staffing levels.** After controlling for hospital characteristics, state-level factors, and year and hospital fixed effects, there was no statistically significant change in total licensed nurse (RN plus LPN) hours in states that legislated a staffing committee, while there was a positive but not significant effect in states that legislated public reporting. In the state that mandated staffing levels (California), there was an increase of 0.996 hours per patient day (DID= 1.022) in total licensed nurse hours compared with states that did not have staffing legislation after the legislation was implemented.

## 4.2 Washington

As described above, Washington state implemented a nurse staffing committee law requiring 50% of the committee to be composed of direct care nurses in 2008, and then, in 2017, the state strengthened the law by adding a public reporting requirement (*Staffing Transparency and Accountability Act, 2017*). The new law was implemented in 2019 and expires June 1, 2023. It included several measures to enhance enforcement of the staffing committee recommendations in each hospital.<sup>1</sup>

We found no independent evaluations of Washington's experience with either the 2008 staffing committee law, or the 2017 enhancements. An examination of the public website reporting data provided to the state since the 2019 implementation of the public reporting requirement shows that many hospitals failed to report, and that among those that did submit data, submissions were provided and made public in a variety of formats, making it almost impossible to aggregate or compare across hospitals (*Hospitals: Nurse Staffing*, n.d.).

As an alternative, we extracted and analyzed Washington specific data (not published) from two national peer reviewed studies described above, and in which this author participated: the Hans

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<sup>1</sup> Enhancements to the law require hospitals to accept the staffing committee's staffing plan or to prepare an alternative annual staffing plan that will be adopted by the hospital; require hospitals to submit the adopted staffing plan and subsequent changes to the staffing plan to the Washington State Department of Health beginning January 1, 2019, requires hospitals to implement these plans; allows nurses to file a complaint with the staffing committee; requires staffing committees to develop a process to examine and respond to these complaints; requires the Washington State Department of Health to investigate complaints; require hospitals to submit a corrective action plan within 45 days if the Washington State Department of Health (DOH) finds a violation; fine hospitals that fails to submit a corrective action plan; requires the Washington State Department of Health to submit a report to the legislature by December 31, 2020, on complaints submitted, investigated, associated costs to DOH and any recommended changes to statute.

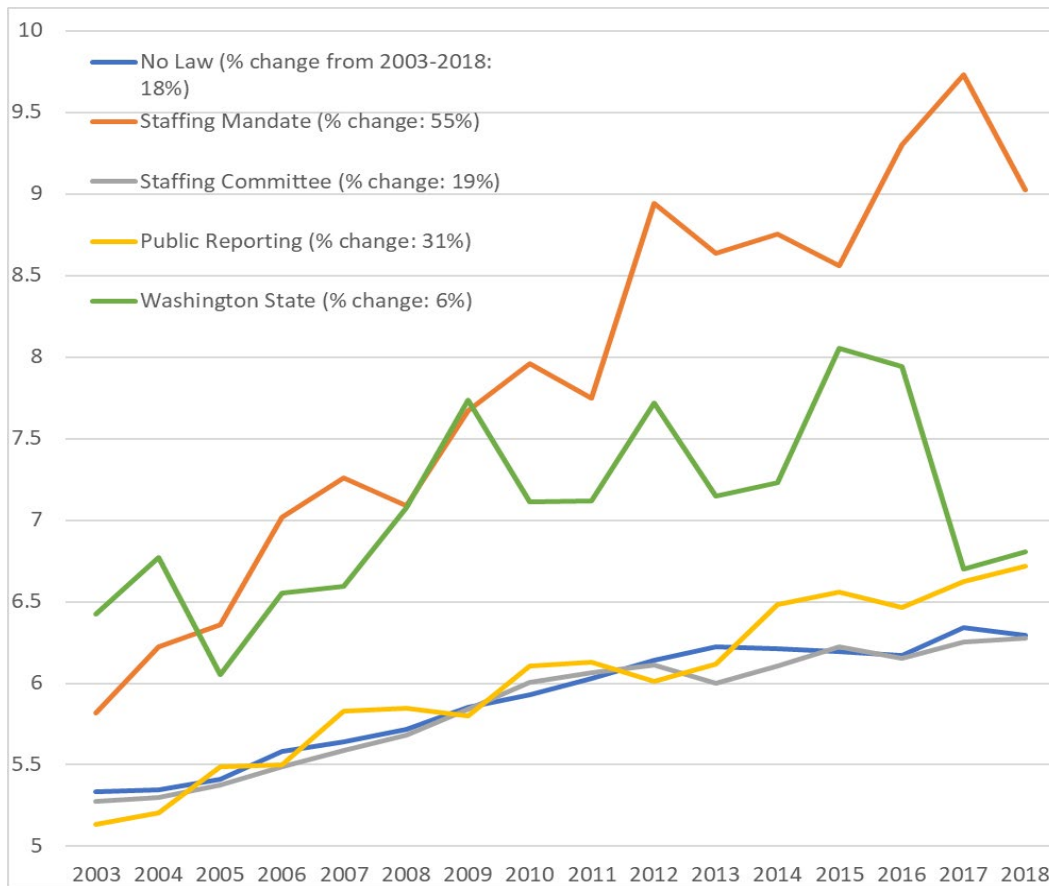


and colleagues’ study, and the Delhy and colleagues’ study (Hans et al., 2021; Delhy et al., 2021). Both studies used facility level staffing data from the American Hospital Association’s (AHA) Annual Survey to determine RN and nursing assistive personnel (NAP) hours per patient day.

**Descriptive Trends for RN and NAP staffing**

Using data from the Han and colleagues study summarized above, we show aggregate nurse staffing levels from 2003 to 2018 for RNs in Washington state (green), and nationally, by type of law and no law (Han et al., 2021). These data suggest that hospital RN hours per patient day increased dramatically (55%) in the one state that legislated minimum ratios (California), while the increase was 31% in states that legislated public reporting, and 19% in states that legislated staffing committees. Washington increased by only 6%. In terms of actual numbers in 2018, California was 9.02 RN hours per patient data, while in Washington it was 6.8.

**Figure 1: RN Staffing Hours per Patient Day 2003-2018 by Type of State Nurse Staffing Laws**

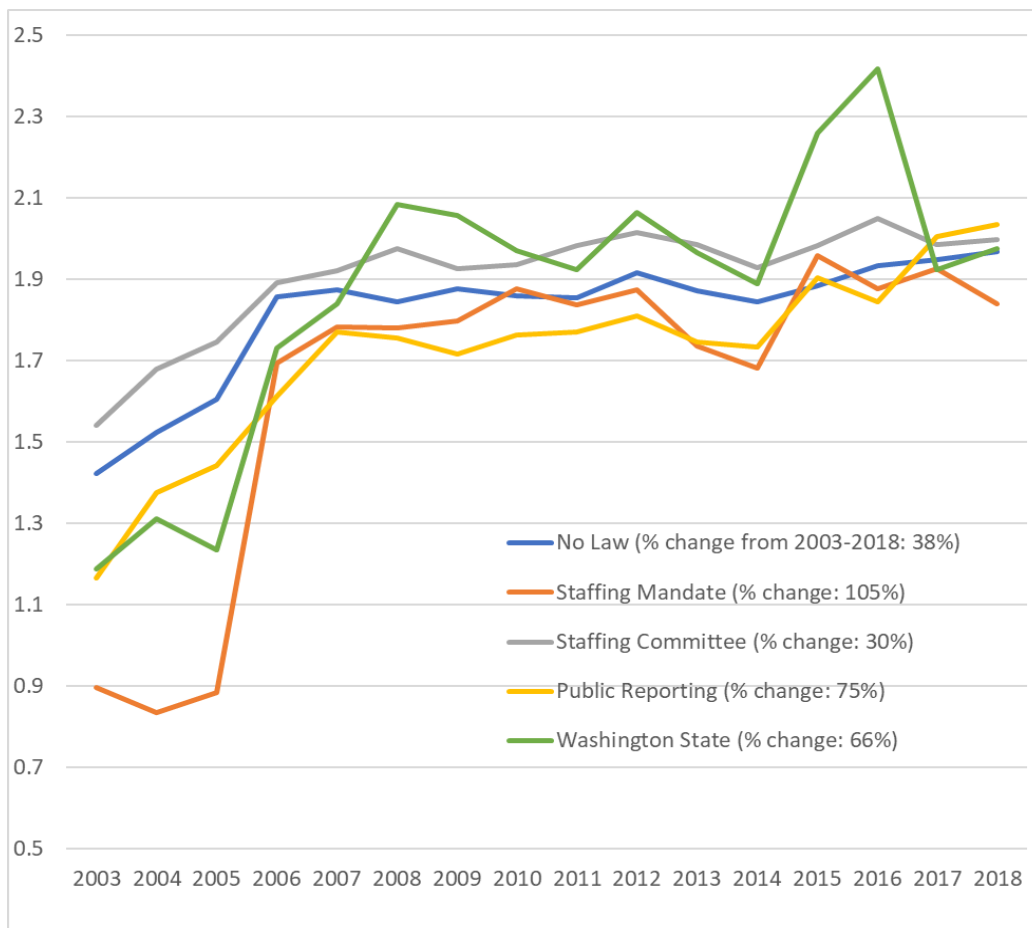


Trend lines for the same period are available for LPN upon request. We found that in all states, LPNs hours drop steadily, with about a 50% reduction. This is likely as a result of research showing

better hospital outcomes with RNs, and the subsequent shifting of the LPN workforce to nursing homes.

Trends for NAP, as shown in Figure 2, were more varied across the country, and the direction was upwards. In 2003, NAP hours per patient day were lowest in the state with a mandate (California), but over the 15 years shown, California increased the most (105%). Washington NAP hours per patient day increased by 66%.

**Figure 2:** NAP Staffing Hours per Patient Day 2003-2018 by Type of State Nurse Staffing Laws



**Threshold Analyses**

The second national study relevant to Washington was a production function analysis conducted by Dehly and colleagues (2021). As described above, the study’s aim was to identify both a marginal and a peak staffing threshold necessary to achieve a certain output - in this case patient satisfaction. The study examined six sub components of patient satisfaction as measured by HCAHPS: (1) cleanliness, (2) quietness, (3) communication, (4) promptness of help, (5) pain control and (6) information about medicine. The last two were assumed to be the most important measures for RNs, while the first four the most important for Nurse Assistants (NA).

While the study was national in scope, we show Washington state data for the purposes of this report (data not published). The study included 45 Washington hospitals, for a total of 326 hospital-year observations with complete data from the AHA Annual Survey and HCAHPS information between the years 2008 and 2016.

Tables 1 and 2 show the threshold values of RN and NA hours per patient day, as well as the percentage of observations that were above those thresholds for hospitals in Washington only. For example, for the promptness score, the incremental benefits to patient satisfaction occur between 5.4 RNs hours per patient day, up to about 13.4 RN hours per patient day. For NA hours it would be just over 2 hours per patient day, up to about 3.7.

**Table 1: Threshold Values of RN Hours per Patient Day and Percentage of Observations Above Thresholds for Hospitals in WA**

	Marginal Impact $\geq 0^a$	RN Hours per Patient Day		
		WA hospitals % observations above threshold	Peak Marginal Impact <sup>b</sup>	WA hospitals % observations above threshold
HCOMP-C – ( <i>cleanliness</i> )	6.212	87%	14.329	2%
HCOMP-Q – ( <i>quietness</i> )	6.044	88%	14.977	2%
HCOMP-1 – ( <i>communication</i> )	5.126	94%	13.402	3%
HCOMP-3 – ( <i>promptness of help</i> )	5.435	93%	13.993	3.5%
Patient Management Measures				
HCOMP-4 – ( <i>pain control</i> )	4.975	95%	13.343	3%
HCOMP-5 – ( <i>medicines information</i> )	5.551	93%	15.042	1.5%

<sup>a</sup> For each patient satisfaction measure, at these values of NA or RN hours per patient day, the marginal impacts are greater or equal than zero. Hours above these thresholds have positive marginal impacts.

<sup>b</sup> Values correspond to the peak of the marginal product

**Table 2: Threshold Values of Nurse Assistant (NA) Hours per Patient Day to Sub- Categories of Patient Satisfaction and Percentage of Observations Above Thresholds for Hospitals in WA**

	NA Hours per Patient Day			
	Marginal Impact $\geq 0^a$	WA hospitals % observations above threshold	Peak Marginal Impact <sup>b</sup>	WA hospitals % observations above threshold
HCOMP-C – ( <i>cleanliness</i> )	1.547	67%	3.921	5%
HCOMP-Q – ( <i>quietness</i> )	2.528	25%	4.650	2%
HCOMP-1 – ( <i>communication</i> )	2.193	36.%	3.770	5.5%
HCOMP-3 – ( <i>promptness of help</i> )	2.028	45.5%	3.692	6%
Patient Management Measures				
HCOMP-4 – ( <i>pain control</i> )	2.221	36%	3.981	4%
HCOMP-5 – ( <i>medicines information</i> )	2.096	40.5%	3.648	6%

<sup>a</sup> For each patient satisfaction measure, at these values of NAP or RN-LPN hours per patient day, the marginal impacts are greater or equal than zero. Hours above these thresholds have positive marginal impacts.

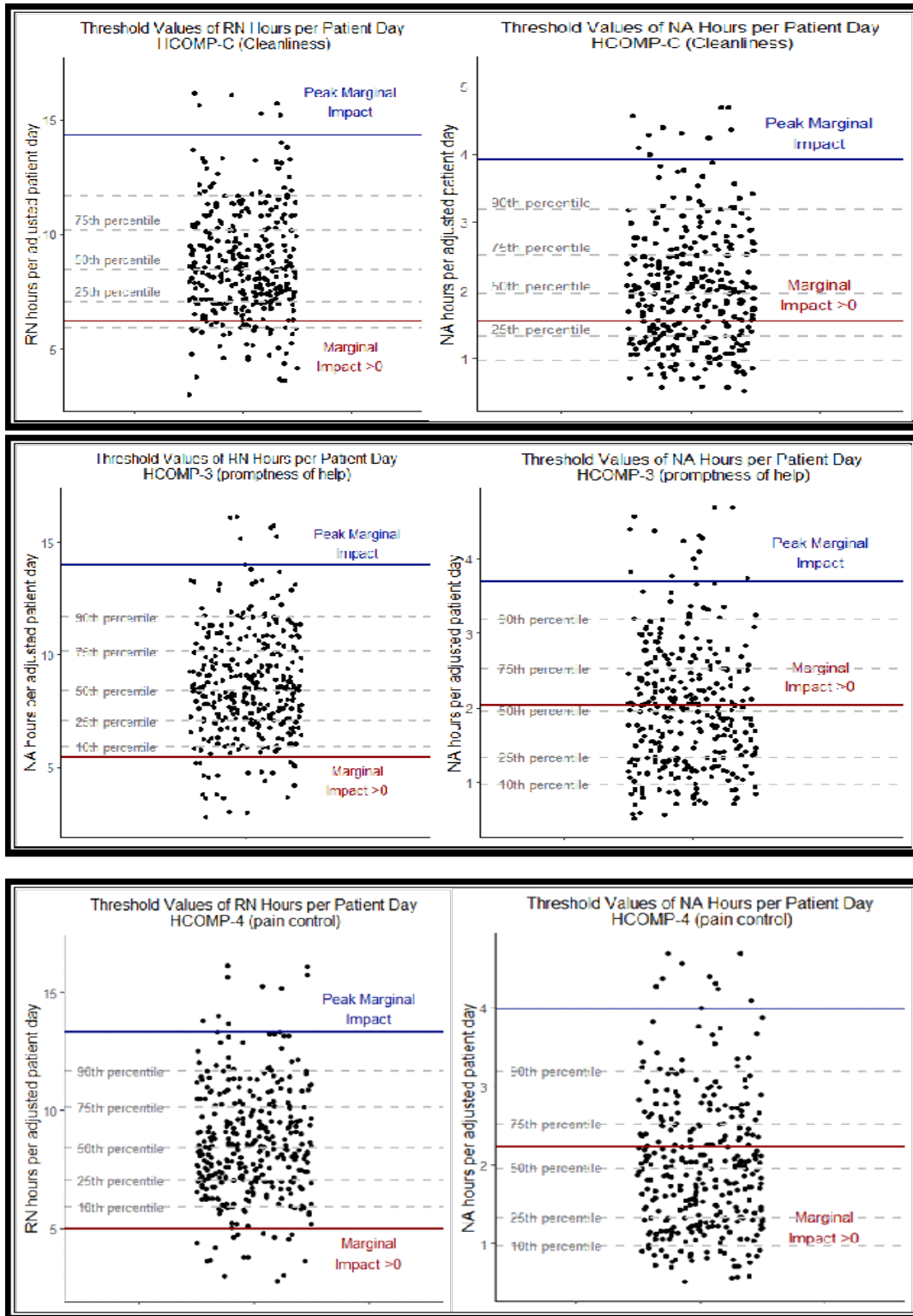
<sup>b</sup> Values correspond to the peak of the marginal product

Overall, the tables suggest that for RNs to have at least some positive marginal impact on these outcomes, between 13% and 5% of hospital observations, depending on the measure, would need to increase nurse staffing. To have the peak (or optimal) impact, beyond which the incremental improvements would decline, between 96.5% and 98.5% would need to staff up, depending on the outcome of interest.

For NA hours per patient days, the results were more dramatic. Between 33% and 75% of hospital observations require more NAs just to reach the marginal positive impact level, and between 94% and 98% would need to increase NA hours to achieve peak patient satisfaction scores. This suggests that the benefit of increasing NAs is particularly important.

Figures 3-8 present the information that corresponds to the first row of each table. The figures simply provide a more graphic way of visualizing the distribution of the values of RN and NA hours in Washington hospital observations, relative to the thresholds of both a positive marginal impact greater than 0, and a peak marginal impact, after which the incremental benefits of increasing staffing begin to fall. By way of example, we present RN and NA results for three domains: Cleanliness, Promptness of Help and Pain Control.

**Figures 3-8: Threshold Values for Washington Hospital RN and NA Hours per Patient Day for 3 Subscales of HCHAP (Cleanliness, Promptness, and Pain Control)**



The implication of this study for Washington is that there is wide variation in hospital staffing levels. **This creates an opportunity to improve patient satisfaction by bringing all hospitals up to an agreed upon point in between the two thresholds.**

While the minimum and maximum thresholds are slightly different for each outcome, the curve of increasing and then diminishing returns provides a potentially useful reference for policy deliberations. Not only can stakeholders estimate staffing levels needed to improve an outcome, but they can also estimate the percent of hospitals that would need to make changes in order to meet whatever standard is selected. Key to this kind of approach is that it requires a large sample size, meaning that a large number of hospital observation years should be aggregated in order to detect the effect. Additional research is needed with other patient outcomes, and at the unit level of hospitals, to further explore this approach.

### **4.3 California**

**As Washington considers mandating nurse staffing levels, the debate over what happened in California will inevitably arise. Fortunately, research on the law's effects has been prolific.**

Bill 394 was signed in 1999 but did not go into effect until 2004 (*California Health and Safety Code Section 1276.4.*). The law required the Department of Health Services to develop detailed regulations. After two years of hearings and deliberations (2002-2004) on the question of which nurse-to-patient levels should be mandated, the resulting regulations were different depending on the type of unit (Serratt et al., 2011). For critical/intensive care, neonatal intensive care, labor and delivery, and post-anesthesia recovery units, the regulations stipulate a minimum of 1 nurse to 2 patients. Pediatrics, emergency department ratios are set at 1:4. Other specialty care were set at 1:5 ratio in 2004 but scheduled to drop to 1:4 in 2008. Medical surgical units were set at 1:6 in 2004 and scheduled to drop to 1:5 in 2005. Similarly, from 2004 to 2005, step down units were mandated at 1:4 and then reduced to 1:3, and telemetry units went from 1:5 to 1:4.

More nuanced features of the law include the requirement that a maximum of 50% of nursing staff could be licensed practical/vocational nurses (LPN/LVN). In addition, the law calls for using a Patient Classification System to determine when additional RNs must be added to the minimum levels based upon severity of illness, complexity of clinical judgment, and the need for specialized technology. The law also restricts “floating” of nursing staff, by requiring that all temporary personnel receive the same orientation and competency determination as permanent staff (*Ratios, 2021*).

Research on the impact of California’s law has taken advantage of its endogenous shock, which has provided an ideal natural experiment for health services research. Moreover, California has particularly high quality publicly available hospital data made available by the Office of Statewide

Health Planning and Development (OSHPD). The data include hospitals reports of unit-level productive hours worked for RNs, LVNs, and aides/orderlies (nursing assistive personnel).

A first point of interest is that, in addition to the Hans et. al. study, **all of the studies using California-specific data, which are described below, confirm that the law had the desired effect of increasing nurse staffing levels.** McHugh and colleagues showed that the staffing mandate actually 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 (2011). The major state nurse union argued that this occurred because **nurses who had resigned or reduced hours returned to bedside, and nurses from other states came to California attracted to the lower patient to nurse ratios (NNU).** Additionally, studies show that even the safety net hospitals have been able to accommodate the increased cost of staffing (Harless et al., 2010; McHugh et al., 2012).

One early point of concern was whether the skill mix of nurses (proportion of RNs, to LPNs, to nursing assistive personnel) would change, with a reduction in higher skilled RNs in favor of lower skilled types of nurses. At least two studies showed that in California hospitals there was no evidence that they had increased their relative reliance on nursing assistive personnel as a cost containment strategy to offset the increased investment in RNs (McHugh et al., 2012; Han et al., 2021).

There was also some concern that the competition for nurses would drive up wages to a point that was unsustainable for hospitals. Munnich and colleagues estimated that wage increases varied across the state from 0% to 8% (Munnich, 2014).

In terms of nurse satisfaction, Tellez conducted a survey of California nurses from 1997 to 2008 (2012). She found **overall job satisfaction increased significantly** as the years passed, suggesting that the nurse staffing law was likely the cause of this improvement.

Research on the effect of the law on patient safety has varied in its findings. Aiken and colleagues used a cross-sectional design to compare California to two other states, concluding that nurses in California's hospitals on average cared for one less patient, and that this number fell to two fewer patients in medical and surgical units (Aiken et al., 2010). **They found these lower ratios were significantly associated with lower mortality, lower nurse burnout and job dissatisfaction, and nurses themselves reported better quality of care.**

Other researchers have used longitudinal designs and were more equivocal. Mark and colleagues found improvement in the rate of failure-to-rescue after a postoperative complication, but no change in rates of postoperative respiratory failure or sepsis (Mark et al., 2013). Burnes-Bolton and colleagues used a convenience sample of California hospitals that participate in the Collaborative Alliance for Nursing Outcomes (CALNOC) to examine the effect of the law on falls, ulcers and use of restraint between 2002, when the law passed (but had not been implemented) and 2006, two years after the implementation process began, but just one year after the 2005



changes and before the 2008 changes (Burnes Bolton et al., 2007). These authors found that while outcomes improved on average over this time period, regression analyses did not demonstrate a statistically significant association with the increased nurse staffing levels and patient outcomes.

Spetz and colleagues also used pre and post data (2000-2006) and, like Mark and colleagues, found decreases in mortality among hospitals in the three lowest quintiles (those with low nurse staffing before the law) (Spetz et al., 2013). They also found the association between nurse staffing and average length of stay to be negative and statistically significant, particularly for hospitals in the lower staffing quintile pre-law. Pressure ulcers and postoperative respiratory failure were also negative, but not statistically significant. On the other hand, length of stay rose for postoperative sepsis, and several other patient safety measures showed increases, rather than the expected decreases, following the law.

Similarly, Cook and colleagues examined failure to rescue in California high staffed and low staffed hospitals before and after the law, using the same two years of post-data (Cook et al., 2012). While they found a significant association in their cross-sectional model, when they incorporated the longitudinal analysis to conduct the difference in difference (DID) analysis, they did not find evidence that failure-to-rescue rates improved more in those hospitals that had to increase their staffing level to reach the mandated minimum, when compared to hospitals that had high staffing all along. The authors suggest that since those hospitals that are safest in terms of failure to rescue are also the ones that employ more nurses per patient, it is likely that there are other complementary factors in those hospitals contributing to safety. They conclude that nurse staffing is likely a necessary, but insufficient part of patient safety.

These DID studies have stronger designs than the cross-sectional studies. On the other hand, they are very early. The last year of data in these studies was 2006, and we know that, as planned in the law, the ratios were reduced for certain units again in both 2005 and 2008. Thus, it is important to revisit these studies with additional years of data.

Taken as a set, however, the research on California's patient outcomes after the law suggest that additional necessary patient safety strategies are likely needed, in addition to minimum nurse staffing. For example, it is possible that hospitals that triage patients most in need of intensive nursing care could be using their nursing resources more efficiently. A large body of research by Eileen Lake and colleagues on the Practice Environment Scale of the Nursing Work Index (PES-NWI) helps identify some of these additional factors (Lake, 2002; Lake, 2007). Indeed, Aiken and others have used this scale to specifically show the interaction of staffing levels, which is one domain in the scale, with the other domains (nurse participation in hospital affairs; nursing foundations for quality care; nurse manager leadership, ability, and support; and collegial nurse-physician relationships) (Kutney-Lee et al., 2013; McHugh & Ma, 2014). The use of the Practice Environment Scale requires survey data, and the California outcomes studies described above relied on administrative data only.

A further point of reflection is that DID studies may miss the threshold phenomenon that was demonstrated in the Delhy study and discussed in the section on Washington (Delhy et al., 2021). Using a production function approach, it might be possible to understand which and how many hospitals fall below the positive marginal impact for NAs and even RNs, and which and how many are above the peak, at which point the incremental impact on quality begins to fall.

#### ***4.4 International Experience: The Case of Queensland***

This report has focused on research conducted in the United States, given the important differences between the U.S. healthcare system and other countries. It is important to note that there is an equally robust body of international research that parallels the U.S. literature with similar findings (Wynendaele et al., 2019). The International Council of Nurses, after reviewing the evidence world-wide, issued a position statement on evidence-based nurse staffing in which they affirm there is more than sufficient international evidence to support acting now to improve hospital nurse staffing (ICN, 2018).

As a result, countries around the world are also debating whether and how nurse staffing levels should be regulated by the government. Wales and Scotland in the United Kingdom, Ireland, and Victoria and Queensland in Australia have now all implemented nurse staffing laws (McHugh et al., 2021).

The Queensland law is particularly interesting for two reasons. The first is its flexibility. It allows variation in terms of individual nurses' patient load but creates a minimum threshold for the average ratio in a given unit (Schlack et.al 2022). The second reason is that Queensland designed the law in phases, so as to allow for the first independent prospective evaluation using an experimental design. In 2016, minimum nurse-to-patient staffing levels were mandated in medical-surgical wards in 27 public hospitals, and 28 hospitals were left out of the experiment. For the intervention group, morning and afternoon shifts could have no more than 4 patients per nurse, and for the night shift, it was 7 patients per nurse maximum.

McHugh and colleagues tracked patient outcomes in both groups of hospitals before the law, and for two years after the law. They found that mortality rates were not significantly higher than at baseline in comparison hospitals, but they were significantly lower than at baseline in intervention hospitals; seven-day readmissions increased in comparison hospitals, but not in intervention hospitals; and while length of stay decreased in both groups after the law, the improvement was more dramatic in intervention hospitals. They concluded that the costs avoided due to fewer readmissions and shorter length of stay were more than twice the cost of the additional nurse staffing.

## 5. CONCLUSIONS

The COVID-19 pandemic has exposed many of the weaknesses in our society, among them the chronic underinvestment in nurse and nurse support staffing, and the associated moral injury and burnout among these workers. Yet we know that nurses were under tremendous stress prior to the pandemic as well (Schlak et. al., 2022).

**As reviewed in this report, there is strong scientific evidence that nurse and nurse assistive staffing levels are critical components of both patient safety and of worker satisfaction and burnout.** The research suggests that there is tremendous opportunity to improve these outcomes by elevating nurse and nurse assistive personnel staffing levels. Moreover, health economists have argued for years that there is a business case for hospitals to invest in higher nurse staffing levels (Dall et al., 2009; Lasater et al., 2021; Needleman et al., 2006, Lasater et al., 2021, McHugh et al., 2021).

Nevertheless, 20 years after the first landmark studies on the relationship of RN staffing and patient and nurse outcomes were published, and almost as long since the California law was passed, many hospitals continue to underinvest in their nurse and nurse support staff. **Because the continued underinvestment in nursing staff leads to cyclical crises of staff burnout, shortages and, ultimately, patient harm, this issue is one that state leaders cannot avoid addressing.** As we are seeing during the COVID-19 pandemic, in order to protect the public many state governments, including Washington, have had to step in and help hospitals. This is partially a result of the surge in patient demand, but the literature suggests that the problem is heightened by staffing practices that pre-date the pandemic.

Nurse staffing laws have been an attempt to prevent such a crisis. We now know, however, that of the three types of laws, **only mandates appear to have an effect on hospital practices;** neither staffing committees, nor public reporting laws have had the desired effect (Han et al 2021). Washington is among the states that has tried these two alternative approaches. The data suggest that neither has worked. As a result, state policymakers must now decide whether to make Washington the second state in the nation to mandate safe staffing.

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